Project Manual for:

Merritt College
CHW Infrastructure Project

Located at:
Merritt College
12500 Campus Drive
Oakland, CA 94619

June 21, 2012

Peralta Community College District
Department of General Services
Johnnie Fudge, Facilities Project Manager
(510) 377-0748

Architect / Engineer:
Salas O'Brien
305 South 11th St.
San Jose, California 95112
Monterey- Oakland- Sacramento- Long Beach- Bloomington

Bid No.: 12/13-03
Advertisement Date: 9/2012
Bid Date: 10/16/2012
(Project No.: 2355B)
## TABLE OF CONTENTS

### INTRODUCTORY INFORMATION
- 00001 Title Page
- 00007 Seals Page
- 00010 Table of Contents

### BIDDING REQUIREMENTS
- 00100 Notice Inviting Bids
- 00200 Instructions to Bidders
- 00201 Bid Vicinity Map
- 00210 Access, Indemnity and Release Agreement
- 00320 Geotechnical Data and Existing Conditions
- 00400 Bid Form
- 00411 Bond Accompanying Bid
- 00420 Bidder Registration and Safety Experience Form
- 00430 Subcontractors List
- 00450 Statement of Qualifications
- 00481 Non-collusion Affidavit
- 00482 Bidder Certifications

### CONTRACT FORMS
- 00505 Notice of Intent to Award
- 00510 Notice of Award
- 00520 Agreement
- 00550 Notice to Proceed
- 00610 Construction Performance Bond
- 00620 Construction Labor and Material Payment Bond
- 00630 Guaranty
- 00650 Agreement and Release of Any and All Claims
- 00660 Substitution Request Form
- 00670 Escrow Bid Documents
- 00680 Escrow Agreement for Security Deposits in Lieu of Retention

### CONDITIONS OF THE CONTRACT
- 00700 General Conditions
- 00800 Supplemental General Conditions
- 00801 Supplemental Conditions – Naturally Occurring Asbestos
- 00821 Insurance and Indemnification
- 00822 Apprenticeship Program
- 00825 Project Labor Agreement
- 00910 Addenda
SPECIFICATIONS

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 SUMMARY
01 1200 MEASUREMENT AND PAYMENT
01 1250 MODIFICATION PROCEDURES

01 13 00 PROJECT COORDINATION
01 1315 PROJECT MEETINGS
01 1320 PROGRESS SCHEDULES AND REPORTS
01 1330 SUBMITTALS
01 1340 SAFETY SUBMITTALS

01 14 00 WORK RESTRICTIONS
01 1410 REGULATORY REQUIREMENTS
01 1455 TESTING AND INSPECTION
01 1540 SITE SECURITY AND SAFETY
01 1580 PROJECT IDENTIFICATION AND SIGNS

01 21 12 ALLOWANCES
01 22 00 UNIT PRICES
01 30 00 ADMINISTRATIVE REQUIREMENTS
01 40 00 QUALITY REQUIREMENTS
01 50 00 TEMPORARY FACILITIES AND CONTROLS
01 60 00 PRODUCT REQUIREMENTS
01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS
01 715 EXISTING UNDERGROUND FACILITIES

01 78 00 CLOSEOUT SUBMITTALS
01 1780 PROJECT RECORD DOCUMENTS

DIVISION 03 - CONCRETE

03 30 00 CAST-IN-PLACE CONCRETE

DIVISION 05 - METALS

05 50 00 METAL FABRICATIONS
05 52 13 PIPE AND TUBE RAILINGS

DIVISION 26 - ELECTRICAL

26 05 01 MINOR ELECTRICAL DEMOLITION
26 05 10 ELECTRICAL GENERAL PROVISIONS
26 05 12 BASIC MATERIAL AND METHODS
26 05 13 MEDIUM-VOLTAGE CABLE
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 73 POWER SYSTEM STUDY
26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 02 ELECTRICAL ACCEPTANCE TESTING
26 11 16 SECONDARY UNIT SUBSTATIONS
26 13 21 AIR INTERRUPTER SWITCHES

DIVISION 31 - EARTHWORK

31 10 01 SITE PREPARATION
31 23 16.13 TRENCHING
31 23 16.26 ROCK REMOVAL
DIVISION 32 - EXTERIOR IMPROVEMENTS
32 12 16   ASPHALT PAVING
32 13 13   CONCRETE PAVING
32 31 13   CHAIN LINK FENCES AND GATES

END OF DOCUMENT
NOTICE INVITING BIDS

1 NOTICE. The Peralta Community College District, (hereinafter “Owner”), will receive sealed Bids for the following public work:

Merritt College
CHW Infrastructure Project
(Bid No.: 12/13-03)
(Project No. 2355B)

2 BID SUBMISSION. Owner will receive sealed Bids no later than 2:00 p.m. on October 16, 2012. The Bid opening will be in accordance with procedures set forth in Document 00200 (Instructions to Bidders). All abbreviations and definitions of terms used in this Document 00100 are set forth in Section 01420 (References and Definitions).

3 DESCRIPTION OF THE WORK. The Work consists of all activities necessary to construct the above referenced projects as indicated on the Contract Documents, including but not limited to the drawings and the specifications. The Work includes, but is not limited to alteration of Building F, and underground chilled water infrastructure with connections to Building L, and Building Q. Work includes the installation of a chilled water plant in Building F, with cooling tower yard, including new electrical service. Also included is stub out service to future Science Building. Building F alterations include converting the existing entrance into a chiller room, installing second floor stair exiting and lower room addition with acoustical louvers, a cooling tower yard with site screen chain link fences & gates, pumps and new electrical substation to serve the new central chilled water plant equipment. Exposed pipes to have outdoor box enclosures on exterior walls and low roofs. Bidding Documents contain the full description of the Work.

This is a Public Works project and will require payment of prevailing wages. In order to perform the work, Bidders at the time of the Bid Opening and for the duration of the project shall possess a valid California Contractor’s license: Class A or Class B, Building Contractor’s License.

4 CONTRACT TIME. The Work shall be substantially completed within 334 Calendar Days from the date when Contract Time commences to run.

5 CONTACT INFORMATION.
5.1 For information concerning the proposed work, contact:

   Johnnie Fudge
   Facilities Project Manager
   Phone: (510) 466-7244
   Email: jfudge@peralta.edu

5.2 For an appointment to visit the Site, contact:

   Same as Above

6 MANDATORY PRE-BID MEETING AND SITE VISIT. Owner will conduct one Mandatory Pre-Bid Meeting and Site Visits at Merritt College, 12500 Campus Drive, Oakland, CA 94619. (Meet in front of Building F Main entrance) Phone (510) 377-0748, on September 14, 2012 at 10:00 a.m. Each Bidder must be represented at the meeting. Each representative shall sign an attendance sheet identifying the Bidder represented. Any Bidder wishing to investigate subsurface conditions at the Site must schedule such a visit with Owner in accordance with Document 00200 (Instructions to Bidders).
STATEMENT OF QUALIFICATIONS. Each Bidder shall be required to submit, in accordance with Document 00200 (Instructions to Bidders) and Document 00450 (Statement of Qualifications for Construction Work), a Statement of Qualifications.

REQUIRED CONTRACTOR’S LICENSE(S). A California class A or B contractor’s license is required to Bid this Contract. Joint ventures must secure a joint venture license prior to award of this Contract. Removal, handling, and/or disposal of hazardous materials may by law require hazardous substance removal certification by the Contractor’s State License Board.

PREVAILING WAGE LAWS. The successful Bidder must comply with all prevailing wage laws applicable to the Project and related requirements contained in the Contract Documents.

INSTRUCTIONS. Bidders shall refer to Document 00200 (Instructions to Bidders) for required documents and items to be submitted in sealed envelopes for deposit into the Bid box, and applicable times for submission.

SUBSTITUTION OF SECURITIES. Owner will permit successful Bidder to substitute securities for retention monies withheld to ensure performance of Contract, as set forth in Document 00680 (Escrow Agreement for Security Deposit in Lieu of Retention), in accordance with California Public Contract Code, Section 22300. By this reference, Document 00680 (Escrow Agreement for Security Deposit in Lieu of Retention) is incorporated in full in this Document 00100.

RESTRICTIONS ON SUBSTITUTIONS. As provided below, Owner will consider substitution requests only for “or equal” items. Bidders wanting to use “or equal” item(s) may submit Document 00660 (Substitution Request Form) no later than 60 Days after the issuance of the Notice of Award. As a limitation on Bidder's privilege to substitute “or equal” items, Owner has found that certain items are designated as Owner standards and certain items are designated to match existing items in use on a particular public improvement either completed or in the course of completion or are available from one source. As to such items, Owner will not permit substitution.

PROCUREMENT OF BIDDING DOCUMENTS. The Contract Documents, including the Instructions to Bidders and the plans and specifications for the work, may be examined at:

(Available for purchase)
ARC Northern California
1700 Jefferson Street,
Oakland, CA 94612
Tel. (510) 287-5485 Fax (510) 444-1264
www.e-arc.com
Email: oakland@e-arc.com
Attn: Christina

Note: The Bid and Contract Documents are available at ARC Northern California for non-refundable payment of the cost of reprographics and shipping per set. Payment shall be made to ARC Northern California.

(Available for viewing)
Department of General Services
Plan Room
Peralta Community College District
333 East 8th Street, Oakland, CA 94606

A copy of Contract Documents may be obtained online through the Peralta Website.

Website: www.peralta.edu
Click “Service Centers”, then click “Purchasing” and then click “List of Current RFPs/Bids” to download the bid packet.
Note: Drawings are not scalable/full size. For the scalable drawings, please purchase them from ARC Northern California.

13.1 The following plan room services have received sets of Bidding Documents for the Work contemplated herein:

**Builders Exchange of Alameda**  
3055 Alvarado Street  
San Leandro, CA 94577  
Tel. 510-483-8880 Fax 510-352-1509  
Email: beac@beac.com  
Attn: Jan Sanchez

**McGraw Hill Construction**  
11875 Dublin Blvd., Suite A118  
Dublin, CA 94565  
Tel. 925-833-9750 Fax 925-833-9754  
Email: Gerry_mccarthy@mcgraw-hill.com  
Attn: Gerry McCarthy

14 **BID PREPARATION COST.** Bidders are solely responsible for the cost of preparing their Bids.

15 **RESERVATION OF RIGHTS.** Owner specifically reserves the right, in its sole discretion, to reject any or all Bids, to re-bid, or to waive inconsequential defects in bidding not involving time, price or quality of the work. Owner may reject any and all Bids and waive any minor irregularities in the Bids.

END OF DOCUMENT
DOCUMENT 00200

INSTRUCTIONS TO BIDDERS

Bids are requested by the Peralta Community College District, (hereinafter “Owner”), for a general construction contract, or work described in general, as follows:

Merritt College
CHW Infrastructure Project
(Bid No.: 12/13-03)
(Project No.2355B)

1 RECEIPT OF BIDS.

1.1 Sealed bids will be received by Owner no later than the time specified for receipt of bids in Document 00100 (Notice Inviting Bids). Owner will receive Bids in two opaque sealed 10” x 13” envelopes labeled Envelope “A” and Envelope “B,” each containing the respective items described in paragraphs 4 and 5 below, respectively. All Bid envelopes will be time stamped to reflect their submittal time. Envelope “A” and Envelope “B” shall be due by 2 p.m. Owner will reject all Bids received after the specified time and will return such Bids to Bidders unopened. Bidders must submit Bids in accordance with this Document 00200.

2 BID SUBMITTAL LOCATION.

2.1 Bid shall be received and reviewed at:

Peralta Community College District
Purchasing Department
Attn: David Imada
501 5th Avenue
Oakland, CA 94606
(510) 466-7225

Document 00201 (Bid Submittal Map) shows the location.
3 BID SUBMISSION.

3.1 Bidder should mark its Bid envelopes as “BID FOR THE Peralta Community College District, BID NUMBER 12/13-03, Merritt College, CHW Infrastructure Project”, Envelope “A” or “Envelope “B,” as appropriate. Bids shall be deemed to include the written responses of the Bidder to any questions or requests for information of Owner made as part of Bid evaluation process after submission of Bid. Bidder’s failure to submit all required documents strictly as required entitles Owner to reject the bid as non-responsive.

4 CONTENTS OF ENVELOPE “A” - BID PRICE.

5 Envelope “A” shall include:

5.1 Document 00400 (Bid Form) completed in accordance with paragraph 6 of this Document 00200.
5.2 Bid security supplied and completed in accordance with paragraph 7 of this Document 00200.
5.3 Document 00430 (Subcontractors List) in accordance with paragraph 8 of this Document 00200.
5.4 Document 00481 (Non-Collusion Affidavit).

6 CONTENTS OF ENVELOPE “B” - BIDDER QUALIFICATIONS.

7 Envelope “B” shall include:

7.1 Statement of Qualifications submitted in accordance with paragraph 9 of this Document 00200 and Document 00450 (Statement of Qualifications for Construction Work).
7.2 Document 00420 (Bidder Registration Form). Bidder must complete this form and include comprehensive answers to all questions.
7.3 Document 00482 (Bidder Certifications). Bidder must complete this form as indicated.

8 REQUIRED BID FORMS.

8.1 All Bidders must submit Bids using, where applicable, documents supplied in this Project Manual, including without limitation Document 00400 (Bid Form) Document 00420 (Bidder Registration Form), Document 00430 (Subcontractors List), Document 00450 (Statement of Qualifications), Document 00460 (Schedule of Major Equipment and Material Suppliers), Document 00481 (Non-Collusion Affidavit) and Document 00482 (Bidder Certifications). Owner will reject as non-responsive any Bid not submitted on the required forms. Bids must be full and complete and legible. Bidders must complete all Bid items and supply all information required by Bidding Documents. Owner reserves the right in its sole discretion to reject any Bid as non-responsive as a result of any error or omission in the bid. Bidders may not modify the Bid Form or qualify their Bids. Bidders must clearly make any changes in their Bids by crossing out original entries, entering new entries, and initialing new entries. Owner reserves the right to reject any Bid not clearly written.

9 REQUIRED BID SECURITY.

9.1 Bidders must submit with their Bids either: cash, a cashier’s check, or certified check from a responsible bank in the United States, or corporate surety bond furnished by a surety authorized to do business in the State of California, of not less than ten percent of the total amount of Bid (excluding alternates, if any), payable to Owner. All Bidders choosing to submit a surety bond must submit it on the required form, Document 00411 (Bond Accompanying Bid). Owner will reject as non-responsive any Bid submitted without the necessary Bid security.

9.2 Owner may retain Bid securities and Bid bonds of other than the Apparent Low Bidder for a period of 90 Days after award or full execution of the Contract, whichever first occurs. Upon full execution of the Contract, and upon request by Bidder, Owner will return to the respective unsuccessful Bidders their Bid securities and Bid bonds.
10 REQUIRED SUBCONTRACTORS LIST.

10.1 All Bidders must submit with their Bids the required information on all Subcontractors in Document 00430 (Subcontractors List) for those Subcontractors who will perform any portion of Work, including labor, rendering of service, or specially fabricating and installing a portion of the Work of improvement according to detailed drawings contained in the plans and specifications, in excess of one half of one percent of total Bid. Violation of this requirement may result in Bid being deemed non-responsive and not being considered.

11 REQUIRED STATEMENT OF QUALIFICATIONS

11.1 Required Statement of Qualifications:

11.1.1 In order for a Bidder to be eligible to Bid on this Contract, it must submit with its bid a final Statement of Qualifications responsive to the requirements identified in Document 00450 (Statement of Qualifications for Construction Work) (“SOQ”), including without limitation qualification information for Subcontractors, superintendent, project management and schedulers, identified in Document 00450. Except as otherwise provided in paragraphs 20 and 21 of this Document 00200 or in Document 00450, Owner will make final determinations regarding Bidder responsibility based upon the SOQ submitted as part of Envelope “B” on Bid day. Information in the SOQ shall be current as of Bid Day.

11.2 Subcontractor Qualifications:

11.2.1 Bidders attention is drawn to the fact that the qualifications of Designated Subcontractors is deemed integral and part of Bidders qualifications and the determination by Owner of a Bidder as a responsible bidder.

12 MANDATORY PRE-BID MEETING AND SITE VISIT.

12.1 Owner will conduct one Mandatory Pre-Bid Meeting and Site Visit at 10:00 a.m. on October 16, 2012.

12.2 The mandatory Pre-Bid Meeting and Site Visit will cover, among other matters, the requirements for the final SOQ. The Meetings will commence at Project site, 12500 Campus Drive, Oakland, CA, and will include a walking tour of the Project Site. Each Bidder must be represented at Meeting and Site Visit. Each representative shall sign an attendance sheet identifying the Bidder represented.

12.3 Owner reserves the right to schedule and organize the Site Visits to minimize disruption to surrounding facilities and congestion. Any Bidder wishing to investigate subsurface conditions or otherwise conduct invasive investigations, explorations, test, or studies at this Site, shall schedule such examinations with Owner by providing Owner at least seven (7) days written notice. Additionally, any such Bidder must deliver an executed Document 00210 (Access, Indemnity and Release Agreement) and provide an insurance certificate as described therein by noon of the Day prior to the site examination. Bidders who intend only to observe Site conditions and not conduct such examinations are not required to provide an executed Document 00210 or an insurance certificate.

12.4 Bidders are encouraged to submit written questions in connection with the Meetings and Site Visits. Owner will transmit to all parties recorded as having received Bidding Documents such Addenda as Owner in its discretion considers necessary in response to written questions. Bidders shall not rely on oral statements. Oral statements will not be binding or legally effective.
13 OTHER REQUIREMENTS PRIOR TO BIDDING.

13.1 Submission of Bid signifies Bidder’s careful examination of Bidding Documents and complete understanding of the nature, extent, and location of Work to be performed. Bidder’s attention is directed to Document 00700 (General Conditions), Article 2, that describes Bidder’s required pre-bid investigations, notices to Owner of questions and receipt of answers in Addenda. Bidders must advise Owner of any unresolved questions, ambiguities, or inconsistencies in the supplied bidding documents.

14 EXISTING DRAWINGS AND GEOTECHNICAL DATA.

14.1 Bidders may examine any available existing conditions information (e.g. record documents, specifications, studies, drawings of previous work on site) by giving Owner reasonable advance notice, as well as applicable environmental assessment information (if any) regarding the Project. Document 00320 (Geotechnical Data and Existing Conditions) applies to all supplied existing conditions information and geotechnical reports and all other information supplied regarding existing conditions either above ground or below ground Owner will make copies available for the cost of printing. A Bidder must give two (2) days advanced notice if copies are desired.

15 ADDENDA.

15.1 Bidders must direct all questions about the meaning or intent of Bidding Documents to Owner (Attention: Project Manager) in writing, using attached form. Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda mailed, faxed, or delivered to all parties recorded by Owner as having received Bidding Documents. Addenda will be written and will be issued to each Bidder to the address or fax number supplied to Owner by Bidder. Owner may not answer questions received less than ten (10) Days prior to the date for opening Bids. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. To the extent that Owner, or any representative thereof, upon inquiry by Bidder, orally direct Bidder’s attention to specific provisions of the Contract Documents which cover the subject of the inquiry, the entire set of Contract Documents shall nonetheless govern.

15.2 In addition:

15.2.1 Addenda may also be issued to modify the Bidding Documents as deemed advisable by Owner.

15.2.2 Addenda shall be acknowledged by number with signature in Document 00400 (Bid Form) and shall be part of the Contract Documents. A complete listing of Addenda may be secured from Owner.

16 SUBSTITUTIONS.

16.1 Bidders must base their Bids on products and systems specified in Contract Documents or listed by name in Addenda.

16.1.1 Bidders wanting to use “or equal” item(s) may submit Document 00660 (Substitution Request Form) no later than the date specified in Document 00100. After that date, Owner will not accept “or equal” substitution requests. To assess “or equal” acceptability of product or system, submittals of substitutions shall contain the information required in Document 00660 and set forth in Section 01600 (Product Requirements). Insufficient information will be grounds for rejection of substitution. Owner shall, within a reasonable period of time after having received a request for substitution, issue in writing its decision as to whether the proposed substitute item is an “or equal” item for compatibility to Owner systems, durability, or quality. Owner’s decision shall be conclusive on all Bidders.

16.1.2 Approved substitutions made during the bid period, shall be listed in Addenda and become part of Contract Documents.

16.1.3 Substitutions may be requested after submitting Bids and Award of Contract only in accordance with Section 01600 (Product Requirements).

16.1.4 As a limitation on Bidder’s privilege to substitute “or equal” items, Owner has found that certain items are designed as Owner standards and certain items are designed to match existing items in use on a particular public improvement either completed or in the course of completion. As to
such items, Owner will not permit substitution. Such items are: Lock sets, and as noted in documents. As a further limitation on Bidder’s privilege to substitute items, Owner has found that certain necessary items are only available from one source. As to such items, Owner will not permit substitution.

17 WAGE RATES.

17.1 General prevailing rates of per diem wages for each craft, classification, or type of worker needed to execute the Contract, as determined by Director of the State of California Department of Industrial Relations, are deemed included in the Bidding Documents. The California Department of Industrial Relations website is www.dir.ca.gov.

18 EQUAL EMPLOYMENT OPPORTUNITY.

18.1 Contractor shall comply with all applicable federal, state, and local laws, rules, and regulations in regard to nondiscrimination in employment because of race, color, ancestry, national origin, religion, sex, marital status, age, medical conditions, disability, or any other reason.

19 DRAWINGS AND BIDDING DOCUMENTS.

19.1 Complete sets of Bidding Documents must be used in preparing Bids. Neither Owner nor Architect assume any responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents. The Drawings bound in the Bidding Documents are reduced scale reproductions. The amount of reduction is indicated by a note or scale bar on the Drawings. Copies of full-scale Drawings, including individual Drawings, may be obtained from Architect for the cost of reproduction, plus shipping and handling. Full-size drawings will only be made available to firms who previously obtained a complete set of Bidding Documents. No return of full-size Drawings is required, and no refund will be made.

20 BID OPENING.

20.1 Owner will open all Bidders’ Envelopes “A” and Envelop “B” at 2:00p.m. on the specified date, initially evaluate them for responsiveness, and determine an Apparent Low Bidder as specified herein. Owner will not open Envelopes “B” publicly, and except for the Apparent Low Bidder’s Envelope “B” and next apparent low bidder’s Envelope “B” (or as otherwise provided in this Document 00200), they will remain unopened.

20.2 Determination of Apparent Low Bidder (Envelope “A”).

20.2.1 All Bidders are required to submit Bids on all Bid items including any alternates. Apparent Low Bid will be determined in accordance with Public Contract Code Section 20103.8(b), and take into account only the specific alternate(s), if any, specifically identified as such in Document 00400 (Bid Form) : [Example: The lowest bid shall be the lowest total of the bid prices on the base bid (without taking into account unit price items) and bid alternates 1 through __, i.e. Bid Items 1-13. See Section 01230, Alternates, for a list of all alternates.] Owner reserves the right to add to or deduct from the Contract any of the additive or deductive items at any time within 60 Days after commencement of Contract Time, etc.

20.3 Evaluation of Bidder Responsibility (Envelope “B”).

20.3.1 Owner will open Apparent Low Bidder’s Envelope “B” and check its contents for compliance with paragraph 5 above and this paragraph 20. Owner will notify Apparent Low Bidder in writing of any deficiencies found and will provide Bidder the opportunity to respond in writing with reasonable clarifications but will not allow any changes in the nature of Bidder as a business entity.

20.3.2 If any Apparent Low Bidder is determined to be non-responsive or non-responsible, Owner may proceed to examine the next Apparent Low Bidder’s Envelope “B” pursuant to any procedures determined in its reasonable discretion, and proceed for all purposes as if this Apparent Low Bidder were the original Apparent Low Bidder. Owner shall use reasonable efforts to make the responsive responsible Apparent Low Bidder’s Envelope “B” public on the fifth Day following opening of the Bidders’ Envelope “A”’s, subject to paragraph 29 below.
20.3.3 Document 00450 sets forth the minimum criteria for a Bidder to be found responsible. Bidder’s attention is called to the requirements of Document 00450 for a Bidder to be found responsible to perform the Work.

21 BID EVALUATION.

21.1 Owner may reject any or all bids and waive any informalities or minor irregularities in the Bids. Owner also reserves the right, in its discretion, to reject any or all Bids and to re-Bid the Project. Owner reserves the right to reject any or all nonconforming, non-responsive, unbalanced, or conditional Bids, and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. For purposes of this paragraph, an “unbalanced Bid” is one having nominal prices for some work items and enhanced prices for other work items.

21.1.1 In evaluating Bids, Owner will consider Bidders’ qualification, whether or not the Bids comply with the prescribed requirements, unit prices and other data, as may be requested in Document 00400 (Bid Form) or prior to the Notice of Award.

21.1.2 Subject to any pre-qualification process for the Bidders, Owner may otherwise conduct reasonable investigations and reference checks of Bidder, proposed Subcontractors, suppliers and other persons and organizations as Owner deems necessary to assist in the evaluation of any Bid. Owner shall also have the right to communicate directly with Bidder’s surety regarding Bidder’s bonds.

21.1.3 Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum or any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between written words and figures will be resolved in favor of the words.

21.1.4 Quantities stated in the Bidding Documents are approximate only and are subject to correction upon final measurement of the Work, and are subject further to the rights reserved by Owner to increase or diminish the amount of work under any classification as advantages to design or construction needs require.

21.1.5 Owner may determine whether a Bidder is qualified in its sole discretionary judgment.

22 AWARD.

22.1 If the Contract is to be awarded, it will be awarded to the lowest responsive, responsible Bidder. Following completion of all required Owner procedures and receipt of all Owner approvals, Owner will issue Document 00510 (Notice of Award) to successful Bidder. If a bid protest is filed, then Owner reserves the right to request that each Bidder agree to extend by an additional twenty (20) days the mandatory time periods specified in Document 00400 (Bid Form) for their bid to remain open, to which each Bidder may consent in its discretion.

23 BID PROTEST.

23.1 Any Bid protest must be submitted in writing to Owner’s offices before 2:00 p.m. of the tenth Day following posting in the District website of Document 00505 (Notice of Intent to Award for Construction). Time will be determined by clock in conference room of Owner’s Headquarters. Owner will use reasonable efforts to deliver by facsimile a copy of Document 00505 to all Bidders who submitted Bids no later than the Business Day after issuance, although any delay or failure to do so will not extend the Bid protest deadline described above.

23.2 Procedures for Submitting Bid Protests:

23.2.1 The initial protest must contain a complete statement of the basis for the protest.

23.2.2 The protest must refer to the specific portion of the document that forms the basis for the protest.

23.2.3 The protest must include the name, address, and telephone number of the person representing the protesting party.

23.2.4 Only Bidders who Owner otherwise determines are responsive and responsible are eligible to protest a Bid; protests from any other Bidder will not be considered. In order to determine
whether a protesting Bidder is responsive and responsible, Owner may open and evaluate information contained in any protesting Bidder’s Envelope “B”, and conduct the same investigation and evaluation as Owner is entitled to make regarding an Apparent Low Bidder.

23.2.5 The party filing the protest must concurrently transmit a copy of the initial protest document and any attached documentation to all other parties with a direct financial interest that may be adversely affected by the outcome of the protest. Such parties shall include all other Bidders who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.

23.3 Exclusive Remedy

23.3.1 The procedure and time limits set forth in this paragraph are mandatory and are Bidder’s sole and exclusive remedy in the event of a Bid protest. Bidder’s failure to comply with these procedures shall constitute a waiver of any right to further pursue the Bid protest, including filing a Government Code Claim or legal proceedings. A Bidder may not rely on a protest submitted by another Bidder, but must timely pursue its own protest.

24 POST-NOTICE OF AWARD REQUIREMENTS.

24.1 After Notice of Award, the successful Bidder must execute and submit the following documents to Owner by 2:00 p.m. of the tenth (10) Day following Notice of Award. Execution of Contract by Owner depends upon approval of these documents, and any other document identified in Owner’s Notice of Award:

24.1.1 Document 00520 (Agreement): To be executed by successful Bidder. Submit four originals, each bearing an original signature.

24.1.2 Document 00610 (Construction Performance Bond): To be executed by successful Bidder and surety, in the amount set forth in Document 00610 (Construction Performance Bond). Submit one original.

24.1.3 Document 00620 (Construction Labor and Material Payment Bond): To be executed by successful Bidder and surety, in the amount set forth in Document 00620 (Construction Labor and Materials Payment Bond). Submit one original.

24.1.4 Insurance certificates and endorsements required by Document 00700 (General Conditions) or Document 00821 (Supplementary Conditions – Insurance). Submit one original set.

24.1.5 Document 00630 (Guaranty). Submit four originals, each bearing an original signature.

24.1.6 Any other item described in Document 00510 (Notice of Award).

24.2 Owner shall have the right to communicate directly with Apparent Low Bidder’s proposed performance bond surety, to confirm the performance bond. Owner may elect to extend the time to receive faithful performance and labor and material payment bonds.

24.3 Successful Bidder’s failure to submit the documents required herein, in a proper and timely manner, entitles Owner to rescind its award, and to cause Bidder’s Bid security to be forfeited as provided herein.

25 FAILURE TO EXECUTE AND DELIVER DOCUMENTS.

25.1 If Bidder to whom Contract is awarded shall, within the period described in paragraph 24 of this Document 00200, fail or neglect to execute and deliver all required Contract Documents and file all required bonds, insurance certificates, and other documents, Owner may, in its sole discretion, foreclose on Bidder’s deposit surety bond, or deposit Bidder’s cashier’s check or certified check for collection, and retain the proceeds thereof as liquidated damages for Bidder’s failure to enter into the Contract Documents. Bidder agrees that calculating the damages Owner may suffer as a result of Bidder’s failure to execute and deliver all required Contract Documents would be extremely difficult and impractical and that the amount of Bidder’s required Bid security shall be the agreed and presumed amount of Owner’s damages. In addition, upon such failure Owner may determine the next Apparent Low Bidder and proceed accordingly.

26 MODIFICATION OF COMMENCEMENT OF WORK.
26.1 Owner expressly reserves the right to modify the currently anticipated date for the Commencement of Work under the Contract and to independently perform and complete work related to the Project, subject, however, to the procedures in Document 00700 (General Conditions).

27 WITHDRAWAL OF BIDS.

27.1 Bidders may withdraw their Bids at any time prior to the Bid opening time fixed in this Document 00200, only by written request for the withdrawal of Bid filed with Owner at Owner’s office. Bidder or its duly authorized representative shall execute request to withdraw Bid. The submission of a Bid does not commit Owner to award a contract for the Project, to pay costs incurred in the preparation of a Bid, or to procure or contract for any goods or services.

28 INELIGIBLE CONTRACTORS AND SUBCONTRACTORS.

28.1 Owner shall not accept a Bid from a Bidder who is ineligible to bid or work on, or be awarded, a public works project pursuant to California Labor Code section 1777.1 or 1777.7. Bidders and the Contractor who is awarded the project contract shall not utilize, or allow work by, any subcontractor who is ineligible to bid or work on, or be awarded, a public works project pursuant to California Labor Code section 1777.1 or 1777.7. (See California Public Contract Code section 6109.) The California Division of Labor Standards Enforcement publishes a list of debarred contractors and subcontractors on the Internet at www.dir.ca.gov/DLSE/debar.html.
29 PUBLIC RECORDS ACT REQUESTS.

29.1 Per the Public Records Act, Owner will make available to the public Bidder’s SOQ (if bidder’s Envelope “B” is opened), all correspondence and written questions submitted during the Bid period, all Bid submissions opened in accordance with the procedures of the Document 00200, and all subsequent Bid evaluation information. All submissions not opened will remain sealed and eventually be returned to the submitter. Except as otherwise require by law, Owner will not disclose trade secrets or proprietary financial information submitted that has been designated confidential by Bidder (including but not limited to the SOQ). Any such trade secrets or proprietary financial information that a Bidder believes should be exempted from disclosure shall be specifically identified and marked as such. Blanket-type identification by designating whole pages or sections shall not be permitted and shall be invalid. The specific information must be clearly identified as such.

29.2 Upon a request for records regarding this Bid, Owner will notify Bidder involved within ten Days from receipt of the request when the records will be made available for inspection. If the Bidder timely identifies any “proprietary, trade secret, or confidential commercial or financial” information that Bidder determines is not subject to public disclosure, and requests Owner to refuse to comply with the records request, Bidder shall take all appropriate legal action and defend Owner’s refusal to produce the information in all forums; otherwise Owner will make such information available to the extent require by applicable law, without restriction.

29.3 Information disclosed in the SOQ and the attendant submissions are the property of Owner unless Bidder makes specific reference to data that is considered proprietary. Subject to the requirements in the Public Records Act, reasonable efforts will be made to prevent the disclosure of information except on a need-to-know basis during the evaluation process.

30 CONSTRUCTION PAYMENT BOND AND CONSTRUCTION LABOR AND MATERIALS BOND SURETY.

30.1 Document 00610 (Construction Performance Bond) and Document 00620 (Construction Labor and Material Payment Bond) shall be executed by a surety insurer admitted in the State of California by the Department of Insurance. Bidder shall verify Surety’s admission by either: (1) printing out information from the website of the Department of Insurance confirming that Surety is an admitted surety insurer; or, (2) obtaining a certificate from the County Clerk confirming that Surety is an admitted insurer. Bidder shall attach such verification to Document 00610 and Document 00620.

31 CONFORMED CONSTRUCTION DOCUMENTS.

31.1 Following Award of Contract, Owner may prepare a conformed set of Contract Documents reflecting Addenda issued during bidding, which will, failing reasonable objection, constitute the approved set of Contract Documents.

32 DEFINITIONS.

32.1 All abbreviations and definitions of terms used in this Document 00200 are set forth in Section 01420 (References and Definitions).

END OF DOCUMENT
DOCUMENT 00201

BID SUBMITTAL MAP

1 SUMMARY

1.1 This Document 00201 describes in graphic detail on how to locate Owner offices to submit Bid documents to the appropriate building at Owner offices.

2 MAP

2.1 See attached map showing Bid submittal location.

END OF DOCUMENT
DOCUMENT 00210

ACCESS, INDEMNITY AND RELEASE AGREEMENT

Dated ______________________________

POTENTIAL BIDDER: _________________________________________________________________________

OWNER: Peralta Community College District, (hereinafter “Owner”)

SITE: Merritt College, 12500 Campus Drive, Oakland, CA 94619

PROJECT: CHW Infrastructure Project PROJECT No. 2355B BID No.: 12/13-03

In consideration of the above-referenced Owner’s permitting the undersigned potential bidder ("Bidder") to have access to, and to conduct investigations, tests and/or inspections on the Site ("access"), and effective upon such access, Bidder hereby agrees as follows:

1. To the greatest extent permitted by law, including without limitation California Civil Code Section 2782, Bidder hereby releases, and shall defend, indemnify and hold harmless Owner, and its officers, employees, consultants (including without limitation Architect/Engineer), representatives, and agents, and all other parties having any other interest in the Site, against any claim or liability, including attorney’s fees, arising from or relating to any Site-related access, investigation, test, inspection and/or other access activity conducted by Bidder or any of Bidder’s officers, employees, consultants, representatives, and/or agents, regardless of whether claim or liability is caused in part by the negligence of Owner or by any released and indemnified party.

2. In connection with the release referenced in paragraph 1 above, Bidder hereby waives the provisions of California Civil Code Section 1542 which provides as follows:

A general release does not extend to claims that the creditor does not know or suspect to exist in his or her favor at the time of executing the release, which if known by him or her, must have materially affected his or her settlement with the debtor.

3. Bidder shall repair any damage to the Site or adjacent property resulting from activities by or on behalf of Bidder authorized hereunder, and comply with and be subject to all other requirements and obligations described or referenced in Document 00320 (Geotechnical Data and Existing Conditions).

4. Attached hereto (or to be delivered separately before Bidder’s visit to the Site) is a certificate for comprehensive general liability insurance satisfying the requirements of Document 00700 (General Conditions) and Document 00821 (Supplemental Conditions – Insurance).

5. Although this Access, Indemnity and Release Agreement is not a Contract Document (see Document 00520 Agreement), it shall be fully effective and binding regardless of whether Bidder submits a Bid for the subject Project, is awarded a contract for the Project or otherwise.

________________________________________
Name of Bidder

By: ________________________________  By: ________________________________
Signature  Signature

Its: ________________________________  Its: ________________________________
Title (If Corporation: Chairman, President or Vice President)  Title (If Corporation: Secretary, Assistant Secretary, Chief Financial Officer or Assistant Treasurer)

END OF DOCUMENT

Error! Unknown document property name. 00210 - 1 Access Indemnity and Release Agreement
DOCUMENT 00320

GEOTECHNICAL DATA AND EXISTING CONDITIONS

1 SUMMARY

1.1 This Document 00320 sets forth the terms and conditions under which Bidder may review, study, use, or rely upon geotechnical data at or contiguous to the Site, and existing conditions information concerning existing conditions at or contiguous to the Site. This Document 00320, the available geotechnical data, and the supplied existing conditions information are not Contract Documents.

2 REPORT AND INFORMATION

2.1 Owner, its consultants, and prior contractors may have collected documents providing a general description of the Site and conditions of the Work. These documents may consist of geotechnical reports for and around the Site, contracts, contract specifications, tenant improvement contracts, as-built drawings, utility drawings, and information regarding Underground Facilities. These reports, documents and other information are not part of the Contract Documents.

2.2 Bidders may inspect geotechnical reports and information regarding existing conditions available at the Owner’s Office, and may obtain copies at cost of reproduction and handling upon Bidder’s payment for the costs. These reports, documents and other information are not part of the Contract Documents. Nevertheless, by submitting a Bid, Bidder accepts full responsibility for reviewing, knowing and understanding the contents of all of these materials.

2.3 Geotechnical reports may be included in the Project Manual and information regarding existing conditions may also be included in the Project Manual, but neither shall be considered part of the Contract Documents.

3 USE OF INFORMATION ON EXISTING CONDITIONS

3.1 Aboveground Existing Conditions.

3.1.1 Under no circumstances shall Owner be deemed to make a warranty or representation of existing aboveground conditions, as-built conditions, or other aboveground actual conditions verifiable by reasonable independent investigation. These conditions are verifiable by Bidder by the performance of its own independent investigation that Bidder must perform prior to bidding and Bidder must not rely on the information supplied by Owner regarding existing conditions. Bidder represents and agrees that in submitting its Bid, it is not relying on any information regarding existing conditions supplied by Owner.

3.2 Underground Facilities.

3.2.1 Information supplied regarding existing Underground Facilities at or contiguous to the Site is based on information furnished to Owner by others (e.g., the owners or builders of such Underground Facilities or others). Except as expressly set forth in this Document 00320, Owner does not assume responsibility for the accuracy, completeness or thoroughness of this information, and Bidder is solely responsible for any interpretation or conclusion drawn from this information. Except as expressly set forth in this Document 00320, Owner will be responsible only for the general accuracy of information regarding Underground Facilities, and only for those Underground Facilities that are owned by Owner. This express assumption of responsibility applies only if Bidder has conducted the independent investigation required of it and discrepancies were not apparent.

4 LIMITED RELIANCE PERMITTED ON CERTAIN INFORMATION

4.1 Limitations on Geotechnical Data.

4.1.1 Except as expressly set forth in this Document 00320, Owner does not warrant, and makes no representation regarding, the accuracy or thoroughness of any geotechnical data. Bidder represents and agrees that in submitting its Bid, it is not relying on any geotechnical data supplied by Owner, except as specifically set forth herein.
4.2 Limitations on Technical Data.

4.2.1 Bidder may rely upon the general accuracy of the “technical data” contained in the geotechnical reports and drawings identified above, but only insofar as it relates to subsurface conditions, provided Bidder has conducted the independent investigation required of it and discrepancies were not apparent. The term “technical data” in the referenced reports and drawings shall be limited as follows:

1. The term “technical data” shall include actual reported depths, reported quantities, reported soil types, reported soil conditions, and reported material, equipment, or structures that were encountered during subsurface exploration.

2. The term “technical data” does not include, and Bidder may not rely upon, any other data, interpretations, opinions or information shown or indicated in such drawings or reports that otherwise relate to subsurface conditions or described structures.

3. The term “technical data” shall not include the location of Underground Facilities.

4. Bidder may not rely on the completeness of reports and drawings for the purposes of bidding or construction. Bidder may rely upon the general accuracy of the “technical data” contained in such reports or drawings.

5. Bidder is solely responsible for any interpretation or conclusion drawn from any “technical data” or any other data, interpretations, opinions, or information contained in supplied geotechnical data.

5 INVESTIGATIONS

5.1 Before submitting a Bid, each Bidder shall be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site or otherwise, which may affect cost, progress, performance or furnishing of Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of Contract Documents. Bidders shall advise Owner in writing during the Bid period of any questions, suppositions, inferences or deductions Bidders may have for Owner’s review and response.

5.2 Owner has provided time in the period prior to bidding for Bidder to perform these investigations.

6 ACCESS TO SITE FOR INVESTIGATIONS

6.1 Subject to reasonable scheduling, Owner will provide each Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies, as each Bidder deems necessary for submission of a Bid. Bidders must fill all holes, clean up and restore the Site to its former conditions upon completion of such explorations, investigations, tests, and studies. Such investigations may be performed only under the provisions of Document 00200 (Instructions to Bidders) and Document 00700 (General Conditions) including, but not limited to, proof of insurance and obligation to indemnify against claims arising from such investigation work. Each Bidder shall supply all equipment required to perform any investigations as each Bidder deems necessary. Owner has the right to limit the number of pieces of machinery operating at one time due to safety concerns.

END OF DOCUMENT
DOCUMENT 00400

BID FORM

TO THE BOARD OF TRUSTEES OF THE PERALTA COMMUNITY COLLEGE DISTRICT

THIS BID IS SUBMITTED BY:

____________________________________________________________________________________

(Firm/Company Name)

Re: THE PERALTA COMMUNITY COLLEGE DISTRICT, CHW INFRASTRUCTURE PROJECT at 12500 Campus Drive, Oakland, CA 94619, BID Number: 12/13-03, Project Number: 2355B

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with PERALTA COMMUNITY COLLEGE DISTRICT (hereinafter “Owner”) in the form included in the Contract Documents, Document 00520 (Agreement), to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Sum and within the Contract Time indicated in this Bid and in accordance with all other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Contract Documents, Document 00100 (Notice Inviting Bids), and Document 00200 (Instructions to Bidders), including, without limitation, those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for 60 Days after the day of Bid opening.

3. In submitting this Bid, Bidder represents:

(a) Bidder has examined all of the Contract Documents and the following Addenda (receipt of all of which is hereby acknowledged).

<table>
<thead>
<tr>
<th>Addendum Number</th>
<th>Addendum Date</th>
<th>Signature of Bidder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Bidder acknowledges receipt of Pre-Bid Conference minutes, if any.

(c) Bidder has visited the Site and performed all tasks, research, investigation, reviews, examinations, and analysis and given notices, regarding the Project and the Site, as required in Document 00700 (General Conditions), Article 2.

(e) Bidder has given Owner prompt written notice of all conflicts, errors, ambiguities, or discrepancies that it has discovered in or among the Contract Documents and as-built drawings and actual conditions and the written resolution thereof through Addenda issued by Owner is acceptable to Contractor.

4. Based on the foregoing, Bidder proposes and agrees to fully perform the Work within the time stated and in strict accordance with the Contract Documents for the following sums of money listed in the following Schedule of Bid Prices:
SCHEDULE OF BID PRICES

All Bid items, including lump sums and unit prices, must be filled in completely. Bid items are described in Section 01100 (Summary of Work). Quote in figures only, unless words are specifically requested.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>[ENTER BID ITEM 1]</td>
<td>$</td>
</tr>
<tr>
<td>2.</td>
<td>[ENTER BID ITEM 2]</td>
<td>$</td>
</tr>
<tr>
<td>3.</td>
<td>[ENTER BID ITEM 3]</td>
<td>$</td>
</tr>
<tr>
<td>4.</td>
<td>[continue as needed]</td>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>TOTAL BID PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$</td>
</tr>
</tbody>
</table>

Total Bid Price: ____________________________________________________________ (Words)

<table>
<thead>
<tr>
<th>Alternate No. 1</th>
<th>[ENTER ALTERNATIVE 1]</th>
<th>$</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate No. 2</td>
<td>[ENTER ALTERNATIVE 2]</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

[if there are alternates, include scope reference]

5. **Selection of Apparent Low Bidder** The undersigned acknowledges that the Apparent Low Bidder will be the Bidder submitting the “Total Bid Price” (i.e., the total of Bid Items 1 through 7) **reduced by the value of Alternate No. 1**, based on the assumptions (if any) set forth in the Schedule of Bid Prices. [Although Alternate No. 1 will be considered in the calculation of Apparent Low Bidder, Owner may exercise Alternate No. 1 in its sole discretion.]

6. Subcontractors for work included in all Bid items are listed on the attached Document 00430 (Subcontractors List).

7. The undersigned Bidder understands that Owner reserves the right to reject this Bid.

8. If written notice of the acceptance of this Bid, hereinafter referred to as Notice of Award, is mailed or delivered to the undersigned Bidder within the time described in Paragraph 2 of this Document 00400 or at any other time thereafter before it is withdrawn, the undersigned Bidder will execute and deliver the documents required by Document 00200 (Instructions to Bidders) within the times specified therein. These documents include, but are not limited to, Document 00520 (Agreement), Document 00610 (Construction Performance Bond), and Document 00620 (Construction Labor and Material Payment Bond).

9. Notice of Award or request for additional information may be addressed to the undersigned Bidder at the address set forth below.
10. The undersigned Bidder herewith encloses cash, a cashier’s check, or certified check of or on a responsible bank in the United States, or a corporate surety bond furnished by a surety authorized to do a surety business in the State of California, in form specified in Document 00200 (Instructions to Bidders), in the amount of ten percent (10%) of the Total Bid Price and made payable to Owner.

10. The undersigned Bidder agrees to commence Work under the Contract Documents on the date established in Document 00700 (General Conditions) and to complete all Work within the time specified in Document 00520 (Agreement).

11. The undersigned Bidder agrees that, in accordance with Document 00700 (General Conditions), liquidated damages for failure to complete all Work in the Contract within the time specified in Document 00520 (Agreement) shall be as set forth in Document 00520 (Agreement).

12. The names of all persons interested in the foregoing Bid as principals are:

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, give the legal name of corporation, state where incorporated, and names of president and secretary thereof; if a partnership, give name of the firm and names of all individual co-partners composing the firm; if Bidder or other interested person is an individual, give first and last names in full.

NAME OF BIDDER: __________________________

licensed in accordance with an act for the registration of Contractors, and with license number: ________________

_________________________________________ Expiration: ________________

_________________________________________ (Place of Incorporation, if Applicable) (Principal)

_________________________________________ (Principal)

_________________________________________ (Principal)

I certify (or declare) under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

_________________________________________ (Signature of Bidder)

NOTE: If Bidder is a corporation, set forth the legal name of the corporation together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation. If Bidder is a partnership, set forth the name of the firm together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership.

Business Address: __________________________

_________________________________________
Contractor’s Representative(s):

(Name/Title)

(Name/Title)

(Name/Title)

Officers Authorized to Sign Contracts

(Name/Title)

(Name/Title)

(Name/Title)

Telephone Number(s):

(Area Code) (Number)

(Area Code) (Number)

Fax Number(s):

(Area Code) (Number)

Date of Bid:

END OF DOCUMENT
DOCUMENT 00411

BOND ACCOMPANYING BID

KNOW ALL BY THESE PRESENTS:

That the undersigned ____________________________,

(Name of Contractor)

as Principal and the undersigned as Surety are held and firmly bound unto THE PERALTA COMMUNITY COLLEGE DISTRICT (hereinafter “Owner”), as obligee, in the penal sum of ______________________ Dollars ($______________) lawful money of the United States of America being at least ten percent (10%) of the aggregate amount of said Principal’s Total Bid Price, for the payment of which, well and truly to be made, we bind ourselves, our successors, executors, administrators, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal is submitting a Bid for Owner, Bid Number: 12/13-03, Project Number: 2355B, PERALTA COMMUNITY COLLEGE DISTRICT, MERRITT COLLEGE CHW INFRASTRUCTURE PROJECT at Purchasing Department, 501 5th Avenue, Oakland CA 94606, Attn: David Imada.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the Bid submitted by the said Principal be accepted and the Contract be awarded to said Principal and said Principal shall within the required periods enter into the Contract so awarded and provide the required Construction Performance Bond, Construction Labor and Material Payment Bond, insurance certificates, and all other endorsements, forms, and documents required under Document 00200 (Instructions to Bidders), then this obligation shall be void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument this ____ day of ________________, [20____.]

(Month)

(Corporate Seal)     By ______________________________________________

Principal

(Corporate Seal)

By ______________________________________________

Surety

(Corporate Seal)

By ______________________________________________

Attorney in Fact

END OF DOCUMENT
DOCUMENT 00420

BIDDER REGISTRATION FORM

INSTRUCTIONS

In order to register to undertake work for THE PERALTA COMMUNITY COLLEGE DISTRICT (hereinafter “Owner”), Bidder must:

1) Fill out this registration form completely; do not leave blanks.

2) Provide certificates of insurance or a letter evidencing coverage complying with Paragraph 4.1 of Document 00700 (General Conditions) and Document 00821 (Supplementary Conditions – Insurance).

INDEPENDENT CONTRACTOR REGISTRATION

Contractor’s License # ____________________________________________________________

Date: ___________________________ Fed I.D. # _______________________________

Full Corporate Name of Company: ____________________________________________

Street Address: _______________________________________________________________

Mailing Address: ________________________________________________________________

Phone: ___________________________ Fax: ________________________________

Name of Principal Contact: ____________________________________________________

Type of Business:  _____ Sole Proprietor  _____ Partnership

  _____ Non-Profit 501(c)(3)  _____ Corporation

  _____ other (please explain: __________________________________________________)

INSURANCE

Workers’ Compensation:

Carrier: __________________________________________________________

Address: ___________________________________________________________

Phone and Fax: ______________________________________________________

Policy Number: _______________________________________________________

Error! Unknown document property name. 00420- 1 Bidder Registration Form
### General Liability:
- Carrier: 
- Address: 
- Phone and Fax: 
- Policy Number: 
- Policy Limits: $
- A.M. Best Rating: 

### Automobile Liability:
- Carrier: 
- Address: 
- Phone and Fax: 
- Policy Number: 
- Policy Limits: $
- A.M. Best Rating: 

### All-risk Course of Construction:
- Carrier: 
- Address: 
- Phone and Fax: 
- Policy Number: 
- Policy Limits: $
- A.M. Best Rating: 

### Pollution Legal Liability Insurance (if applicable, as required by Document 00821 [Supplementary Conditions – Insurance]):
- Carrier: 
- Address: 
- Phone and Fax: 
- Policy Number: 
- Policy Limits: $
- A.M. Best Rating: 
BIDDER CERTIFIES, UNDER PENALTY OF PERJURY, THAT THE FOREGOING INFORMATION IS CURRENT AND ACCURATE AND AUTHORIZES OWNER, AND ITS AGENTS AND REPRESENTATIVES TO OBTAIN A CREDIT REPORT AND/OR VERIFY ANY OF THE ABOVE INFORMATION.

BIDDER’S NAME: ________________________________________________

By:  _____________________________________________________________

Signature

Its:  _____________________________________________________________

Title

Date_____________________________________________________________
SAFETY EXPERIENCE

The following statements as to the Bidder’s safety experience are submitted with the Bid, as part thereof, and the Bidder guarantees the truthfulness and accuracy of all information.

1. List Bidder’s interstate Experience Modification Rate for the last three years.
   20___  _____  20___  _____  20___  _____

2. Use Bidder’s last year’s Cal/OSHA 200 log to fill in the following number of injuries and illnesses:
   a. Number of lost workday cases  _______________
   b. Number of medical treatment cases  _______________
   c. Number of fatalities  _______________

3. Employee hours worked last year  _______________

4. State the name of Bidder’s safety engineer/manager: ____________________________________

   Attach a resume or outline of this individual's safety and health qualifications and experience.

   I CERTIFY, UNDER PENALTY OF PERJURY, THAT THE FOREGOING INFORMATION IS CURRENT AND ACCURATE AND I AUTHORIZE OWNER, AND ITS AGENTS AND REPRESENTATIVES TO OBTAIN A CREDIT REPORT AND/OR VERIFY ANY OF THE ABOVE INFORMATION.

   BIDDER’S NAME: ________________________________________________

   By:  _____________________________________________________________
       Signature

   Its:  _____________________________________________________________
       Title

   Date_____________________________________________________________

END OF DOCUMENT
Bidder submits the following information as to the subcontractors Bidder intends to employ if awarded the Contract.

<table>
<thead>
<tr>
<th>Name, address, and telephone number of office of Subcontractor</th>
<th>Type of Work to be Done</th>
<th>License Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Repeat page as needed)

END OF DOCUMENT
STATEMENT OF QUALIFICATIONS FOR CONSTRUCTION WORK

1  GENERAL INFORMATION

1.1  In Document 00100 (Advertisement for Bids) the PERALTA COMMUNITY COLLEGE DISTRICT (“Owner”) has indicated that it will receive sealed Bids for the Contract for the construction of the MERRITT COLLEGE, CHW INFRASTRUCTURE PROJECT, BID No.:12/13-03, Project No. 2355B, The Contract will require Contractor to construct the Project, all in accordance with the scope of Work set forth in the Contract.

1.1.1  Owner will accept Bids only from Bidders duly licensed in accordance with the California Business & Professions Code. Additionally, Bidder must meet the following requirements, at a minimum, in order to be considered by Owner to be qualified for award of the Contract:

(1) Three years experience as a continuously operating entity engaged in the performance of similar work.
(2) Within the past five years completed DSA projects of a similar nature and complexity with a contract dollar amount of at least $1 million each, or $5 million in the aggregate.

1.1.2  Bidder’s compliance with the minimum qualification requirements in paragraph 1.1.1 of this document 00450 will also be measured by the experience of the supervisory personnel who will have responsible charge of the various major components of the Work.

(1) If Bidder subcontracts portions of the Work, Owner, in its determination of whether the minimum qualification requirements have been met, will consider the qualifications of the Subcontractor’s supervisory personnel.
(2) The qualifications of the Key Personnel are to be submitted with the SOQ, by providing the information described in paragraph 2.7 of this document 00450.

2  REQUIRED CONTENTS OF SOQ SUBMISSION

2.1  Transmittal Letter.

2.1.1  The Transmittal Letter shall name the proposed prime contractor, its legal structure (i.e., corporation, partnership, limited partnership, joint venture), and all of the Subcontractors to be used on the Project, and the roles and responsibilities proposed for each firm. If a joint venture or partnership is proposed, Bidder shall identify partner and/or member of the joint venture and their roles and responsibilities.

2.2  Financial Capacity.

2.2.1  Include audited or reviewed financial statements for the three most recently completed fiscal years for Bidder and each member of any proposed consorting or joint venture. Also include audited or reviewed financial statements for the three most recently completed fiscal years for any parent companies) of Bidder and each member of any proposed consortium or joint venture.

2.3  Capability to Provide Required Performance and Payment Bonds.

2.3.1  Bidder shall include a letter from a surety duly licensed to do business in the State of California, having a financial rating from A.M. Best Company of or better that the surety has agreed to provide Bidder with the required performance and payment bonds in accordance with the requirements set forth in Documents 00610 (Construction Performance Bond) and 00620 (Construction Labor and material Payment bond). Such performance and payment bonds shall be in the minimum penal sums provided therein. Bidder shall include authorization that gives Owner the right to verify with the surety that the surety, based upon the Bid prices, will issue the required bonds under the conditions stated.
2.4 **Capability to Provide the Required Insurance.**

2.4.1 Bidder shall provide a letter from an insurance underwriters), having a financial rating from A.M. Best Company of or better, confirming that the insurer will provide Bidder the required coverage’s and amounts specified in document 00700 (General Conditions).

2.5 **Human and Physical Resources.**

2.5.1 Bidder shall identify, describe, and quantify for itself and separately for its designated Subcontractor(s) (as defined in Document 00200 Instructions to Bidders), the following technical information for the construction work:

1. Description and location of manufacturing facilities, naming products and quantifying production capacity and current demand;
2. Description of field organization(s), naming skills and equipment;
3. Description of safety program quality control procedures, and safety experience; and
4. Evidence of a valid California A or B contractor's license and required licenses of all licensees of persons who are Key Personnel if the Bidder or any designated Subcontractors.

2.6 **Completed Questionnaire.**

2.6.1 Bidder shall include a completed Statement of Qualification Questionnaire in the form attached to this Document 00450 as Attachment “A”. Bidder shall make sure its answers to the Questionnaire describe for itself its Key Personnel proposed, and it’s designated Subcontractor(s), their public works construction projects of at least $10 million each. Add supplementary information if necessary.

2.7 **Resumes of Proposed Key Personnel.**

2.7.1 Bidder shall provide a resume for each named Key Personnel of Bidder and Bidder’s (including but not limited to the superintendent) designated Subcontractor(s), to include the following:

1. Name and proposed assignment of Key Personnel; do not include home addresses or phone numbers
2. Years of experience;
3. Education - degrees, schools and years obtained;
4. Professional Registrations;
5. Fluency in English (Yes/No);
6. Experience directly related to Chiller plant and infrastructure, DSA regulated, and similar projects.
7. At least two client references, including contact names, addresses and telephone numbers, and
8. Description of projects of a similar nature worked on in the past five years.

2.8 **Litigation History.**

2.8.1 Description of litigation history for the past three years, including names of involved parties, nature of dispute, and disposition.

3 **GENERAL CONDITIONS**

3.1 **General Conditions for Content.**

3.1.1 The SOQ shall be clear and concise to enable management-oriented personnel to make a thorough evaluation and arrive at a sound determination as to whether the SOQ meet Owner's requirement. To this end, the SOQ should be so specific, detailed and complete as to demonstrate clearly and fully that the Bidder has a thorough understanding of and has demonstrated knowledge of the requirements to perform the Work (or applicable portion thereof).
3.2 **Explanations to SOQ.**

3.2.1 Any explanation requested by a Bidder regarding the meaning or interpretation of this Document 00450 must be requested in writing and with sufficient time allowed for a reply to reach Bidder before the submission of its SOQ. Oral explanations or instructions will not be binding. Any information provided to any prospective Bidder concerning this Document 00450 will be furnished to all prospective Bidders as an Addendum to the Bidding Documents.

3.3 **Definitions.**

3.3.1 Except as set forth herein, all abbreviations and definitions of terms used in this document 00450 are as set forth in Document 00700 (General Conditions) or Section 01420 (References and Definitions).

STATEMENT OF QUALIFICATION QUESTIONNAIRE FOLLOWS ON NEXT PAGE
ATTACHMENT “A” – Statement of Qualification Questionnaire

Bidders shall complete the entire Statement of Qualification Questionnaire and submit it in accordance with Document 00200 (Instructions to Bidders) and Document 00450 (Statement of Qualifications). Failure to complete the questionnaire or inclusion of any false statement(s) shall be ground for immediate disqualification.

CONTACT INFORMATION

Company Name: ____________________________

Owner of Company: ____________________________

Contact Person: ____________________________

Address: ____________________________

Phone: ____________________________ Fax: ____________________________

PART A: GENERAL INFORMATION

1. Does Bidder possess a valid and current California Contractor’s license for the work proposed? Yes ___ No ___

2. Does Bidder have a minimum of $5,000,000 liability insurance coverage? Yes ___ No ___

3. Has Bidder’s License been revoked at any time in the last five years? Yes ___ No ___

4. Has Bidder been “default terminated” by an owner (other than for convenience), or has a Surety completed a contract for Bidder within the last five years? Yes ___ No ___

5. Has Bidder been convicted more than twice for failure to pay prevailing wages in the last three years? Yes ___ No ___

6. Has Bidder attached copies of its reviewed or audited financial statements and accompanying notes for the last three years? Yes ___ No ___

Bidder may be disqualified if any answer to questions 1, 2, or 6 is No.
Bidder may be disqualified if any answer to questions 3, 4, or 5 is Yes.

PART B: SAFETY, PREVAILING WAGE, DISPUTES AND BONDS

(SAFETY)

1. Has Cal/OHSA, Federal OSHA, the EPA or any Air Quality Management Owner cited Bidder in the past five years? Yes ___ No ___ If yes, attach description of each citation.

2. How often does Bidder require documented safety meetings be held for:
   - Field Supervisor Weekly _____ Bi-Weekly _____ Monthly _____ Less Than Monthly _____
   - Employees Weekly _____ Bi-Weekly _____ Monthly _____ Less Than Monthly _____
   - New Hires Weekly _____ Bi-Weekly _____ Monthly _____ Less Than Monthly _____
   - Subcontractors Weekly _____ Bi-Weekly _____ Monthly _____ Less Than Monthly _____

3. How often does Bidder conduct documented safety inspections?
   - Quarterly _____ Semi-annually _____ Annually _____ Other _____
4. Does Bidder have home office safety representatives who visit/audit the job site?
   Quarterly _____ Semi-annually _____ Annually _____ Other _____

5. What is Bidder’s Interstate Experience Modification Rate? ____________. (A rating in excess of 1.0 may constitute grounds for disqualification as non-responsible).

(PREVAILING WAGE PROVISIONS)

6. Has Bidder been fined, penalized or otherwise found to have violated any prevailing wage or labor code provision? If yes, attach description of each occurrence.
   Yes _____ No _____

(LICENSE PROVISIONS)

7. Has Bidder changed names or license numbers in the past 5 years? If so, please state reason for change.
   Yes _____ No _____ Reason:
   ____________________________________________________________________________________
   ____________________________________________________________________________________

(DISPUTES)

8. Has Bidder had any claims, litigation, or disputes ending in mediation or arbitration, or termination for cause associated with any project in the past 5 years? If yes, attach description of each instance including details of total claim amount, settlement amount, and owner’s name and phone number.
   Yes _____ No _____

(BONDING)

9. Bonding Capacity – Provide documentation from Bidder’s surety identifying the following:
   Name of bonding company/surety: ______________________________________________________
   Name of Surety Agent: __________________________________________________________________
   Surety Agent address: __________________________________________________________________
   Surety Agent phone number: __________________________________________________________________
   Is surety a California-admitted surety? Yes _____ No _____
   Is surety listed in the current edition of the California Department of the Treasury’s Listing of approved sureties? Yes _____ No _____
   List surety’s A.M. Best Rating: __________________________________________________________________
   What is Bidder’s total bonding capacity? __________________________________________________________________
   What percent does Bidder pay for bonds? __________________________________________________________________

PART C: EXPERIENCE OF PRIME CONTRACTOR

The unique nature of this Project requires prior similar experience for the firm and the Key Personnel assigned. Summarize similar project experience below and provide the detailed project information requested:

Prime Contractor: List 3 DSA projects of a similar nature and complexity with a contract dollar amount of at least $1 million each, or $5 million, completed in the past five years, and indicate who were the superintendent, project manager and scheduler:
### Recent Projects.

Bidder shall provide information about five of its most currently completed projects. Names and references must be current and verifiable. If a separate sheet is used, it must contain all of the following information:

1. Project Name: ____________________________________________________________
   
   Location: ________________________________________________________________
   
   Owner: ________________________________________________________________
   
   Owner Contact (name and phone): _______________________________________

List Key Personnel that will be assigned to the Work of the current Project and their experience/training with the projects listed above:

- Project Manager: ____________________________________________________________
- Project Superintendent: ____________________________________________________
- Project Scheduler: ________________________________________________________

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Construction Cost ($)</th>
<th>Year Completed</th>
<th>Name of Project Superintendent</th>
<th>Name of Project Manager</th>
<th>Name of Project Scheduler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rev. 0
8/18/10
Architect/Engineer: ________________________________________________________________

Architect/Engineer Contact (name and phone number): __________________________________

Const. Mgr. or Project Mgr. (name and phone number): _________________________________

Description of Project, Scope of Work Performed: _______________________________________

________________________________________________________________________________

Total Construction Cost: _____________________________________________________________

Total Change Order Amount: _________________________________________________________

Did Change Orders exceed 10% of original contract sum? ________ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _____________________________________________

Time Extensions Granted (number of Days): ____________________________________________

Actual Date of Completion: _________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: _____________________________

2. Project Name: ____________________________________________________________________

Location: __________________________________________________________________________

Owner: _____________________________________________________________________________

Owner Contact (name and phone): ____________________________________________________

Architect/Engineer: __________________________________________________________________

Architect/Engineer Contact (name and phone number): __________________________________

Const. Mgr. Or Project Mgr. (name and phone number): _________________________________

Description of Project, Scope of Work Performed: _______________________________________

________________________________________________________________________________

Total Construction Cost: _____________________________________________________________

Total Change Order Amount: _________________________________________________________

Did Change Orders exceed 10% of original contract sum? ________ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _____________________________________________

Time Extensions Granted (number of Days): ____________________________________________

Actual Date of Completion: _________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: _____________________________

3. Project Name: ____________________________________________________________________
Location: ________________________________________________________________

Owner: ________________________________________________________________

Owner Contact (name and phone): _________________________________________

Architect/Engineer: _______________________________________________________

Architect/Engineer Contact (name and phone number): ________________________

Const. Mgr. Or Project Mgr. (name and phone number): _______________________  

Description of Project, Scope of Work Performed: ____________________________

________________________________________________________________________

Total Construction Cost: _________________________________________________

Total Change Order Amount: _____________________________________________

Did Change Orders exceed 10% of original contract sum? ______ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: ________________________________

Time Extensions Granted (number of Days): ______________________________

Actual Date of Completion: _____________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ________________

4. Project Name: _________________________________________________________

Location: ______________________________________________________________

Owner: ________________________________________________________________

Owner Contact (name and phone): _________________________________________

Architect/Engineer: _______________________________________________________

Architect/Engineer Contact (name and phone number): ________________________

Const. Mgr. Or Project Mgr. (name and phone number): _______________________  

Description of Project, Scope of Work Performed: ____________________________

________________________________________________________________________

Total Construction Cost: _________________________________________________

Total Change Order Amount: _____________________________________________

Did Change Orders exceed 10% of original contract sum? ______ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: ________________________________

Time Extensions Granted (number of Days): ______________________________

Statement of Qualifications
Actual Date of Completion: ____________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ________________________________

5. Project Name: ______________________________________________________________________
Location: __________________________________________________________________________
Owner: ____________________________________________________________________________
Owner Contact (name and phone): ______________________________________________________
Architect/Engineer: __________________________________________________________________
Architect/Engineer Contact (name and phone number): _____________________________________
Const. Mgr. Or Project Mgr. (name and phone number): ___________________________________
Description of Project, Scope of Work Performed: __________________________________________
__________________________________________________________________________________

Total Construction Cost: ______________________________________________________________

Total Change Order Amount: ____________________________________________________________

Did Change Orders exceed 10% of original contract sum? ___________ If yes, please explain on separate sheet.

Original Scheduled Date of Completion: _________________________________________________

Time Extensions Granted (number of Days): ______________________________________________

Actual Date of Completion: ____________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ________________________________

PART D: EXPERIENCE OF DESIGNATED SUBCONTRACTOR(S)

The unique nature of this Project requires prior similar experience of the designated Subcontractor(s) and the Key Personnel assigned. Summarize similar project experience below and provide the detailed project information requested for each of the designated Subcontractor(s). Also expressly indicate which, if any, of the designated Subcontractor(s) functions Bidder will perform itself.

Mechanical Subcontractor: List three similar typed projects completed in the past five years and indicate who were the superintendent and scheduler.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Construction Cost ($)</th>
<th>Year Completed</th>
<th>Name of Project Manager</th>
<th>Name of Project Superintendent</th>
<th>Name of Project Scheduler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Error! Unknown document property name.
List Key Personnel that will be assigned to the Work:

Project Manager: ________________________________________________________________

Project Superintendent: ___________________________________________________________

**Electrical Subcontractor:** List three similar typed projects completed in the past five years and indicate who were the superintendent and scheduler.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Construction Cost ($)</th>
<th>Year Completed</th>
<th>Name of Project Manager</th>
<th>Name of Project Superintendent</th>
<th>Name of Project Scheduler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List Key Personnel that will be assigned to the Work:

Project Manager: ________________________________________________________________

Project Superintendent: ___________________________________________________________

**Specialty Subcontractor:** List three similar typed projects completed in the past five years and indicate who were the superintendent and scheduler.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Construction Cost ($)</th>
<th>Year Completed</th>
<th>Name of Project Manager</th>
<th>Name of Project Superintendent</th>
<th>Name of Project Scheduler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List Key Personnel that will be assigned to the Work:

Project Manager: ________________________________________________________________

Project Superintendent: ___________________________________________________________

**Recent Projects.**

Provide information about three of its most recently completed, similar projects for each of the designated Subcontractor(s). Names and references must be current and verifiable. Use additional sheets if necessary. If a separate sheet is used, it must contain all of the following information for each of the designated Subcontractor(s):

1.  Project Name: ________________________________________________________________

Error! Unknown document property name.
Location: __________________________________________________________

Owner: ____________________________________________________________

Owner Contact (name and phone): ______________________________________

Architect/Engineer: _________________________________________________

Architect/Engineer Contact (name and phone number): ____________________

Prime Contractor: _________________________________________________

Prime Contractor Contact (name and phone number): ______________________

Const. Mgr. Or Project Mgr. (name and phone number): ____________________

Description of Project, Scope of Work Performed: _________________________

____________________________________________________________________

Value of Construction Contract: _______________________________________

Value of Change Orders: _____________________________________________

Original Scheduled Date of Completion: _________________________________

Time Extensions Granted (number of Days): _____________________________

Actual Date of Completion: _________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ______________

2. Project Name: ____________________________________________________

Location: __________________________________________________________

Owner: ____________________________________________________________

Owner Contact (name and phone): ______________________________________

Architect/Engineer: _________________________________________________

Architect/Engineer Contact (name and phone number): ____________________

Prime Contractor: _________________________________________________

Prime Contractor Contact (name and phone number): ______________________

Const. Mgr. Or Project Mgr. (name and phone number): ____________________

Description of Project, Scope of Work Performed: _________________________

____________________________________________________________________

Value of Construction Contract: _______________________________________

Value of Change Orders: _____________________________________________
Original Scheduled Date of Completion: _________________________________________________

Time Extensions Granted (number of Days): _____________________________________________

Actual Date of Completion: __________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ______________________________

3. Project Name: ____________________________________________________________________

Location: __________________________________________________________________________

Owner: ____________________________________________________________________________

Owner Contact (name and phone): ______________________________________________________

Architect/Engineer: __________________________________________________________________

Architect/Engineer Contact (name and phone number): _____________________________________

Prime Contractor: ____________________________________________________________________

Prime Contractor Contact (name and phone number): _______________________________________

Const. Mgr. Or Project Mgr. (name and phone number): ____________________________________

Description of Project, Scope of Work Performed: _________________________________________

__________________________________________________________________________________

Value of Construction Contract: ________________________________________________________

Value of Change Orders: ______________________________________________________________

Original Scheduled Date of Completion: _________________________________________________

Time Extensions Granted (number of Days): _____________________________________________

Actual Date of Completion: __________________________________________________________

Number of Stop Notices filed by Subcontractors or Suppliers: ______________________________

PART E: FINANCIAL INFORMATION

1. Has Bidder ever reorganized under the protection of bankruptcy laws?
   Yes _____ No _____ If yes, please state when _______________

2. If Bidder has had the general liability carrier identified in Document 00420 (Bidder Registration and Safety Experience Form) for less than 5 years, please provide additional information below for balance of the last 5 years:

   Agency Name: ______________________________________________________________________

   Contact Name: _____________________________________________________________________

   Phone Number: _____________________________________________________________________
Carrier: ___________________________________ A.M. Best Rating: _________________________

Carrier: ___________________________________ A.M. Best Rating: _________________________

Carrier: ___________________________________ A.M. Best Rating: _________________________

3. Has Bidder ever had insurance terminated by a carrier? Yes _____ No _____
   If yes, explain on a separate signed sheet marked with correlating cross-reference to this paragraph of the
   questionnaire.

Bidder hereby declares under penalty of perjury that all the information provided in this questionnaire is true and
correct.

______________________________
SIGNATURE

______________________________
TITLE

END OF DOCUMENT
NON-COLLUSION AFFIDAVIT

PUBLIC CONTRACT CODE §7106

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

STATE OF CALIFORNIA  )
COUNTY OF _________________ ) ss.

_________________________________________________________________________, being first duly sworn,

(Name of Principal of Bidder)

deposes and says that he or she is __________________________________________________________________

(Office of Affiant)

of _________________________________________________________________________________, the party

(Name of Bidder)

making the foregoing Bid, that the Bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the Bid is genuine and not collusive or sham; that Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham Bid, and has not directly or indirectly colluded, conspired, connived or agreed with any bidder or anyone else to put in a sham Bid, or that anyone shall refrain from bidding, and that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication or conference with anyone to fix the Bid price of Bidder or any other bidder, or to fix any overhead, profit or cost element of the Bid price, or of that of any other bidder, or to secure any advantage against the Peralta Community College District, or anyone interested in the proposed contract; that all statements contained in the Bid are true; and further, that Bidder has not, directly or indirectly, submitted its Bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, Bid depository, or to any member or agent thereof to effectuate a collusive or sham Bid.

Executed under penalty of perjury under the laws of the State of California:

______________________________________________________________

(Name of Bidder)

______________________________________________________________

(Signature of Principal)

Subscribed and sworn before me

______________________________________________________________

This _____________ day of ____________________________, 20____

Notary Public of the State of __________________________________

In and for the County of ________________________________________

My Commission expires ________________________________________ (Seal)
NOTE: If Bidder is a partnership or a joint venture, this affidavit must be signed and sworn to by every member of the partnership or venture.

NOTE: If Bidder [including any partner or venturer of a partnership or joint venture] is a corporation, this affidavit must be signed by the Chairman, President, or Vice President and by the Secretary, Assistant Secretary, Chief Financial Officer, or Assistant Treasurer.

NOTE: If Bidder’s affidavit on this form is made outside the State of California, the official position of the person taking such affidavit shall be certified according to law.

END OF DOCUMENT
DOCUMENT 00482

BIDDER CERTIFICATIONS

THE PERALTA COMMUNITY COLLEGE DISTRICT
CHW INFRASTRUCTURE PROJECT AT MERRITT COLLEGE
12500 CAMPUS DRIVE, OAKLAND, CA 94619
BID NUMBER 12/13-03, PROJECT NUMBER: 2355B

TO BE EXECUTED BY ALL BIDDERS AND SUBMITTED WITH BID

The undersigned Bidder certifies to the PERALTA COMMUNITY COLLEGE DISTRICT as set forth in sections 1 through [5] below.

1. STATEMENT OF CONVICTIONS

By my signature hereunder, I hereby swear, under penalty of perjury, that no more than one final, unappealable finding of contempt of court by a Federal Court has been issued against Bidder within the past two years because of failure to comply with an order of a Federal Court or to comply with an order of the National Labor Relations Board.

2. CERTIFICATION OF WORKER'S COMPENSATION INSURANCE

By my signature hereunder, as the Contractor, I certify that I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that Code, and I will comply with such provisions before commencing the performance of the work of this Contract.

3. CERTIFICATION OF PREVAILING WAGE RATES AND RECORDS

By my signature hereunder, as the Contractor, I certify that I am aware of the provisions of Section 1773 of the California Labor Code, which requires the payment of prevailing wage on public projects. Also, that the Contractor and any subcontractors under the Contractor shall comply with California Labor Code §1776, regarding wage records, and with California Labor Code §1777.5, regarding the employment and training of apprentices. It is the Contractor’s responsibility to ensure compliance by any and all subcontractors performing work under this Contract.

4. CERTIFICATION OF COMPLIANCE WITH PUBLIC WORKS CHAPTER OF LABOR CODE

By my signature hereunder, as the Contractor, I certify that I am aware of Sections 1777.1 and 1777.7 of the California Labor Code and Contractor and Subcontractors and am eligible to bid and work on public works projects.
5. **CERTIFICATION OF ADEQUACY OF CONTRACT AMOUNT**

By my signature hereunder, as the Contractor, pursuant to Labor Code Section 2810(a), I certify that, if awarded the Contract based on the undersigned’s Bid, the Contract will include funds sufficient to allow the Contractor to comply with all applicable local, state, and federal laws or regulations governing the labor or services to be provided. I understand that the County will be relying on this certification if it awards the Contract to the undersigned.

**BIDDER:**

(Name of Bidder)

Date: ___________________, [20____]  

By: _____________________________  

(Signature)

Name: ___________________________  

(Print Name)

Its: _____________________________  

(Title)

**END OF DOCUMENT**
DOCUMENT 00505

NOTICE OF INTENT TO AWARD FOR CONSTRUCTION

DATE POSTED: ___________________________, 20____

CONTRACT NO. __________

PROJECT TITLE:
Merritt College
CHW Infrastructure Project
(Bid No.: 12/13-03)
(Project No.2355B)

The Peralta Community College District intends to recommend to its Board of Trustees award of the above-referenced project to (Name of Contractor) _________________________________.

SIGNATURE ________________________________ DATE ____________________

______________________________
Title

END OF DOCUMENT
NOTICE OF AWARD

Dated __________________________

TO: ________________________________________________________________

ADDRESS: _______________________________________________________________________

CONTRACT NO.: ______________________________

CONTRACT FOR: THE PERALTA COMMUNITY COLLEGE DISTRICT (“OWNER”) CHW INFRASTRUCTURE PROJECT AT MERRITT COLLEGE, 12500 CAMPUS DRIVE, OAKLAND, CA 94619

The Contract Sum of your contract is _______________________________________________________________
______________________________________________________________________ Dollars ($_____________).

1. Several copies of the proposed Contract Documents listed below accompany this Notice of Award.

2. You must comply with the following conditions precedent by 5:00 p.m. of the 20th Day following the date of this Notice of Award, that is, by November 5, 2012

   a. Deliver to Owner four fully executed counterparts of Document 00520 (Agreement). Each copy of Document 00520 (Agreement) must bear your original signature on the signature page and your initials on each page.

   b. Deliver to Owner one original of Document 00610 (Construction Performance Bond), executed by you and your surety.

   c. Deliver to Owner one original of Document 00620 (Construction Labor and Material Payment Bond), executed by you and your surety.

   d. Deliver to Owner one original set of the insurance certificates with endorsements required under Document 00700 (General Conditions) and Document 00821 (Supplementary Conditions – Insurance).

   e. Deliver to Owner four original copies of Document 00630 (Guaranty), each executed by you.

3. Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid abandoned, to annul this Notice of Award, and to declare your Bid security forfeited.

4. Within 21 Days after you comply with the conditions in Paragraph 2 of this Document 00510, Owner will return to you one fully signed counterpart of Document 00520 (Agreement) with [insert number] copies of the Project Manual (including Specifications and Drawings) and [insert number] sets of full-size Drawings.
5. Before you may start any Work at the Site, you must attend a preconstruction conference. The preconstruction conference may be arranged through Johnnie Fudge, Facilities Project Manager, (510) 466-7244, Cell: (510) 377-0748, Email: jfudge@peralta.edu Questions regarding bonds and insurance may be directed to Carol Reil, Project Coordinator, (510) 466-7339, Email creil@peralta.edu, at the same number. All other inquiries regarding the Project should be directed to Johnnie Fudge, Facilities Project Manager, (510) 466-7244, Cell: (510) 377-0748, Email: jfudge@peralta.edu.

6. Upon commencement of the Work, you and each of your Subcontractors shall certify and provide Owner copies of payroll records on forms provided by the Division of Labor Standards Enforcement, in accordance with California Labor Code §1776.

OWNER: [ENTER NAME OF OWNER]

BY: __________________________________________
   (Title)

__________________________________________
   (Print Name)

ATTEST:  ______________________________________
            Secretary

__________________________________________
   (Print Name)

AUTHORIZED BY BOARD RESOLUTION:

NO: _________________________________

ADOPTED: ____________________________, 20___

[Copy of Resolution Attached]

END OF DOCUMENT
AGREEMENT

THIS AGREEMENT, dated this [date] day of [Month], [201__], by and between [Name of Contractor] whose place of business is located at [Address of Contractor] ("Contractor"), and [Insert Name of Owner] ("Owner"), acting under and by virtue of the authority vested in Owner by the laws of the State of California.

WHEREAS, Owner, by its Resolution No. [insert number] adopted on the [date] day of [Month, Year] awarded to Contractor the following Contract:

CONTRACT NUMBER [Insert Number]

[PROJECT NAME]
at
[PROJECT STREET ADDRESS]
[CITY], CA [ZIP CODE]

NOW, THEREFORE, in consideration of the mutual covenants hereinafter set forth, Contractor and Owner agree as follows:

1 SCOPE OF WORK OF THE CONTRACT

1.1 Work of the Contract

1.1.1. Contractor shall complete all Work specified in the Contract Documents, in accordance with the Specifications, Drawings, and all other terms and conditions of the Contract Documents (Work).

1.2 Price for Completion of the Work

1.2.1. Owner shall pay Contractor the following Contract Sum (Contract Sum) for completion of Work in accordance with Contract Documents as set forth in Contractor’s Bid, attached hereto.

[ATTACHMENT]

2 COMMENCEMENT AND COMPLETION OF WORK

2.1 Commencement of Work

2.1.1. Contractor shall commence Work on the date established in the Notice to Proceed (Commencement Date).

2.1.2. Owner reserves the right to modify or alter the Commencement Date.

2.2 Completion of Work

2.2.1. Contractor shall achieve Substantial Completion of the entire Work within [_____] Days from the Commencement Date.

2.2.2. Contractor shall achieve Final Completion of the entire Work [_____] Days from the Commencement Date.

3 PROJECT REPRESENTATIVES

3.1 Owner’s Project Manager

3.1.1. Owner has designated [________ or other] as its Project Manager to act as Owner’s Representative in all matters relating to the Contract Documents.

3.1.2. Project Manager shall have final authority over all matters pertaining to the Contract Documents and shall have sole authority to modify the Contract Documents on behalf of
Owner, to accept work, and to make decisions or actions binding on Owner, and shall have sole signature authority on behalf of Owner.

3.1.3. Owner may assign all or part of the Project Manager’s rights, responsibilities and duties to a Construction Manager, or other Owner Representative.

3.2 Contractor’s Project Manager

3.2.1. Contractor has designated [________ or other] as its Project Manager to act as Contractor’s Representative in all matters relating to the Contract Documents.

3.3 Architect/Engineer

3.3.1. [Identify Architect/Engineer] furnished the Plans and Specifications and shall have the rights assigned to Architect/Engineer in the Contract Documents.

3.3.2. Architect/Engineer has designated [________] as its project manager, to act as its representative for receiving and making communications authorized under the Contract Documents.

4 LIQUIDATED DAMAGES FOR DELAY IN COMPLETION OF WORK

4.1 Liquidated Damage Amounts

4.1.1. As liquidated damages for delay Contractor shall pay Owner ____________ dollars ($______.00) for each Day that expires after the time specified herein for Contractor to achieve Substantial Completion of the entire Work, until achieved.

4.1.2. As liquidated damages for delay Contractor shall pay Owner ____________ dollars ($______.00) for each Day that expires after the time specified herein for Contractor to achieve Final Completion of the entire Work, until achieved.

4.2 Scope of Liquidated Damages

4.2.1. Measures of liquidated damages shall apply cumulatively.

4.2.2. Limitations and stipulations regarding liquidated damages are set forth in Document 00700 (General Conditions).

5 CONTRACT DOCUMENTS

5.1 Contract Documents consist of the following documents, including all changes, Addenda, and Modifications thereto:

- Document 00510 Notice of Award
- Document 00520 Agreement
- Document 00550 Notice to Proceed
- Document 00610 Construction Performance Bond
- Document 00620 Construction Labor and Material Payment Bond
- Document 00630 Guaranty
- Document 00650 Release of Claims
- Document 00660 Substitution Request Form
- Document 00680 Escrow Agreement for Security Deposits
- Document 00700 General Conditions
- Document 00800 Supplementary Conditions
- Document 00805 Supplemental Conditions – Hazardous Materials
- Document 00806 Labor Compliance Program [If Required by Funding Source]
- Document 00821 Supplementary Conditions – Insurance and Indemnification
- Document 00822 Apprenticeship Programs
- Document 00910 Addenda
- Specifications Divisions 1 through [__]

[Maps, Drawings and Sketches listed in Document 00015 (if any)]
5.2 There are no Contract Documents other than those listed above. The Contract Documents may only be amended, modified or supplemented as provided in Document 00700 (General Conditions).

6 MISCELLANEOUS

6.1 Terms and abbreviations used in this Agreement are defined in Document 00700 (General Conditions) and Section 01420 (References and Definitions) and will have the meaning indicated therein.

6.2 It is understood and agreed that in no instance are the persons signing this Agreement for or on behalf of Owner or acting as an employee, agent, or representative of Owner, liable on this Agreement or any of the Contract Documents, or upon any warranty of authority, or otherwise, and it is further understood and agreed that liability of Owner is limited and confined to such liability as authorized or imposed by the Contract Documents or applicable law.

6.3 The Contract Sum includes all allowances (if any).

6.4 In entering into a public works contract or a subcontract to supply goods, services or materials pursuant to a public works contract, Contractor or Subcontractor offers and agrees to assign to the awarding body all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. §15) or under the Cartwright Act (Chapter 2 (commencing with §16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time Owner tenders final payment to Contractor, without further acknowledgment by the parties.

6.5 Copies of the general prevailing rates of per diem wages for each craft, classification, or type of worker needed to execute the Contract, as determined by Director of the State of California Department of Industrial Relations, are deemed included in the Contract Documents and on file at Owner’s Office, and shall be made available to any interested party on request. Pursuant to California Labor Code §§ 1860 and 1861, in accordance with the provisions of Section 3700 of the Labor Code, every contractor will be required to secure the payment of compensation to his employees. Contractor represents that it is aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code, and Contractor shall comply with such provisions before commencing the performance of the Work of the Contract Documents.

6.6 This Agreement and the Contract Documents shall be deemed to have been entered into in the County of [   ], State of California, and governed in all respects by California law (excluding choice of law rules). The exclusive venue for all disputes or litigation hereunder shall be in the Superior Court for the County of [   ].

IN WITNESS WHEREOF the parties have executed this Agreement in quadruplicate the day and year first above written.

CONTRACTOR: [CONTRACTOR’S NAME]

By: _______________________________  By: _______________________________
(Signature)                         (Signature)

Its: _______________________________  Its: _______________________________
Title (If Corporation: Chairman, President or Vice President) Title (If Corporation: Secretary, Assistant Secretary, Chief Financial Officer or Assistant Treasurer)

OWNER: [INSERT NAME OF OWNER]

By: _______________________________
(Signature)

________________________
(Print Name)

________________________
(Title)

Attest: ______________________
Secretary

________________________
(Print Name)

APPROVED AS TO FORM AND LEGALITY
THIS __ DAY OF _____, [201__]

By: ______________________
    Attorney for Owner

________________________
(Print Name)

RESOLUTION NO. ______________

END OF DOCUMENT
DOCUMENT 00550

NOTICE TO PROCEED

Dated: ______________________, 20____

To: _____________________________________________________________________________
   (Contractor)

Address: _________________________________________________________________________

________________________________________________________________________________

CONTRACT FOR: The Peralta Community College District, Merritt College CHW Infrastructure Project

BID NO: 12/13-03

PROJECT NO: 2355B

You are notified that the Contract Time under the above Contract will commence to run on __________, 20____. On that date, you are to start performing your obligations with respect to Work at the Site under the Contract Documents. In accordance with Article 3 of Document 00520 (Agreement), the dates of Substantial Completion and Final Completion for the entire Work are __________, 20____ and __________, 20____, respectively.

Before you may start any Work at the Site, you must:

1. Submit certified Safety Program and related information

2. Submit approved fire protection plan, if applicable

3. Complete training required by Project Labor Agreement, (PLA).

BY ORDER OF THE BOARD OF TRUSTEES OF THE PERALTA COMMUNITY COLLEGE DISTRICT

By: ________________________________

Its: ________________________________

END OF DOCUMENT
CONSTRUCTION PERFORMANCE BOND

THIS CONSTRUCTION PERFORMANCE BOND ("Bond") is dated [Month, Day], 20___ is in the penal sum of ________________________________, which is one hundred percent of the Contract Sum, and is entered into by and between the parties listed below to ensure the faithful performance of the Construction Contract listed below. This Bond consists of this page and the Bond Terms and Conditions, Paragraphs 1 through 12, attached to this page. Any singular reference to __________________________________________ ("Contractor"), __________________________________________ ("Surety"), __________________________________________ (hereinafter “Owner”), or other party shall be considered plural where applicable.

CONTRACTOR:

Name

Address

City/State/Zip

SURETY:

Name

Principal Place of Business

City/State/Zip

CONSTRUCTION CONTRACT: [ENTER NAME OF OWNER] [ENTER PROJECT TITLE]
[Enter Project Subtitle/Inclusive Work]

[Enter Project Address]

DATED __________________________, 20___ in the amount of $__________________________ (the "Penal Sum").

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

Signature: __________________________

Name: __________________________

Title: __________________________

SURETY

Company: (Corp. Seal)

Signature: __________________________

Name: __________________________

Title: __________________________
BOND TERMS AND CONDITIONS

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Owner for the complete and proper performance of the Construction Contract, which is incorporated herein by reference.

2. If Contractor completely and properly performs all of its obligations under the Construction Contract, Surety and Contractor shall have no obligation under this Bond.

3. If there is no Owner Default, Surety’s obligation under this Bond shall arise after:
   3.1 Owner has declared a Contractor Default under the Construction Contract pursuant to the terms of the Construction Contract; and
   3.2 Owner has agreed to pay the Balance of the Contract Sum:
      3.2.1 To Surety in accordance with the terms of this Bond and the Construction Contract; or
      3.2.2 To a contractor selected to perform the Construction Contract in accordance with the terms of this Bond and the Construction Contract.

4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly (within 60 Days) and at Surety’s expense elect to take one of the following actions:
   4.1 Arrange for Contractor, with consent of Owner, to perform and complete the Construction Contract (but Owner may withhold consent, in which case the Surety must elect an option described in Paragraphs 4.2, 4.3 or 4.4, below); or
   4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; provided, that Surety may not select Contractor as its agent or independent contractor without Owner’s consent; or
   4.3 Undertake to perform and complete the Construction Contract by obtaining bids from qualified contractors acceptable to Owner for a contract for performance and completion of the Construction Contract and, upon determination by Owner of the lowest responsive and responsible Bidder, arrange for a contract to be prepared for execution by Owner and the contractor selected with Owner’s concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract; and, if Surety’s obligations defined in Paragraph 6, below, exceed the Balance of the Contract Sum, then Surety shall pay to Owner the amount of such excess; or
   4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances and, after investigation and consultation with Owner, determine in good faith its monetary obligation to Owner under Paragraph 6, below, for the performance and completion of the Construction Contract and, as soon as practicable after the amount is determined, tender payment therefor to Owner with full explanation of the payment’s calculation. If Owner accepts Surety’s tender under this Paragraph 4.4, Owner may still hold Surety liable for future damages then unknown or unliquidated resulting from the Contractor Default. If Owner disputes the amount of Surety’s tender under this Paragraph 4.4, Owner may exercise all remedies available to it at law to enforce Surety’s liability under Paragraph 6, below.

5. If Surety does not proceed as provided in Paragraph 4, above, then Surety shall be deemed to be in default on this Bond ten Days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond. At all times Owner shall be entitled to enforce any remedy available to Owner at law or under the Construction Contract including, without limitation, and by way of
example only, rights to perform work, protect Work, mitigate damages, advance critical Work to mitigate schedule delay, or coordinate Work with other consultants or contractors.

6. Surety’s monetary obligation under this Bond is limited by the amount of this Bond identified herein as the Penal Sum. This monetary obligation shall augment the Balance of the Contract Sum. Subject to these limits, Surety’s obligations under this Bond are commensurate with the obligations of Contractor under the Construction Contract. Surety’s obligations shall include, but are not limited to:

   6.1 The responsibilities of Contractor under the Construction Contract for completion of the Construction Contract and correction of Defective Work;

   6.2 The responsibilities of Contractor under the Construction Contract to pay liquidated damages.

   6.3 Additional legal, design professional and delay costs resulting from Contractor Default or resulting from the actions or failure to act of the Surety under Paragraph 4, above (but excluding attorney’s fees incurred to enforce this Bond).

7. No right of action shall accrue on this Bond to any person or entity other than Owner or its successors or assigns.

8. Surety hereby waives notice of any change, alteration or addition to the Construction Contract or to related subcontracts, purchase orders and other obligations, including changes of time. Surety consents to all terms of the Construction Contract, including provisions on changes to the Contract. No extension of time, change, alteration, Modification, deletion, or addition to the Contract Documents, or of the Work required thereunder, shall release or exonerate Surety on this Bond or in any way affect the obligations of Surety on this Bond unless such change, alteration, Modification, deletion or addition is a cardinal change.

9. Any proceeding, legal or equitable, under this Bond shall be instituted in any court of competent jurisdiction where a proceeding is pending between Owner and Contractor regarding the Construction Contract, or in the courts of the County of Kern, or in a court of competent jurisdiction in the location in which the Work is located. Communications from Owner to Surety under Paragraph 3.1 of this Bond shall be deemed to include the necessary agreements under Paragraph 3.2 of this Bond unless expressly stated otherwise.

10. All notices to Surety or Contractor shall be mailed or delivered (at the address set forth on the signature page of this Bond), and all notices to Owner shall be mailed or delivered as provided in Document 00520 (Agreement). Actual receipt of notice by Surety, Owner or Contractor, however accomplished, shall be sufficient compliance as of the date received at the foregoing addresses.

11. Any provision in this Bond conflicting with any statutory or regulatory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein.

12. Definitions

   12.1 Balance of the Contract Sum: The total amount payable by Owner to Contractor pursuant to the terms of the Construction Contract after all proper adjustments have been made under the Construction Contract, for example, deductions for progress payments made, and increases/decreases for approved Modifications to the Construction Contract.

   12.2 Construction Contract: The agreement between Owner and Contractor identified on the signature page of this Bond, including all Contract Documents and changes thereto.

   12.3 Contractor Default: Material failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract, limited to “default”
or any other condition allowing a termination for cause as provided in Document 00700 (General Conditions).

12.4 Owner Default: Material failure of Owner, which has neither been remedied nor waived, to pay Contractor progress payments due under the Construction Contract or to perform other material terms of the Construction Contract, if such failure is the cause of the asserted Contractor Default and is sufficient to justify Contractor termination of the Construction Contract.

END OF DOCUMENT
DOCUMENT 00630

GUARANTY

TO: The Peralta Community College District, (hereinafter “Owner”), for construction of the Merritt College CHW Infrastructure Project.

The undersigned guarantees that all construction performed on this Project, and all material and equipment incorporated therein, shall meet or exceed the requirements of the Contract Documents.

Contractor hereby grants to Owner for a period of one year following the date of Final Acceptance of the Work completed, or such longer period specified in the Contract Documents, its unconditional warranty of the quality and adequacy of all of the Work including, without limitation, all labor, materials and equipment provided by Contractor and its Subcontractors of all tiers in connection with the Work.

Neither final payment nor use nor occupancy of the Work performed by the Contractor shall constitute an acceptance of Work not done in accordance with this Guaranty or relieve Contractor of liability in respect to any express warranties or responsibilities for faulty materials or workmanship. Contractor shall remedy any defects in the Work and pay for any damage resulting therefrom, which shall appear within one year, or longer if specified, from the date of Final Acceptance of the Work completed.

If within one year after the date of Final Acceptance of the Work completed, or such longer period of time as may be prescribed by laws or regulations, or by the terms of Contract Documents, any Work is found to be Defective, Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions, correct such Defective Work. Contractor shall remove any Defective Work rejected by Owner and replace it with Work that is not Defective, and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor fails to promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the Defective Work corrected or the rejected Work removed and replaced. Contractor shall pay for all claims, costs, losses and damages caused by or resulting from such removal and replacement. Where Contractor fails to correct Defective Work, or defects are discovered outside the correction period, Owner shall have all rights and remedies granted by law.

Inspection of the Work shall not relieve Contractor of any of its obligations under the Contract Documents. Even though equipment, materials, or Work required to be provided under the Contract Documents have been inspected, accepted, and estimated for payment, Contractor shall, at its own expense, replace or repair any such equipment, material, or Work found to be Defective or otherwise not to comply with the requirements of the Contract Documents up to the end of the guaranty period.

All abbreviations and definitions of terms used in this Agreement shall have the meanings set forth in the Contract Documents, including, without means of limitation, Document 00700 (General Conditions) and Section 01420 (References and Definitions).

The foregoing Guaranty is in addition to any other warranties of Contractor contained in the Contract Documents, and not in lieu of, any and all other liability imposed on Contractor under the Contract Documents and at law with respect to Contractor’s duties, obligations, and performance under the Contract Documents. In the event of any conflict or inconsistency between the terms of this Guaranty and any warranty or obligation of the Contractor under the Contract Documents or at law, such inconsistency or conflict shall be resolved in favor of the higher level of obligation of the Contractor.

Date: __________________________________ [20___]

Contractor's name
By: ________________________________
    Signature

_______________________________
Print Name

_______________________________
Title

_______________________________
Street Address

_______________________________
City, State, Zip code

END OF DOCUMENT
DOCUMENT 00670

ESCROW BID DOCUMENTS

1 REQUIREMENTS FOR ESCROW BID DOCUMENTS.

1.1 Within the time period established in Document 00200 (Instructions to Bidders), Contractor shall submit to Owner a set of Escrow Bid Documents as defined in paragraph 2 below. Escrow Bid Documents will be used only in the manner and for the purposes described in this Document 00670.

1.2 The submission of the Escrow Bid Documents, as with the bonds and insurance documents required under Document 00200 (Instructions to Bidders), is considered an essential part of the Contract award. Should Contractor fail to make the submission within the allowed time specified, Contractor may be deemed to have failed to enter into the Contract, Contractor shall forfeit the amount of its Bid security accompanying Contractor’s Bid, and Owner may award the Contract to the next lowest responsive responsible Bidder.

1.3 NO PAYMENTS WILL BE MADE, NOR WILL OWNER ACCEPT CHANGE ORDER REQUESTS UNTIL THE ABOVE-REQUIRED INFORMATION IS SUBMITTED AND APPROVED. ALTERNATIVELY, OWNER MAY DECLARE THE BID NON-RESPONSIVE.

1.4 Contractor shall submit the Escrow Bid Documents, in person by an authorized representative of the Contractor, to:

__________________
__________________
__________________
__________________

2 SCOPE OF ESCROW BID DOCUMENTS.

2.1 Within the time period specified in Document 00200 (Instructions to Bidders), Contractor shall submit one (1) copy of all documentary information received or generated by Contractor in preparation of Bid prices for the Contract Documents, as specified in paragraphs 5 and 6 of this Document 00670. This material is referred to in this Document 00670 as the “Escrow Bid Documents.” Contractor’s Escrow Bid Documents will be held in escrow as provided in this Document 00670.

2.2 Contractor represents and agrees, as a condition of award of the Contract, that the Escrow Bid Documents constitute all written information used in the preparation of its Bid, and that no other written Bid preparation information shall be considered in resolving disputes or claims or may be considered in legal proceedings. Contractor also agrees that nothing in the Escrow Bid Documents shall change or modify the terms or conditions of the Contract Documents. Contractor is advised that the Escrow Bid Documents will only be used as a guide in the resolution of disputes and claims.

3 OWNERSHIP OF ESCROW BID DOCUMENTS.

3.1 The Escrow Bid Documents are, and shall always remain, the property of Contractor, subject to joint review by Owner and Contractor, as provided in this Document 00670.

3.2 Owner stipulates and expressly acknowledges that the Escrow Bid Documents constitute trade secrets. This acknowledgement is based on Owner’s express understanding that the information contained in the Escrow Bid Documents is not known outside Contractor’s business, is known only to a limited extent and only by a limited number of Contractor’s employees, is safeguarded while in Contractor’s possession, is extremely valuable to Contractor and could be extremely valuable to Contractor’s competitors by virtue of it reflecting Contractor’s contemplated construction techniques. Owner further acknowledges that the Escrow Bid Documents and the information contained in them are made available to Owner only because such action is an express pre-requisite to award of the Contract. Owner agrees to safeguard the Escrow Bid Documents, and all information contained in them, against disclosure to the fullest extent permitted by law, consistent with paragraph 4 of this Document 00670.

4 USE OF ESCROW BID DOCUMENTS.
4.1 Escrow Bid Documents may be used in the determination of price adjustments and change orders and in the settlement of disputes and claims. If used in legal proceedings, Escrow Bid Documents shall be subject to an appropriate protective order limiting their disclosure.

5 FORMAT AND CONTENTS OF ESCROW BID DOCUMENTS.

5.1 Contractor may submit Escrow Bid Documents in their usual cost-estimating format; a standard format is not required. Contractor shall prepare and submit the Escrow Bid Documents in English.

5.2 Owner requires Contractor to itemize clearly in the Escrow Bid Documents the estimated costs of performing the work of each Bid item contained in Contractor’s Bid. Contractor shall separate Bid items into sub-items as required to present a detailed cost estimate and allow a detailed cost review. The Escrow Bid Documents shall include all Subcontractor bids or quotes, supplier bids or quotes, quantity take-offs, crews, equipment, calculations of rates of production and progress, copies of quotes from Subcontractors and suppliers, and memoranda, narratives, add/deduct sheets, and all other information used by Contractor to arrive at the prices contained in the Bid. Escrow Bid Documents shall include costs of scheduled maintenance, depreciation, fleet rental expense discounts and incentives, and similar cost adjustments if used by Contractor to calculate its Bid prices. Estimated costs shall be broken down into Contractor’s usual estimate categories such as direct labor, repair labor, equipment ownership and operation, expendable materials, permanent materials and subcontract costs as appropriate. Plant and equipment and indirect costs should be detailed in Contractor’s usual format. Contractor shall identify its allocation of indirect costs, contingencies, markup and other items to each Bid item.

5.3 Contractor shall identify all costs. For Bid items amounting to less than $10,000, Contractor may estimate costs without a detailed cost estimate, provided that Contractor includes applicable labor, equipment, materials and subcontracts, and allocates applicable indirect costs, contingencies and markup.

5.4 Bid documents provided by Owner should not be included in the Escrow Bid Documents unless needed to comply with these requirements.

6 SUBMITTAL OF ESCROW BID DOCUMENTS.

6.1 Contractor shall submit the Escrow Bid Documents within 14 Days after the award. The container shall be clearly marked on the outside with Contractor’s name, date of submittal, project name and the words “Escrow Bid Documents - Open only in the presence of Authorized Representatives of both Owner and Contractor.” Owner will review the Escrow Bid Documents for initial compliance. Owner has three Days after receipt of Bidder's Escrow Bid Documents to demand additional information.

6.2 By submitting Escrow Bid Documents, Contractor represents that the material in the Escrow Bid Documents constitutes all the documentary information used in preparation of the Bid and that Contractor has personally examined the contents of the Escrow Bid Documents container and has found that the documents in the container are complete. Contractor agrees that it will not introduce or rely on any other documents to prove how it prepared its Bid.

6.3 If Contractor’s proposal is based upon subcontracting any part of the Work, each Subcontractor whose total subcontract price exceeds five percent of the total Contract Sum proposed by Contractor, shall provide separate Escrow Documents to be included with those of Contractor. Such documents shall be opened and examined in the same manner and at the same time as the examination described above for Contractor.

6.4 If Contractor wishes to subcontract any portion of the Work after award, Owner retains the right to require Contractor to submit Escrow Documents for the Subcontractor before approval of the subcontract.

7 STORAGE, EXAMINATION, AND FINAL DISPOSITION OF ESCROW BID DOCUMENTS.

7.1 The Escrow Bid Documents will be placed in escrow until Final Completion of Work on the Project, in a mutually agreeable institution. Contractor shall pay the cost of storage for the Escrow Bid Documents until that time. The storage facilities shall be the appropriate size for all the Escrow Bid Documents and located conveniently to both Owner’s and, to the extent reasonably possible, Contractor’s offices, but in no event outside the County in which the Owner’s main office is located.

7.2 Both Owner and Contractor shall examine the Escrow Bid Documents, at any time deemed necessary by either Owner or Contractor, to assist in the negotiation of price adjustments and change orders or the settlement of disputes and claims. Examination of the Escrow Bid Documents is subject to the following conditions:
7.2.1 As trade secrets, the Escrow Bid Documents are proprietary and confidential under paragraph 3.2. of this Document 00670.

7.2.2 Owner and Contractor (and any Subcontractor, to the extent Escrow Bid Documents are required by a Subcontractor) shall each designate in writing to the other party(s) at least seven Days prior to any examination, representatives who are authorized to examine the Escrow Bid Documents. Except as otherwise provided in a court order, no other persons shall have access to the Escrow Documents.

7.2.3 Except as otherwise provided in a court order, access to the documents may take place only in the presence of duly designated representatives of both Owner and Contractor. If Contractor fails to designate a representative or appear for joint examination on seven Days’ notice, then Owner’s representative may examine the Escrow Bid Documents upon an additional three (3) Days’ notice.

7.2.4 Following Final Completion of Work on the Project and achievement of final settlement, Owner shall direct the escrow agent holding the Escrow Bid Documents in writing to return those documents to Contractor.

END OF DOCUMENT
ESCROW AGREEMENT FOR SECURITY DEPOSIT IN LIEU OF RETENTION

California Public Contract Code §22300

THIS ESCROW AGREEMENT (“Escrow Agreement”) is made and entered into this [Date] day of [Month], [20__], by and between [Enter Name of Owner] (hereinafter “Owner”), whose address is [Enter Owner’s Address]; [Name of Contractor] (“Contractor”), whose place of business is located at [Contractor’s Address]; and [Owner, as escrow agent OR [Name of Bank], a state or federally chartered bank in the State of California, whose place of business is located at [Address] (“Escrow Agent”).

For the consideration hereinafter set forth, Owner, Contractor and Escrow Agent agree as follows:

1. Pursuant to California Public Contract Code §22300, Contractor has the option to deposit securities with Escrow Agent as a substitute for retention earnings required to be withheld by Owner pursuant to Contract Number [Insert number] entered into between Owner and Contractor for the [ENTER NAME OF OWNER] [ENTER PROJECT TITLE] [Enter Project Subtitle] at [ENTER PROJECT ADDRESS] in the amount of [Contract Sum] dated [Date of Contract, 20____] (the “Contract”). Alternatively, on written request of Contractor, Owner shall make payments of the retention earnings directly to Escrow Agent. When Contractor deposits the securities as a substitute for Contract earnings, Escrow Agent shall notify Owner within ten Days of the deposit. The market value of the securities at the time of substitution shall be at least equal to the cash amount then required to be withheld as retention under terms of Contract between Owner and Contractor. Securities shall be held in name of _______________________, and shall designate Contractor as the beneficial owner.

2. Owner shall make progress payments to Contractor for those funds which otherwise would be withheld from progress payments pursuant to Contract provisions, provided that Escrow Agent holds securities in form and amount specified in Paragraph 1 of this Document 00680.

3. When Owner makes payment(s) of retention earned directly to Escrow Agent, Escrow Agent shall hold said payment(s) for the benefit of Contractor until the time that the escrow created under this Escrow Agreement is terminated. Contractor may direct the investment of the payments into securities. All terms and conditions of this Escrow Agreement and the rights and responsibilities of the parties shall be equally applicable and binding when Owner pays Escrow Agent directly.

4. Contractor shall be responsible for paying all fees for the expenses incurred by Escrow Agent in administering the Escrow Account, and all expenses of Owner. Such expenses and payment terms shall be determined by Owner, Contractor, and Escrow Agent.

5. Interest earned on securities or money market accounts held in escrow and all interest earned on that interest shall be for sole account of Contractor and shall be subject to withdrawal by Contractor at any time and from time to time without notice to Owner.

6. Contractor shall have the right to withdraw all or any part of the principal in the Escrow Account only by written notice to Escrow Agent accompanied by written authorization from Owner to Escrow Agent that Owner consents to withdrawal of amount sought to be withdrawn by Contractor.

7. Owner shall have the right to draw upon the securities in event of default by Contractor. Upon seven Days written notice to Escrow Agent from Owner of the default, Escrow Agent shall immediately convert the securities to cash and shall distribute the cash as instructed by Owner.

8. Upon receipt of written notification from Owner certifying that the Contract is final and complete, and that Contractor has complied with all requirements and procedures applicable to the Contract, Escrow Agent shall release to Contractor all securities and interest on deposit less escrow fees and charges of the Escrow
Account. The escrow shall be closed immediately upon disbursement of all moneys and securities on deposit and payments of fees and charges.

9. Escrow Agent shall rely on written notifications from Owner and Contractor pursuant to Paragraphs 5 through 8, inclusive, of this Document 00680 and Owner and Contractor shall hold Escrow Agent harmless from Escrow Agent’s release and disbursement of securities and interest as set forth.

10. Names of persons who are authorized to give written notice or to receive written notice on behalf of Owner and on behalf of Contractor in connection with the foregoing, and exemplars of their respective signatures are as follows:

ON BEHALF OF OWNER:  

Title 
Name 
Signature 
Address 
City/State/Zip Code

ON BEHALF OF CONTRACTOR:  

Title 
Name 
Signature 
Address 
City/State/Zip Code

ON BEHALF OF ESCROW AGENT:  

Title 
Name 
Signature 
Address 
City/State/Zip Code

IN WITNESS WHEREOF, the parties have executed this Escrow Agreement by their proper officers on the date first set forth above.

OWNER  

Title 
Name 
Signature

CONTRACTOR  

Title 
Name 
Signature
ATTEST

_____________________________________
Signature

_____________________________________
Print Name

Secretary

ESCROW AGENT

_____________________________________
Title

_____________________________________
Print Name

_____________________________________
Signature

REVIEWED AS TO FORM:

_____________________________________
Counsel for Owner

_____________________________________
Date

At the time the Escrow Account is opened, Owner and Contractor shall deliver to Escrow Agent a fully executed counterpart of this Document 00680.

END OF DOCUMENT
1 INTERPRETATION OF CONTRACT ................................................................................................................................. 1
   1.1 DEFINED TERMS ................................................................................................................................................ 1
   1.2 CONTRACT DOCUMENTS ................................................................................................................................. 1
   1.3 PRECEDENCE OF DOCUMENTS ....................................................................................................................... 1
2 BID PERIOD INVESTIGATIONS AND SUBCONTRACTORS ............................................................................................... 1
   2.1 CONTRACTOR’S INVESTIGATIONS BEFORE BIDDING .................................................................................... 1
   2.2 SUPPLIED INFORMATION ON UNDERGROUND EXISTING CONDITIONS .................................................. 2
   2.3 SUPPLIED INFORMATION ON ABOVE GROUND EXISTING CONDITIONS ................................................... 3
   2.4 SUBCONTRACTORS ........................................................................................................................................ 3
3 CONTRACT AWARD AND COMMENCEMENT OF THE WORK .......................................................................................... 3
   3.1 TIME ALLOWANCES FOR PERFORMANCE OF CONTRACT DOCUMENTS .......................................................... 3
   3.2 COMMENCEMENT OF WORK ........................................................................................................................... 4
4 INSURANCE AND INDEMNIFICATION .......................................................................................................................... 4
   4.1 INSURANCE ...................................................................................................................................................... 4
5 DRAWINGS AND SPECIFICATIONS ..................................................................................................................................... 4
   5.1 INTENT ............................................................................................................................................................. 4
   5.2 DRAWING DETAILS ........................................................................................................................................ 4
   5.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS ............................................................................... 5
   5.4 CHECKING OF DRAWINGS ............................................................................................................................. 5
   5.5 STANDARDS TO APPLY WHERE SPECIFICATIONS ARE NOT FURNISHED ..................................................... 5
   5.6 DEVIATION FROM SPECIFICATIONS AND DRAWINGS ................................................................................... 5
   5.7 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND CONTRACT DOCUMENTS .................................... 6
6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS ...................................................................................... 6
   6.1 OWNER’S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS ............................. 6
   6.2 MUTUAL RESPONSIBILITY .................................................................................................................................. 6
   6.3 OWNER AUTHORITY OVER COORDINATION .................................................................................................. 6
7 PAYMENT BY OWNER ..................................................................................................................................................... 7
   7.1 RECEIPT AND PROCESSING OF APPLICATIONS FOR PAYMENT ..................................................................... 7
8 CONTROL OF THE WORK .................................................................................................................................................. 7
   8.1 SUBCONTRACTORS .......................................................................................................................................... 7
   8.2 SUPERVISION OF WORK BY CONTRACTOR ....................................................................................................... 7
   8.3 OBSERVATION OF WORK BY OWNER ............................................................................................................. 7
   8.4 ACCESS TO WORK ........................................................................................................................................... 8
9 CONTRACTOR’S WARRANTY, GUARANTY, AND INSPECTION OF WORK .......................................................................... 9
   9.1 WARRANTY AND GUARANTY .......................................................................................................................... 9
   9.2 INSPECTION OF WORK ................................................................................................................................... 10
   9.3 CORRECTION OF DEFECTIVE WORK ................................................................................................................ 11
   9.4 ACCEPTANCE AND CORRECTION OF DEFECTIVE WORK BY OWNER ........................................................... 12
   9.5 RIGHTS UPON INSPECTION OR CORRECTION ................................................................................................. 12
9.6 Samples and Tests of Materials and Work ......................................................... 13
9.7 Proof of Compliance of Contract Provisions .................................................... 13
9.8 Acceptance ....................................................................................................... 13

10 Contractor's Organization and Equipment ....................................................... 13
10.1 Contractor's Legal Address ............................................................................ 13
10.2 Contractor's Office at the Work Site .............................................................. 13
10.3 Contractor's Superintendents or Forepersons ...................................... 13
10.4 Proficiency in English .............................................................................. 14
10.5 Contractor's and Subcontractors' Employees ....................................... 14
10.6 Contractor to List Trades Working ............................................................. 14
10.7 Contractor's Use of the Site ........................................................................ 14

11 Prosecution and Progress of the Work ............................................................ 14
11.1 Contractor to Submit Required Schedules .............................................. 14
11.2 Contractor to Submit Submittals and Shop Drawings ......................... 15
11.3 Contractor to Maintain Cost Data .......................................................... 15
11.4 Contractor to Supply Sufficient Workers and Materials ..................... 15
11.5 Contractor to Locate Underground Facilities ........................................ 16
11.6 Contractor's to Protect Underground Facilities ...................................... 16
11.7 Contractor to Not Disrupt Owner Operation ........................................... 17

12 Claims by Contractor / Non-Judicial Settlement Procedure ....................... 17
12.1 Scope .......................................................................................................... 17
12.2 Procedure .................................................................................................. 18
12.3 Claim Format .............................................................................................. 19
12.4 Mediation ................................................................................................... 19
12.5 Subcontractor Claims ............................................................................... 19
12.6 Waiver ....................................................................................................... 20

13 Legal and Miscellaneous .............................................................................. 20
13.1 Laws and Regulations .............................................................................. 20
13.2 Permits and Taxes ..................................................................................... 20
13.3 Suspension of Work .................................................................................. 21
13.4 Termination of Contract for Cause .......................................................... 21
13.5 Termination of Contract for Convenience .............................................. 22
13.6 Contingent Assignment of Subcontracts ............................................... 24
13.7 Remedies and Contract Integration ......................................................... 24
13.8 Patents ........................................................................................................ 25
13.9 Substitution for Patented and Specified Articles .................................... 25
13.10 Interest of Public Officers ....................................................................... 25
13.11 Limit of Liability ..................................................................................... 25
13.12 Severability .............................................................................................. 26

14 Modifications of Contract Documents .......................................................... 26
14.1 Alterations, Modifications and Force Account Work .............................. 26
14.2 Time Allowances ....................................................................................... 27
14.3 Notice of Delay .......................................................................................... 27
14.4 Non-Compensable Time Extensions; Adverse Weather Parameters ...... 27
14.5 Compensable Time Extensions ............................................................... 28
14.6 Liquidated Damages .............................................................................. 29
14.7 Differing Site Conditions .......................................................................... 29
14.8 Change Orders Related to Underground Facilities ............................... 30

15 Working Conditions and Prevailing Wages .................................................. 31
15.1 Use of Site/Sanitary Rules ........................................................................ 31
15.2 Protection of Work, Persons, Property and Operations ......................... 31
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.3</td>
<td>RESPONSIBILITY FOR SAFETY AND HEALTH</td>
<td>32</td>
</tr>
<tr>
<td>15.4</td>
<td>EMERGENCIES</td>
<td>32</td>
</tr>
<tr>
<td>15.5</td>
<td>USE OF ROADWAYS AND WALKWAYS</td>
<td>33</td>
</tr>
<tr>
<td>15.6</td>
<td>NONDISCRIMINATION</td>
<td>33</td>
</tr>
<tr>
<td>15.7</td>
<td>PREVAILING WAGES</td>
<td>33</td>
</tr>
<tr>
<td>15.8</td>
<td>ENVIRONMENTAL CONTROLS</td>
<td>34</td>
</tr>
<tr>
<td>15.9</td>
<td>SHORING SAFETY PLAN</td>
<td>34</td>
</tr>
</tbody>
</table>
GENERAL CONDITIONS

1 INTERPRETATION OF CONTRACT

1.1 Defined Terms

1.1.1. All abbreviations and definitions of terms used and not otherwise defined in this Document 00700 are set forth in Section 01420 (References and Definitions). This Document 00700 subdivides at first level into Articles, and then into paragraphs, then into subparagraphs.

1.2 Contract Documents

1.2.1. Contract Documents are complementary; what is called for by one is as binding as if called for by all. Contract Documents shall not be construed to create a contractual relationship of any kind between (1) Architect/Engineer or any Owner Representative and Contractor; (2) Owner and/or its representatives and (except as provided in Article 13 below) a Subcontractor, sub-Subcontractor, or supplier of any Project labor, materials, or equipment; or (3) between any persons or entities other than Owner and Contractor.

1.3 Precedence Of Documents

1.3.1. In the case of discrepancy or ambiguity in the Contract Documents, the following order of precedence shall prevail:

(1) Modifications in inverse chronological order (i.e., most recent first), and in the same order as specific portions they are modifying;
(2) Document 00520 (Agreement), and terms and conditions referenced therein;
(3) Document 00800 (Supplementary Conditions);
(4) Document 00700 (General Conditions);
(5) Division 1 Specifications;
(6) Drawings;
(7) Written numbers over figures, unless obviously incorrect;
(8) Figured dimensions over scaled dimensions;
(9) Large-scale drawings over small-scale drawings.
(10) Division 2 through [ENTER FINAL DIVISION NUMBER] Specifications

1.3.2. Any conflict between Drawings and Division 2 through [ENTER FINAL DIVISION NUMBER] Specifications will be resolved in favor of the document of the latest date (i.e., the most recent document), and if the dates are the same or not determinable, then in favor of Specifications.

1.3.3. Any conflict between a bill or list of materials shown in the Contract Documents and the actual quantities required to complete Work required by Contract Documents, will be resolved in favor of the actual quantities.

1.3.4. In the event the Specifications include divisions above Division [ENTER FINAL DIVISION NUMBER] (e.g., Division 18 and above), then such divisions shall be included within the Contract Documents unless identified otherwise.

2 BID PERIOD INVESTIGATIONS AND SUBCONTRACTORS

2.1 Contractor’s Investigations Before Bidding

2.1.1. Prior to submitting its Bid, Contractor must investigate fully the Work of the Contract. Contractor must visit the Site, examine thoroughly and understand fully the nature and extent of the Contract Documents, Work, Site, locality, actual conditions and as-built conditions, and all other information made available for bidding. Contractor’s investigation shall include, but is not limited to, a thorough examination of all reports of exploration and tests of subsurface conditions, as-built drawings, drawings, product specification(s) or reports, available for Bidding purposes, of physical conditions, including Underground Facilities and information identified in Document 00320 (Geotechnical Data and Existing Conditions) and/or Document 00335 (Hazardous Materials Surveys) (if used), or which may appear in the Contract Documents, and all local conditions, and federal, state and local laws and regulations that in any manner may affect cost, progress,
2.1.2. Prior to submitting its Bid, Contractor shall take care to note the existence and potential existence of Underground Facilities, in particular, above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, chemical, hot water, and other similar items and utilities. Contractor shall carefully consider all supplied information, request additional information Contractor may deem necessary, and visually inspect the Site for above ground indications of Underground Facilities (such as, for example not by way of limitation, the existence of existing service laterals, appurtenances or other types of utilities, indicated by the presence of an underground transmission main or other visible facilities, such as buildings, new asphalt, meters and junction boxes, on or adjacent to the Site.)

2.1.3. Prior to submitting its Bid, Contractor must correlate its experience, knowledge and the results of its required investigation with the terms and conditions of the Contract Documents, and must give Owner prompt written notice of all conflicts, errors, ambiguities, or discrepancies of any type, that it may discover in or among the Contract Documents, as-built drawings (if any) and/or actual conditions. Contractor shall give this notice during the Bid period and submission of a Bid indicates Contractor’s agreement that Owner responded to the notice through Addenda issued by Owner which is acceptable to Contractor.

2.1.4. Prior to submitting its Bid, Contractor must consider fully the fact that information supplied regarding existing Underground Facilities at or contiguous to the Site is in many cases based on information furnished to Owner by others (e.g., the builders of such Underground Facilities or others), and that due to their age or their chain of custody since preparation, may not meet current industry standards for accuracy. Contractor must also consider local underground conditions and typical practices for Underground Facilities, either through its own direct knowledge or through its subcontractors, and fully consider this knowledge in assessing the existing information and the reasonableness of its reliance.

2.1.5. Prior to submitting its Bid, Contractor shall conduct (or request that Owner have conducted) any such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site or otherwise, which may affect cost, progress, performance or furnishing of Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Contractor and safety precautions and programs incident thereto or which Contractor deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of Contract Documents.

2.1.6. Prior to submitting its Bid, Contractor may rely on Owner supplied information regarding existing conditions only where such conditions are underground and not subject to reasonable verification. If existing information supplied by Owner indicates a discrepancy or a substantial risk of inaccuracy or omission, then Contractor must request specific additional information. Contractor shall advise Owner in writing during the Bid period of any questions, suppositions, inferences or deductions Contractor may have, for Owner’s review and response by Addenda, and may not assert any such matters later that were not brought forth during the Bid period.

2.1.7. During performance of the Contract, Contractor will be charged with knowledge of all information that it should have learned in performing this required pre-Bid investigation, and shall not be entitled to change orders (time or compensation) due to information or conditions that Contractor should have known as a part of this pre-Bid investigation.

2.2 Supplied Information On Underground Existing Conditions

2.2.1. Regarding Underground Facilities shown in the Contract Documents or supplied through Document 00320, Owner has compiled this information in good faith, relying on its records and third party records. Because of the nature and location of Owner and the Project, the existence of Underground Facilities is deemed inherent in the Work of the Contract, as is the fact that
Underground Facilities are not always accurately shown or completely shown on as-built records, both as to their depth and location. In Article 14 of this Document 00700, this Contract establishes a heightened standard for claims involving Underground Facilities. Contractor shall consider this fact in its bidding and in its planning and execution of the Work involving Underground Facilities.

2.2.2. Regarding subsurface conditions other than Underground Facilities, shown on the Contract Documents or supplied in Document 00320 (Existing Conditions), Contractor may rely only upon the general accuracy of actual reported depths, actual reported character of materials, actual reported soil types, actual reported water conditions, or actual obstructions shown or indicated in the Contract Documents. Owner is not responsible for the completeness of any subsurface condition information for bidding or construction, Contractor’s conclusions or opinions drawn from any subsurface condition information, or subsurface conditions that are not specifically shown. (For example, Owner is not responsible for soil conditions in areas contiguous to areas where a subsurface condition is shown.)

2.3 Supplied Information On Above Ground Existing Conditions

2.3.1. Regarding aboveground and as-built conditions shown on the Contract Documents or supplied through Document 00320 (Existing Conditions), such information has been compiled in good faith, however, Contractor must independently verify such information. Owner does not expressly or impliedly warrant or represent that information as to aboveground conditions or as-built conditions indicated in the Contract Documents or Document 00320, is correctly shown or indicated, or otherwise complete for construction purposes.

2.3.2. As a condition to bidding, Contractor shall verify by independent investigation all such aboveground and as-built conditions, and bring any discrepancies to Owner’s attention through written question. In submitting its Bid, Contractor shall rely on the results of its own independent investigation and shall not rely on Owner-supplied information regarding aboveground conditions and as-built conditions, and Contractor shall accept full responsibility for its verification work sufficient to complete the Work as intended.

2.4 Subcontractors

2.4.1. Consistent with Public Contract Code Sections 4101 et seq., Contractor shall not substitute any other person or firm in place of any Subcontractor listed in the Bid. Subcontractors shall not assign or transfer their subcontracts or permit them to be performed by any other contractor without Owner’s written approval. At Owner’s request, Contractor shall provide Owner with a complete copy of all executed subcontracts or final commercial agreements with Subcontractors and/or suppliers.

2.4.2. Subcontract agreements shall preserve and protect the rights of Owner under the Contract Documents so that subcontracting will not prejudice such rights. To the extent of the Work to be performed by a Subcontractor, Contractor shall require the Subcontractor’s written agreement (1) to be bound to the terms of Contract Documents and (2) to assume vis-à-vis Contractor all the obligations and responsibilities that Contractor assumes toward Owner under the Contract Documents. (These agreements include for example, and not by way of limitation, all warranties, claims procedures and rules governing submittals of all types to which Contractor is subject under the Contract Documents.)

2.4.3. Contractor shall provide for the assignment to Owner of all rights any Subcontractor may have against any manufacturer, supplier, or distributor for breach of warranties and guaranties relating to the Work performed by the Subcontractor under the Contract Documents.

2.4.4. Owner shall be deemed to be an intended third-party beneficiary of all Subcontracts (of any tier) for the provision of labor, services, supplies or material to the Project, and each such agreement shall so provide.

3 CONTRACT AWARD AND COMMENCEMENT OF THE WORK

3.1 Time Allowances For Performance Of Contract Documents

3.1.1. When Contractor and Owner have signed the Contract Documents, Owner will serve a Notice to Proceed upon Contractor to that effect, either by depositing notice in a post office or post office box
regularly maintained by United States Postal Service in a pre-paid wrapper directed to Contractor at legal address or (at Owner’s option) by delivery by other means authorized for notices under the Contract documents at legal address.

3.1.2. The start date for Contract Time shall be on the date indicated in the applicable Notice to Proceed. If no date is indicated, the start date for Contract Time shall be the fifth Day from the date that Contractor receives, by hand or overnight delivery or facsimile transmission, Owner’s written Notice to Proceed, unless the Notice to Proceed is served by mail only, in which case the start date for Contract Time shall be the fifth Day following the mailing date.

3.1.3. The total number of Days for completion of the Work under the Contract Documents shall be as provided in Document 00520 (Agreement).

3.2 Commencement Of Work
The Contract Time will commence to run on the 30th Day after the issuance of the Notice of Award or, if a Notice to Proceed is given, on the date indicated in the Notice to Proceed. Owner may give a Notice to Proceed at any time within 30 Days after the Notice of Award. Contractor shall not do any Work at the Site prior to the date on which the Contract Time commences to run.

4 INSURANCE AND INDEMNIFICATION

4.1 Insurance
4.1.1. See Document 00821 (Insurance and Indemnification), incorporated herein by this reference.

5 DRAWINGS AND SPECIFICATIONS

5.1 Intent
5.1.1. Drawings and Specifications are intended to describe a functionally complete and operable Project (and all parts thereof) to be constructed in accordance with the requirements of Contract Documents. Contractor shall perform any work, provide services and furnish any materials or equipment that may reasonably be inferred from the requirements of Contract Documents or from prevailing custom or trade usage as being required to produce this intended result. Contractor shall interpret words or phrases used to describe work (including services), materials or equipment, that have well-known technical or construction industry or trade meaning in accordance with that meaning. Drawings’ intent specifically includes the intent to depict construction that complies with all applicable laws, codes and standards.

5.1.2. As part of the “Work,” Contractor shall provide all labor, materials, equipment, machinery, tools, facilities, services, employee training and testing, hoisting facilities, shop drawings, storage, testing, security, transportation, disposal, the securing of all necessary or required field dimensions, the cutting or patching of existing materials, notices, permits, documents, reports, agreements and any other items required or necessary to timely and fully complete Work described and the results intended by Contract Documents and, in particular, Drawings and Specifications. Divisions and Specification Sections and the identification on any Drawings shall not control Contractor in dividing Work among Subcontractors or suppliers or delineating the Work to be performed by any specific trade.

5.1.3. Contractor shall perform reasonably implied parts of Work as “incidental work” although absent from Drawings and Specifications. Incidental work includes any work not shown on Drawings or described in Specifications that is necessary or normally or customarily required as a part of the Work shown on Drawings or described in Specifications. Incidental work includes any Work necessary or required to make each installation satisfactory, legally operable, functional, and consistent with the intent of Drawings and Specifications or the requirements of Contract Documents including required tasks to be performed under Division 1 of Specifications. Contractor shall perform incidental work without extra cost to Owner. Incidental work shall be treated as if fully described in Specifications and shown on Drawings, and the expense of incidental work shall be included in price Bid and Contract Sum.

5.2 Drawing Details
5.2.1. A typical or representative detail on Drawings shall constitute the standard for workmanship and
material throughout corresponding parts of Work. Where necessary, and where reasonably inferable from Drawings, Contractor shall adapt such representative detail for application to such corresponding parts of Work. The details of such adaptation shall be subject to prior approval by Owner. Repetitive features shown in outline on Drawings shall be in exact accordance with corresponding features completely shown.

5.3 Interpretation Of Drawings And Specifications

5.3.1. Should any discrepancy appear or any misunderstanding arise as to the import of anything contained in Drawings and Specifications, or should Contractor have any questions or requests relating to Drawings or Specifications, Contractor shall refer the matter to Owner, in writing. Owner will issue with reasonable promptness written responses, clarifications or interpretations as Owner may determine necessary, which shall be consistent with the intent of and be reasonably inferable from Contract Documents. Such written clarifications or interpretations shall be binding upon Contractor. If Contractor believes that a written response, clarification or interpretation justifies an adjustment in the Contract Sum or Contract Time, Contractor shall give Owner prompt written notice as provided in Section 01250 (Modification Procedures). If the parties are unable to agree to the amount or extent of the adjustment, if any, then Contractor shall perform the Work in conformance with Owner’s response, clarification, or interpretation and may make a written claim for the adjustment as provided in Article 12 of this Document 00700.

5.4 Checking Of Drawings

5.4.1. Before undertaking each part of Work, Contractor shall carefully study and compare Contract Documents and check and verify pertinent figures shown in the Contract Documents and all applicable field measurements. Contractor shall be responsible for any errors that might have been avoided by such comparison. Figures shown on Drawings shall be followed; Contractor shall not scale measurements. Contractor shall promptly report to Owner, in writing, any conflict, error, ambiguity or discrepancy that Contractor may discover. Contractor shall obtain a written interpretation or clarification from Owner before proceeding with any Work affected thereby. Contractor shall provide Owner with a follow-up correspondence every ten days until it receives a satisfactory interpretation or clarification.

5.5 Standards To Apply Where Specifications Are Not Furnished

5.5.1. The following general specifications shall apply wherever in the Specifications, or in any directions given by Owner in accordance with or supplementing Specifications, it is provided that Contractor shall furnish materials or manufactured articles or shall do work for which no detailed specifications are shown. Materials or manufactured articles shall be of the best grade, in quality and workmanship, obtainable in the market from firms of established good reputation. If not ordinarily carried in stock, the materials or manufactured articles shall conform to industry standards for first-class materials or articles of the kind required, with due consideration of the use to which they are to be put. Work shall conform to the usual standards or codes, such as those cited in Section 01420 (References and Definitions), for first-class work of the kind required. Contractor shall specify in writing to Owner the materials to be used or Work to be performed under this paragraph ten Business Days prior to furnishing such materials or performing such Work.

5.6 Deviation From Specifications and Drawings

5.6.1. Contractor shall perform Work in accordance with Drawings and Specifications, and Contractor shall not be relieved of this responsibility by the activities of the Architect/Engineer in the performance of their duties thereunder. Deviations from Drawings and from the dimensions therein given, or from the Specifications, whether or not error is believed to exist, shall be made only when approved in writing by Owner. Contractor may deviate from Drawings or the dimensions given in the Drawings, and may deviate from the Specifications, only upon Owner’s advance written approval of the proposed deviation, either by Change Order or by Instruction Bulletin.

5.6.2. Instruction Bulletins changing the approved drawings and technical specifications may also be used to prevent undue delay.

5.6.3. Contractor acknowledges that changes are a normal feature of construction projects. Contractor shall rely on its experience and proactively cooperate, coordinate and schedule RFI's, submittals,
field questions, inspections, and document assembly, to facilitate the prompt and efficient use of the Change Order and Instruction Bulletin procedure as necessary to prevent delay in actual field construction.

5.6.4. Owner may order that locations, lines and grades for Work vary from those shown on Drawings. Changes may be made in locations, lines or grades for Work under any item of Contract Documents. No payment in addition to unit price fixed in the Contract Documents for Work under respective items will be allowed on account of variations from Drawings in unit price items. In lump sum contracts, or where there are no unit price items covering Work affected by variations of locations, lines or grades, all changes in the Contract Documents will be made as set forth in Article 14 of this Document 00700.

5.7 Ownership And Use Of Drawings, Specifications And Contract Documents

5.7.1. Drawings, Specifications and other Contract Documents were prepared for use for Work of Contract Documents only. No part of Contract Documents shall be used for any other construction or for any other purpose except with the written consent of Owner. Any unauthorized use of Contract Documents is prohibited and at the sole liability of the user.

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 Owner's Right To Perform Construction And To Award Separate Contracts

6.1.1. Owner may perform with its own forces, construction or operations related to the Project. Owner may also award separate contracts in connection with other portions of the Project or other construction or operations, on the Site or areas contiguous to the Site, under conditions similar to these Contract Documents, or may have utility owners perform other work. When separate contracts are awarded for different portions of the Project or other construction or operations on the Site, the term “Contractor” in these Contract Documents shall mean the Contractor herein.

6.1.2. Currently anticipated separate construction contracts (if any) are described in Section 01100.

6.2 Mutual Responsibility

6.2.1. Contractor shall afford all other contractors, utility owners and Owner (if Owner is performing work with its own forces), proper and safe access to the Site, and reasonable opportunity for the installation and storage of their materials. Contractor shall ensure that the execution of its Work properly connects and coordinates with others’ work, and shall cooperate with them to facilitate the progress of the Work.

6.2.2. Contractor shall coordinate its Work with the work of other separate contractors, Owner, and utility owners. Contractor shall hold coordination meetings with other contractors, Owner and its representatives, and utility owners as required by Section 01315 (Project Meetings).

6.2.3. Unless otherwise provided in the Contract Documents, Contractor shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of other separate contractors, Owner or utility owners by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner and the others whose work will be affected.

6.2.4. To the extent that any part of Contractor’s Work is to interface with work performed or installed by other contractors or utility owners, Contractor shall inspect and measure the in-place work. Contractor shall promptly report to Owner in writing any defect in in-place work that will impede or increase the cost of Contractor’s interface unless corrected. Owner will require the contractor responsible for the Defective Work to make corrections so as to conform to its contract requirements, or, if the defect is the result of an error or omission in the Contract Documents, issue a Change Order. If Contractor fails to measure, inspect and/or report to Owner in writing defects that are reasonably discoverable, Contractor shall bear all costs of accomplishing the interface acceptable to Owner. This provision shall be included in any and all other contracts or subcontracts for Work to be performed where such a conflict could exist.

6.3 Owner Authority Over Coordination
6.3.1. Owner will have authority over coordination of the activities of multiple contractors in cases where Owner performs work with its own forces or contracts with others for the performance of other work on the Project, or utilities work on the Site. Owner may at any time and in its sole discretion, designate a person or entity other than Owner to have authority over the coordination of the activities among the various contractors. Owner’s authority with respect to coordination of the activities of multiple contractors and utility owners shall not relieve Contractor of its obligation to other contractors and utility owners to coordinate its Work with other contractors and utility owners as specified in this Document 00700. Contractor shall promptly notify Owner in writing when another contractor on the Project fails to coordinate its work with the Work of Contract Documents.

6.3.2. Contractor shall suspend any part of the Work or carry on the same in such manner as directed by Owner when such suspension or prosecution is necessary to facilitate the work of other contractors or workers. No damages or claims by Contractor will be allowed if the suspension or Work change is due in whole or in part to Contractor’s failure to perform its obligation herein to coordinate its Work with other contractors and utility owners. Claims will be allowed only to the extent of fault by Owner if the suspension or Work change is due in whole or in part to another contractor’s failure to coordinate its work with Contractor, other contractors, and utility owners.

7 PAYMENT BY OWNER

7.1 Receipt And Processing Of Applications For Payment

7.1.1. As required by Section 01200 (Measurement and Payment), Contractor shall prepare the schedules, submit Applications for Payment and warrant title to all Work covered by each Application for Payment. Owner will review Contractor’s Applications for Payment and Owner will and make payment thereon, and Contractor shall make payments to Subcontractors, suppliers and others, as required by Section 01200 (Measurement and Payment).

8 CONTROL OF THE WORK

8.1 Subcontractors

8.1.1. Contractor is fully responsible for Contractor’s own acts and omissions. Contractor is responsible for all acts and omissions of its Subcontractors, suppliers, and other persons and organizations performing or furnishing any of the Work, labor, materials, or equipment under a direct or indirect contract with Contractor.

8.2 Supervision Of Work By Contractor

8.2.1. Contractor shall coordinate the Work and not delegate any responsibility for coordination to any subcontractor. Contractor shall anticipate the inter-relationship of all subcontractors and their relationship with the total Work. Contractor shall coordinate the work of subcontractors and material suppliers, so that their Work is performed in a manner to minimize interference with and to facilitate the progress of the Work.

8.2.2. Contractor shall supervise, inspect, and direct Work competently and efficiently, devoting the attention and applying such personal skills and expertise as may be required and necessary to perform Work in accordance with Contract Documents. Contractor shall be solely responsible for and have control and charge of construction means, methods, techniques, sequences and procedures, safety precautions and programs in connection with the Work. Contractor shall be responsible to see that the completed Work complies accurately with Contract Documents.

8.2.3. Contractor shall designate and keep on the Site at all times during Work progress a competent resident Superintendent or Project Manager, who once designated, shall not be replaced without Owner’s express written consent. The Superintendent or Project Manager shall be Contractor’s representative at the Site and shall have complete authority to act on behalf of Contractor. All communications to and from the Superintendent or Project Manager shall be as binding as if given to or by Contractor.

8.3 Observation Of Work By Owner

8.3.1. Owner Representative(s). Owner Representative(s) will have limited authority to act on behalf of Owner as set forth in the Contract Documents. Except as otherwise provided in these Contract
Documents or subsequently identified in writing by Owner, Owner will issue all communications to Contractor through Owner Representative, and Contractor shall issue all communications to Owner through Owner Representative in a written document delivered to Owner. Should any direct communications between Contractor and Owner’s consultants, architects or Architect/Engineers not identified in Article 2 of Document 00520 (Agreement) occur during field visits or by telephone, Contractor shall immediately confirm them in a written document copied to Owner.

8.3.2. **Means And Methods Of Construction.** Subject to those rights specifically reserved in the Contract Documents, Owner will not supervise, or direct, or have control over, or be responsible for, Contractor’s means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or Contractor’s failure to comply with laws and regulations applicable to the furnishing or performance of Work. Owner will not be responsible for Contractor’s failure to perform or furnish the Work in accordance with Contract Documents.

8.3.3. In exercising its responsibilities and authorities under the Contract Documents, Owner does not assume any duties or responsibilities to any Subcontractor or supplier and does not assume any duty of care to Contractor, Contractor’s Subcontractors or suppliers. Except as expressly set forth in the Contract Documents, in exercising their respective responsibilities and authorities under the Contract Documents, neither Architect/Engineer nor any Owner Representative assume any duties or responsibilities to any Subcontractor, sub-Subcontractor or supplier nor assume any duty of care to Contractor or any Subcontractor, sub-Subcontractor or suppliers.

8.3.4. Work shall be performed under Owner’s general observation and administration. Contractor shall comply with Owner’s directions and instructions in accordance with the terms of Contract Documents, but nothing contained in these General Conditions shall be taken to relieve Contractor of any obligations or liabilities under the Contract Documents. Owner’s failure to review or, upon review, failure to object to any aspect of Work reviewed, shall not be deemed a waiver or approval of any non-conforming aspect of Work.

8.3.5. Owner may engage an independent consultant or Architect/Engineer (collectively for purposes of this paragraph, “Consultant”) to assist in administering the Work. If so engaged, Consultant will advise and consult with Owner, but will have authority to act on behalf of Owner only to extent provided in the Contract Documents or as set forth in writing by Owner. Consultant will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with Work. Consultant will not be responsible for or have control over the acts or omissions of Contractor, Subcontractors or their agents or employees, or any other persons performing Work.

8.3.6. Consultant may review Contractor’s submittals, such as Shop Drawings, Product Data, and Samples, but only for conformance with design concept of Work and with information given in the Contract Documents.

8.3.7. Consultant may visit the Site at intervals appropriate to stage of construction to become familiar generally with the progress and quality of Work and to determine in general if Work is proceeding in accordance with Contract Documents. Based on its observations, Consultant may recommend to Owner that it disapprove or reject Work that Consultant believes to be defective or will not produce a complete Project that conforms to Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by Contract Documents. Owner will also have authority to require special inspection or testing of Work, whether or not the Work is fabricated, installed or completed.

8.3.8. Consultant may conduct inspections to recommend to Owner the dates that Contractor has achieved Substantial Completion and Final Acceptance, and will receive and forward to Owner for review written warranties and related documents required by Contract Documents.

8.4 **Access To Work**

8.4.1. During performance of Work, Owner and its agents, officers, consultants, and employees may at any time enter upon Work, shops or studios where any part of the Work may be in preparation, or factories where any materials for use in Work are being or are to be manufactured, and Contractor shall provide proper and safe facilities for this purpose, and shall make arrangements with manufacturers to facilitate inspection of their processes and products to such extent as Owner’s interests may require. Other contractors performing work for Owner may also enter upon Work for
8.4.2. Owner may, at any time, and from time to time, during the performance of the Work, enter the Work Site for the purpose of installing any necessary work by Owner labor or other contracts, and for any other purpose in connection with the installation of facilities. In doing so, Owner shall endeavor not to interfere with Contractor and Contractor shall not interfere with other work being done by or on behalf of Owner.

8.4.3. If, prior to completion and final acceptance of all the Work, Owner takes possession of any structure or facility (whether completed or otherwise) comprising a portion of the Work with the intent to retain possession thereof (as distinguished from temporary possession contemplating return to Contractor), then, while Owner is in possession of the same, Contractor shall be relieved of liability for loss or damage to such structure other than that resulting from Contractor’s fault or negligence. Such taking of possession by Owner shall not relieve Contractor from any provisions of the Contract respecting such structure, other than to the extent specified in the preceding sentence, nor constitute a final acceptance of such structure or facility. See also Section 01100 (Summary).

8.4.4. If, following installation of any equipment or facilities furnished by Contractor, defects requiring correction by Contractor are found, Owner shall have the right to operate such unsatisfactory equipment or facilities and make reasonable use thereof until the equipment or facilities can be shut down for correction of defects without injury to Owner.

9 CONTRACTOR’S WARRANTY, GUARANTY, AND INSPECTION OF WORK

9.1 Warranty And Guaranty

9.1.1. General Representations and Warranties: Contractor represents and warrants that it is and will be at all times fully qualified and capable of performing every Phase of the Work. Contractor warrants that all construction services shall be performed in accordance with generally accepted professional standards of good and sound construction practices and all requirements of Contract Documents. Contractor warrants that Work, including but not limited to each item of materials and equipment incorporated therein, shall be new, of suitable grade of its respective kind for its intended use, and free from defects in design, architecture and/or engineering, materials, construction and workmanship. Contractor warrants that Work shall conform in all respects with all applicable requirements of federal, state and local laws, applicable construction codes and standards, licenses, and permits, Drawings and Specifications and all descriptions set forth therein, and all other requirements of Contract Documents. Contractor shall not be responsible, however, for the negligence of others in the specification of specific equipment, materials, design parameters and means or methods of construction where that is specifically shown and expressly required by Contract Documents.

9.1.2. Extended Guaranties: Any guaranty exceeding one year provided by the supplier or manufacturer of any equipment or materials used in the Project shall be extended for such term. Contractor expressly agrees to act as co-guarantor of such equipment and materials and shall supply Owner with all warranty and guaranty documents relative to equipment and materials incorporated in the Project and guaranteed by their suppliers or manufacturers.

9.1.3. Environmental and Toxics Warranty: The covenants, warranties and representations contained in this paragraph are effective continuously during Contractor’s Work on the Project and following cessation of labor for any reason including, but not limited to, Project completion. Contractor covenants, warrants and represents to Owner that:

1. To Contractor’s knowledge after due inquiry, no lead or asbestos-containing materials were installed or discovered in the Project at any time during Contractor’s construction thereof. If any lead or asbestos-containing materials were discovered, Contractor made immediate written disclosure to Owner.

2. To Contractor’s knowledge after due inquiry, no electrical transformers, light fixtures with ballasts or other equipment containing PCBs are or were located on the Project at any time during Contractor’s construction thereof.
(3) To Contractor’s knowledge after due inquiry, no storage tanks for gasoline or any other toxic substance are or were located on the Project at any time during Contractor’s construction thereof. If any such materials were discovered, Contractor made immediate written disclosure to Owner.

(4) Contractor’s operations concerning the Project are and were not in violation of any applicable environmental federal, state, or local statute, law or regulation dealing with hazardous materials substances or toxic substances and no notice from any governmental body has been served upon Contractor claiming any violation of any such law, ordinance, code or regulation, or requiring or calling attention to the need for any work, repairs, construction, alteration, or installation on or in connection with the Project in order to comply with any such laws, ordinances, codes, or regulations, with which Contractor has not complied. If there are any such notices with which Contractor has complied, Contractor shall provide Owner with copies thereof.

9.2 Inspection Of Work

9.2.1. All materials, equipment, and workmanship used in Work shall be subject to inspection and testing at all times during construction and/or manufacture in accordance with the terms of Contract Documents. Work and materials, and manufacture and preparation of materials, from beginning of construction until final completion and acceptance of Work, shall be subject to inspection and rejection by Owner, its agents, representatives or independent contractors retained by Owner to perform inspection services, or governmental agencies with jurisdictional interests. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor’s Site safety procedures and program so that they may comply therewith as applicable. Upon request or where specified, Owner shall be afforded access for inspection at the source of supply, manufacture or assembly of any item of material or equipment, with reasonable accommodations supplied for making such inspections.

9.2.2. Contractor shall give Owner and all inspection personnel timely notice of readiness of Work for all required inspections, tests or approvals, shall schedule and coordinate the same, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests. Contractor shall also coordinate, schedule and give adequate notice to the appropriate inspection personnel of any Work that can only be inspected as it is placed or assembled (for example, concrete or masonry work), to enable the constant presence of such inspection personnel during such Work.

9.2.3. In the event that a scheduled inspection is canceled in less than 24 hours notice by Contractor and Owner incurs costs associated with the cancellation, Contractor will reimburse Owner for the actual costs of the canceled inspections. The amount will be deducted from payment owed Contractor.

9.2.4. If applicable laws or regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, and furnish Owner with the required certificates of inspection, or approval. Owner will pay the cost of initial testing and Contractor shall pay all costs in connection with any follow-up or additional testing. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for the acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor’s purchase thereof for incorporation in the Work.

9.2.5. If Contractor covers any Work, or the work of others, prior to any required inspection, test or approval without written approval of Owner, Contractor shall uncover the Work at Owner’s request. Contractor shall bear the expense of uncovering Work and replacing Work.

9.2.6. In any case where Contractor covers Work contrary to Owner’s request, Contractor shall uncover Work for Owner’s observation or inspection at Owner’s request. Contractor shall bear the cost of uncovering Work.

9.2.7. Whenever required by Owner, Contractor shall furnish tools, labor and materials necessary to make examination of Work that may be completed or in progress, even to extent of uncovering or taking down portions of finished Work. Should Work be found unsatisfactory, cost of making examination and of reconstruction shall be borne by Contractor. If Work is found to be satisfactory,
Owner, in manner herein prescribed for paying for alterations, modifications, and extra Work, except as otherwise herein specified, will pay for examination.

9.2.8. Inspection of the Work by or on behalf of Owner, or Owner’s failure to do so, shall not under any circumstances be deemed a waiver or approval of any non-conforming aspect of the Work. Rather, in the absence of a written Change Order or Instruction Bulletin signed by Owner, Contractor’s duty to perform Work in conformance with the Contract Documents shall be absolute.

9.2.9. Any inspection, evaluation, or test performed by or on behalf of Owner relating to the Work is solely for the benefit of Owner, and shall not be relied upon by Contractor. Contractor shall not be relieved of the obligation to perform Work in accordance with the Contract Documents, nor relieved of any guaranty, warranty, or other obligation, as a result of any inspections, evaluations, or tests performed by Owner, whether or not such inspections, evaluations, or tests are permitted or required under the Contract Documents. Contractor shall be solely responsible for testing and inspecting Work already performed to determine whether such Work is in proper condition to receive later Work.

9.3 Correction Of Defective Work

9.3.1. If Contractor fails to supply sufficient skilled workers, suitable materials or equipment, or to furnish or perform the Work in such a way that the completed Work will conform to Contract Documents, Owner may order Contractor to replace any Defective Work, or stop any portion of Work to permit Owner (at Contractor’s expense) to replace such Defective Work. These Owner rights are entirely discretionary on the part of Owner, and shall not give rise to any duty on the part of Owner to exercise the rights for the benefit of Contractor or any other party.

9.3.2. Owner may direct Contractor to correct any Defective Work or remove it from the Site and replace it with Work that is not defective and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting from the correction or removal. Contractor shall be responsible for any and all claims, costs, losses and damages caused by or resulting from such correction or removal. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, Owner may decide the proper amount or, in its discretion may elect to leave the Contract Sum unchanged and deduct from moneys due Contractor, all such claims, costs, losses and damages caused by or resulting from the correction or removal. If Contractor disagrees with Owner’s calculations, it may make a claim as provided in Article 12 of this Document 00700. (Owner exercise of its rights under this paragraph 9 shall be entirely discretionary and, like all other Owner rights and remedies under the Contract, in addition to any other rights and remedies it may have under the Contract Documents or by law.)

9.3.3. Correction period:

1. With respect to equipment and machinery supplied by Contractor and incorporated into the Work, if within one year after the date of Final Completion of the portion of the Work incorporating the equipment and/or machinery (or, to the extent expressed by Change Order or Certificate of Final Completion, one year after Owner’s written acceptance of such equipment), or such longer period as may be prescribed by laws or regulations, or by the terms of the Contract Documents, any equipment or machinery is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions, correct such Defective Work.

2. With respect to structures within the scope of Work, if within one year after the date of Final Acceptance, or such longer period of time as may be prescribed by laws or regulations, or by the terms of Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions, correct such Defective Work.

3. Contractor shall remove any Defective Work rejected by Owner and replace it with Work that is not defective, and satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor fails to promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the Defective Work corrected or the rejected Work removed and replaced.
Contractor shall pay for all claims, costs, losses and damages caused by or resulting from such removal and replacement. Where Contractor fails to correct Defective Work, or defects are discovered outside the correction period, Owner shall have all rights and remedies granted by law.

9.3.4. Additionally, in special circumstances where a part of the Work is occupied or a particular item of equipment is placed in continuous service before Final Acceptance of all the Work, the correction period for that part of Work or that item may start to run from an earlier date if so provided by Change Order or Certificate of Substantial Completion.

9.3.5. Where Defective Work or rejected Work (and damage to other Work resulting therefrom) has been removed and replaced under this provision after the commencement of the correction period, the correction period hereunder with respect to such Work shall be extended for an additional period of one year after such removal and replacement has been satisfactorily completed.

9.3.6. If following installation of any equipment, machinery, or facilities furnished by Contractor, defects requiring correction by Contractor are found, Owner shall have the right to operate such defective equipment or facilities and make reasonable use thereof until the equipment, machinery, or facilities can be shut down for correction of defects without causing injury to Owner.

9.4 Acceptance And Correction Of Defective Work By Owner

9.4.1. Owner may accept Defective Work. Contractor shall pay all claims, costs, losses and damages attributable to Owner’s evaluation of and determination to accept such Defective Work. If Owner accepts any Defective Work prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, Owner may deduct from moneys due Contractor, all claims, costs, losses, damages, expenses and liabilities attributable to the Defective Work. If Contractor disagrees with Owner’s calculations, Contractor may make a claim as provided in Article 12 of this Document 00700. If Owner accepts any Defective Work after final payment, Contractor shall pay to Owner, an appropriate amount as determined by Owner.

9.4.2. Owner may correct and remedy deficiency if, after five Days’ written notice to Contractor, Contractor fails to correct Defective Work or to remove and replace rejected Work in accordance with paragraph 9 of this Document 00700; or provide a plan for correction of Defective Work acceptable to Owner, or perform Work in accordance with Contract Documents. In connection with such corrective and remedial action, Owner may exclude Contractor from all or part of the Site; take possession of all or part of Work and suspend Contractor’s Work related thereeto; take possession of all or part of Contractor’s tools, appliances, construction equipment and machinery at the Site; and incorporate in Work any materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, its representatives, agents, employees, and other contractors and Owner’s consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph 9. Contractor shall be responsible for all claims, costs, losses, damages, expenses and liabilities incurred or sustained by Owner in exercising such rights and remedies. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to Work and the Contract Sum. If the parties are unable to agree to the amount of an appropriate decrease in the Contract Sum, Owner may deduct from moneys due Contractor, all claims, costs, losses and damages caused by or resulting from the correction or removal. If Contractor disagrees with Owner’s calculations, Contractor may make a claim as provided in Article 12 of this Document 00700.

9.5 Rights Upon Inspection Or Correction

9.5.1. Contractor shall not be allowed an extension of Contract Time because of any delay in the performance of Work attributable to the exercise by Owner of its rights and remedies under this Article 9. Where Owner exercises its rights under this Article 9, it retains all other rights it has by law or under the Contract Documents including, but not limited to, the right to terminate Contractor’s right to proceed with the Work under the Contract Documents and/or make a claim or back charge where a Change Order cannot be agreed upon.

9.5.2. Inspection by Owner shall not relieve Contractor of its obligation to have furnished material and
workmanship in accordance with Contract Documents. Payment for Work completed through periodic progress payments or otherwise shall not operate to waive Owner’s right to require full compliance with Contract Documents and shall in no way be deemed as acceptance of the Work paid therefor. Contractor’s obligation to complete the Work in accordance with Contract Documents shall be absolute, unless Owner agrees otherwise in writing.

9.6  **Samples And Tests Of Materials And Work**

9.6.1. Contractor shall furnish, in such quantities and sizes as may be required for proper examination and tests, samples or test specimens of all materials to be used or offered for use in connection with Work. Contractor shall prepare samples or test specimens at its expense and furnish them to Owner. Contractor shall submit all samples in ample time to enable Owner to make any necessary tests, examinations, or analyses before the time it is desired to incorporate the material into the Work.

9.6.2. Test samples or specimens of material for testing shall be taken by the Architect/Engineer, his or her representative, Project Inspector or representative of the testing agency.

9.7  **Proof Of Compliance Of Contract Provisions**

9.7.1. In order that Owner may determine whether Contractor has complied or is complying with requirements of Contract Documents not readily enforceable through inspection and tests of Work and materials, Contractor shall at any time, when requested, submit to Owner properly authenticated documents or other satisfactory proofs of compliance with all applicable requirements.

9.8  **Acceptance**

9.8.1. Inspection by Owner or its authorized agents or representatives, any order or certificate for the payment of money, any payment, acceptance of the whole or any part of Work by Owner, any extension of time, any verbal statements on behalf of Owner or its authorized agents or representatives shall not operate as a waiver or modification of any provision of the Contract Documents, or of any power reserved to Owner herein or therein or any right to damages provided in the Contract Documents. Any waiver of any breach of the Contract Documents shall not be held to be a waiver of any other subsequent breach.

10  **CONTRACTOR’S ORGANIZATION AND EQUIPMENT**

10.1  **Contractor’s Legal Address**

10.1.1. Address and facsimile number given in Contractor’s Bid are hereby designated as Contractor’s legal address and facsimile number. Contractor may change its legal address and facsimile number by notice in writing, delivered to Owner, which in conspicuous language advises Owner of a change in legal address or facsimile number, and which Owner accepts in writing. Delivery to Contractor’s legal address or depositing in any post office or post office box regularly maintained by the United States Postal Service, in a wrapper with postage affixed, directed to Contractor at legal address, or of any drawings, notice, letter or other communication, shall be deemed legal and sufficient service thereof upon Contractor. Facsimile to Contractor’s designated facsimile number of any letter, memorandum, or other communication on standard or legal sized paper, with proof of facsimile transmission, shall be deemed legal and sufficient service thereof upon Contractor.

10.2  **Contractor’s Office At The Work Site**

10.2.1. Contractor shall maintain an office at the Site, which office shall be headquarters of a Contractor representative authorized to transmit to and receive from Owner, communications, instructions or Drawings. Communications, instructions, or Drawings given to Contractor’s representative or delivered at the Site office in representative’s absence shall be deemed to have been given to Contractor.

10.3  **Contractor’s Superintendents Or Forepersons**

10.3.1. Contractor shall at all times be represented on Site by one or more superintendents, project managers or forepersons authorized and competent to receive and carry out any instructions that
Owner may give, and shall be liable for faithful observance of instructions delivered to Contractor or to authorized representative or representatives on Site.

10.4 **Proficiency In English**

10.4.1. Supervisors, security guards, safety personnel and employees who have unescorted access to the Site shall possess proficiency in the English language in order to understand, receive and carry out oral and written communications or instructions relating to their job functions, including safety and security requirements.

10.5 **Contractor's And Subcontractors' Employees**

10.5.1. Contractor shall employ, and shall permit its Subcontractors to employ, only competent and skillful personnel to do Work. If Owner notifies Contractor that any of its employees, or any of its Subcontractors' employees on Work is incompetent, unfaithful, disorderly or profane, or fails to observe customary standards of conduct or refuses to carry out any provision of the Contract Documents, or uses threatening or abusive language to any person on Work representing Owner, or violates sanitary rules, or is otherwise unsatisfactory, and if Owner requests that such person be discharged from Work, then Contractor or its Subcontractor shall immediately discharge such person from Work and the discharged person shall not be re-employed on the Work except with consent of Owner.

10.6 **Contractor To List Trades Working**

10.6.1. Contractor shall list the trades working on the Site and their scheduled activities on a daily basis, and provide a copy of that list to Owner.

10.7 **Contractor's Use Of The Site**

10.7.1. Contractor shall not make any arrangements with any person to permit occupancy or use of any land, structure or building within the limits of the Work, for any purpose whatsoever, either with or without compensation, in conflict with any agreement between Owner and any owner, former owner or tenant of such land, structure or buildings. Contractor may not occupy Owner-owned property outside the limit of the Work as indicated on the Drawings unless it obtains prior written approval from Owner.

**PROSECUTION AND PROGRESS OF THE WORK**

11.1 **Contractor To Submit Required Schedules**

11.1.1. Contractor shall submit schedules and reports, Shop Drawings and Submittals in the appropriate quantity and within the required time, arrange conferences and meetings and proceed with the Work in accordance with Contract Documents, including Sections 01315 (Project Meetings), 01320 (Progress Schedules and Reports), and 01300 (Contractor Submittals).

11.1.2. Contractor shall submit to Owner for review and discussion at the Preconstruction Conference described in Section 01315 (Project Meetings), and again prior to the first payment application: the schedule of values submittals described in Section 01200 (Measurement and Payment), progress schedules and reports as required by Sections 01320 (Progress Schedules and Reports), and schedule of submittals described in Section 01330 (Contractor Submittals). No progress payment shall be due or owing to Contractor until such schedules are submitted to and acceptable to Owner and/or Architect/Engineer as meeting the requirements of the Contract Documents, including Sections 01200 (Measurement and Payment), 01320 (Progress Schedules and Reports) and 01330 (Contractor Submittals). Owner’s acceptance of Contractor’s schedules will not create any duty of care or impose on Owner any responsibility for the sequencing, scheduling or progress of Work nor will it interfere with or relieve Contractor from Contractor’s full responsibility therefor.

11.1.3. Before commencing any portion of Work, Contractor shall inform Owner in writing as to time and place at which Contractor wishes to commence Work, and nature of Work to be done, in order that proper provision for inspection of Work may occur, and to assure measurements necessary for record and payment. Information shall be given to Owner a reasonable time in advance of time at which Contractor proposes to begin Work, so that Owner may complete necessary preliminary work without inconvenience or delay to Contractor.
11.2 **Contractor To Submit Submittals And Shop Drawings**

11.2.1. Contractor shall submit submittals and Shop Drawings to Owner (or Architect/Engineer if Owner so designates) for review in strict accordance with Section 01330 (Contractor Submittals). Submission of a Shop Drawing shall constitute Contractor’s representation that all requirements of Section 01330 (Contractor Submittals) have been complied with. All submittals will be identified as Owner may require and in the number of copies specified in Section 01330 (Contractor Submittals).

11.2.2. Contractor shall not perform Work that requires submission of a Shop Drawing or Sample or other submittal prior to submission and favorable review of the Shop Drawing or Sample or submittal. Where a Shop Drawing or Sample or other submittal is required by Contract Documents or the final Schedule of Shop Drawing and Sample Submittals accepted by Owner, any related Work performed prior to Owner’s approval of the pertinent submittal shall be at the sole expense, responsibility and risk of Contractor.

11.3 **Contractor To Maintain Cost Data**

11.3.1. Contractor shall maintain full and correct information as to the number of workers employed in connection with each subdivision of Work, the classification and rate of pay of each worker in form of certified payrolls, the cost to Contractor of each class of materials, tools and appliances used by Contractor in Work, and the amount of each class of materials used in each subdivision of Work. Contractor shall provide Owner with monthly summaries of this information. If Contractor maintains or is capable of generating summaries or reports comparing actual Project costs with Bid estimates or budgets, Contractor shall provide Owner with a copy of such report upon Owner’s request and whenever it is generated.

11.3.2. Contractor shall maintain daily job reports recording all significant activity on the job, including the number of workers on Site, Work activities, problems encountered and delays. Contractor shall provide Owner with copies for each Day Contractor works on the Project, to be delivered to Owner either the same Day or the following morning before starting work at the Site. Contractor shall take monthly progress photographs of all areas of the Work. Contractor shall maintain copies of all correspondence with Subcontractors and records of meetings with Subcontractors.

11.3.3. Owner shall have the right to audit and copy Contractor’s books and records of any type, nature or description relating to the Project (including but not limited to financial records reflecting in any way costs claimed on the Project), and to inspect the Site, including Contractor’s trailer, or other job Site office, and this requirement shall be contained in the subcontracts of Subcontractors working on Site. By way of example, Owner shall have the right to inspect and obtain copies of all Contract Documents, planning and design documents, Bid proposal and negotiation documents, cost records and job cost variance reports, design modification proposals, value engineering or other cost reduction proposals, revisions made to the original design, job progress reports, photographs, and as-built drawings maintained by Contractor. Owner and any other applicable governmental entity shall have the right to inspect all information and documents maintained under this paragraph 11 at any time during the Project and for a period of five years following Final Completion. This right of inspection shall not relieve Contractor of its duties and obligations under the Contract Documents. This right of inspection shall be specifically enforceable in a court of law, either independently or in conjunction with enforcement of any other rights in the Contract Documents.

11.3.4. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Contract Modifications, Change Orders, Work Directives, Force Account orders, and written interpretations and clarifications in good order and annotated to show all changes made during construction. These Project Record Documents, together with all approved Samples and a counterpart of all approved Shop Drawings, shall be maintained and available to Owner for reference. Upon completion of the Work, Contractor shall deliver to Owner, the Project Record Documents, Samples and Shop Drawings and as-built drawings.

11.4 **Contractor To Supply Sufficient Workers And Materials**

11.4.1. Unless otherwise required by Owner under the terms of Contract Documents, Contractor shall at all times keep on the Site materials and employ qualified workers sufficient to prosecute Work at a rate
11.4.2. At any time during progress of Work should Contractor directly or indirectly (through Subcontractors) refuse, neglect, or be unable to supply sufficient materials or employ qualified workers to prosecute the Work as required, then Owner may require Contractor to accelerate the Work and/or furnish additional qualified workers or materials as Owner may consider necessary, at no cost to Owner. If Contractor does not comply with the notice within three Business Days of date of service thereof, Owner shall have the right (but not a duty) to provide materials and qualified workers to finish the Work or any affected portion of Work, as Owner may elect. Owner may, at its discretion, exclude Contractor from the Site, or portions of the Site or separate work elements during the time period that Owner exercises this right. Owner will deduct from funds or appropriations set aside for purposes of Contract Documents the amount of such payments and charge them to Contractor as if paid to Contractor. Contractor shall remain liable for resulting delay, including liquidated damages and indemnification of Owner from claims of others.

11.4.3. Exercise by Owner of the rights conferred upon Owner in this subparagraph is entirely discretionary on the part of Owner. Owner shall have no duty or obligation to exercise the rights referred to in this subparagraph and its failure to exercise such rights shall not be deemed an approval of existing Work progress or a waiver or limitation of Owner’s right to exercise such rights in other concurrent or future similar circumstances. (The rights conferred upon Owner under this subparagraph are, like all other such rights, cumulative to Owner’s other rights under any provision of the Contract Documents.)

11.5 Contractor To Locate Underground Facilities

11.5.1. During construction, Contractor shall comply with Government Code Sections 4216 to 4216.9, and in particular Section 4216.2 which provides, in part: “Except in an emergency, every person planning to conduct any excavation shall contact the appropriate regional notification center at least two working days, but no more than 14 calendar days, prior to commencing that excavation, if the excavation will be conducted in an area which is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the excavator, and, if practical, the excavator shall delineate with white paint or other suitable markings the area to be excavated. The regional notification center shall provide an inquiry identification number to the person who contacts the center and shall notify any member, if known, who has a subsurface installation in the area of the proposed excavation.”

11.5.2. Contractor shall contact USA, and schedule the Work to allow ample time for the center to notify its members and, if necessary, for any member to field locate and mark its facilities. Contractor is charged with knowledge of all subsurface conditions reflected in USA records. Prior to commencing excavation or trenching work, Contractor shall provide Owner with copies of all USA records secured by Contractor. Contractor shall advise Owner of any conflict between information provided in Document 00320 (Geotechnical Data and Existing Conditions), the Drawings and that provided by USA records. Contractor’s excavation shall be subject to and comply with the Contract Documents, including without limitation Paragraphs 2 and 8 of this Document 00700.

11.5.3. Contractor shall also investigate the existence of existing service laterals, appurtenances or other types of utilities, indicated by the presence of an underground transmission main or other visible facilities, such as buildings, new asphalt, meters and junction boxes, on or adjacent to the Site, even if not shown or indicated in Document 00320 (Geotechnical Data and Existing Conditions), the Drawings or that provided by USA records. Contractor shall immediately secure all such available information and notify Owner and the utility owner, in writing, of its discovery.

11.6 Contractor’s To Protect Underground Facilities

11.6.1. At all times during construction, all operating Underground Facilities shall remain in operation, unless the Contract Documents expressly indicate otherwise. Contractor shall maintain such Underground Facilities in service where appropriate; shall repair any damage to them caused by the Work; and shall incorporate them into the Work, including reasonable adjustments to the design
location (including minor relocations) of the existing or new installations. Contractor shall take immediate action to restore any in service installations damaged by Contractor’s operations.

11.6.2. Prior to performing Work at the Site, Contractor shall lay out the locations of Underground Facilities that are to remain in service and other significant known underground installations indicated by the Underground Facilities Data. Contractor shall further locate, by carefully excavating with small equipment, potholing and principally by hand, all such utilities or installations that are to remain and that are subject to damage. If additional utilities whose locations are unknown are discovered, Contractor shall immediately report to Owner for disposition of the same. Additional compensation or extension of time on account of utilities not shown or otherwise brought to Contractor’s attention, including reasonable action taken to protect or repair damage, shall be determined as provided in this Document 00700.

11.6.3. The cost of all of the following will be included in the Contract Sum and Contractor shall have full responsibility for (a) reviewing and checking all available information and data including, but not limited to, Document 00320 (Geotechnical Data and Existing Conditions) and information on file at USA; (b) locating all Underground Facilities shown or indicated in the Contract Documents, available information, or indicated by visual observation including, but not limited to, and by way of example only, engaging qualified locating services and all necessary backhoeing and potholing; (c) coordination of the Work with the owners of such Underground Facilities during construction; and (d) the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

11.7 Contractor To Not Disrupt Owner Operation

11.7.1. Contractor shall schedule and execute all Work in a manner that does not interfere with or disrupt Owner operations, including but not limited to, parking, utilities (electricity, gas, water), noise, access by employees and administration, access by vendors, physicians, patients and any other person or entity using Owner facilities or doing business with Owner. Contractor shall produce and supply coordination plans and requests to Owner, following Owner procedures, for all necessary interference of construction with Owner, which Owner will reasonably cooperate with, as further described in Section 01100.

12 CLAIMS BY CONTRACTOR / NON-JUDICIAL SETTLEMENT PROCEDURE

12.1 Scope

12.1.1. The claim notice and documentation procedure described in this Article 12 applies to all claims and disputes arising under the Contract Documents, including without limitation any claim or dispute by any Subcontractor or material supplier, and any claims arising under tort law as well as contract law. All Subcontractor and supplier claims of any type shall be brought only through Contractor as provided in this Article 12. Under no circumstances shall any Subcontractor or supplier make any direct claim against Owner.

12.1.2. “Claim” means a written demand or written assertion by Contractor seeking, as a matter of right, the payment of money, the adjustment or interpretation of Contract Documents terms, or other relief arising under or relating to Contract Documents. In order to qualify as a “claim,” the written demand must state that it is a claim submitted under this Article 12. A voucher, invoice, proposed change, Application for Payment, cost proposal, RFI, change order request, or other routine or authorized form of request for payment is not a claim under the Contract Documents. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a claim under the Contract Documents by submitting a separate notice and claim in compliance with claim submission requirements herein.

12.1.3. The provisions of this Article 12 constitute a non-judicial claim settlement procedure, and also step one of a two step claim presentment procedure by agreement under Section 930.2 of the California Government Code. Specifically, step one is compliance with this contract claims procedure and filing/administering timely contract claims in accordance with the Contract Documents. Step two is filing a timely Government Code Section 910 claim in accordance with the California Government Code. Any Government Code Section 910 claims shall be presented in accordance with the Government Code and shall affirmatively indicate Contractor’s prior compliance with the claims procedure herein and previous dispositions under this Article.
12.1.4. The provisions of this Article 12 shall survive termination, breach or completion of the Contract Documents. Contractor shall bear all costs incurred in the preparation and submission of a claim.

12.2 Procedure

12.2.1. Disputed Work. Should any clarification, determination, action or inaction by Owner or Architect/Engineer, Work, third party, or any other event whatsoever, in the opinion of Contractor, exceed the requirements of or not comply with Contract Documents in any way, or otherwise result in Contractor seeking additional compensation in time or money or damages for any reason (collectively “Disputed Work”), then Contractor shall so notify Owner. Contractor and Owner shall make good faith attempts to resolve informally any and all such issues, claims and/or disputes.

12.2.2. Duty to Work During Disputes. Notwithstanding any dispute or Disputed Work, Contractor shall continue to prosecute the Work and the Disputed Work in accordance with the determinations of Owner. Contractor’s sole remedy for Disputed Work is to pursue the remedies in this Article 12 and follow the determinations of Owner.

12.2.3. Timely Notice of Disputed Work Required. Before commencing any Disputed Work, or within ten (10) Days after Contractor’s first knowledge of the Disputed Work, whichever is earlier, Contractor shall file a written notice and preliminary cost proposal for the Disputed Work with Owner stating clearly and in detail its objection and reasons for contending the Disputed Work is outside or in breach of the requirements of Contract Documents. The written notice must identify the subcontractors, vendors, suppliers affected, if any, sufficient for Owner to visit the site to inspect the work and/or conduct a telephonic interview of the persons involved, and/or to photograph the work in question; and Contractor is encouraged to supply digital photographs by email if possible. The preliminary cost proposal must provide a good faith preliminary estimate of the labor (workers, crews), equipment and/or materials involved, and a corresponding good faith preliminary estimate of cost. If a written notice and preliminary cost proposal for Disputed Work is not issued within this time period, or if Contractor proceeds with the Disputed Work without first having given the notice of the Disputed Work, Contractor shall waive its rights to further claim on the specific issue.

12.2.4. Timely Notice of Potential Claims Required. Owner will review Contractor’s timely notice and preliminary cost proposal for Disputed Work and provide a decision. If, after receiving the decision, Contractor disagrees with it or still considers the Work required of it to be outside of the requirements of Contract Documents, then Contractor shall so notify Owner, in writing, within ten (10) Days after receiving the decision, by submitting a notice of potential claim, stating that a formal claim will be issued. (If Owner should fail to provide a decision on a notice and preliminary cost proposal within thirty (30) days, then Contractor shall submit a notice of potential claim within ten days following the thirtieth (30th) day, i.e., or by the 40th day following the notice and preliminary cost proposal.) Contractor shall continue to prosecute the Disputed Work to completion.

12.2.5. Quarterly Claims Required. At the end of each calendar year quarter (March 31, June 30, September 30 and December 31) of each year, for each and every notice of potential claim that Contractor may have submitted in that quarter, Contractor shall submit a formal claim in the form specified herein. Contractor may file a single consolidated claim each quarter, or may file separate claims each quarter, as Contractor sees fit, provided Contractor complies with the requirements below. (Contractor may defer until the next reporting period the filing of a formal claim for any notices of potential claim timely issued within the last 15 days of the prior quarter.) The formal claim(s) shall include all arguments, justification, cost or estimates, schedule analysis, and detailed documentation supporting Contractor’s position, for each notice of potential claim that Contractor intends to pursue as a formal claim (further described below).

12.2.6. Claim Updates Required. If Disputed Work persists longer than a single calendar quarter, then Contractor shall, every quarter until the Disputed Work ceases, submit to Owner a document titled “Claim Update” that shall update and quantify all elements of the claim as completely as possible. Contractor’s failure to submit a Claim Update or to quantify costs every quarter shall result in waiver of the claim for that period. Claims or Claim Updates stating that damages, total damages (direct and indirect), schedule impact and/or any time extension will be determined at a later date shall not comply with this subparagraph and shall result in Contractor waiving its claim(s). Contractor shall also maintain a continuing “claims log” that shall list all outstanding claims and
12.2.7. **Claim Negotiations required.** Upon receipt of Contractor’s formal claim(s) including all arguments, justifications, cost or estimates, schedule analysis, and documentation supporting its position as required herein, Owner or its designee will review the issue and render a final determination. Contractor and Owner may mutually agree upon a claims resolution protocol, a neutral facilitator or mediator, or other alternative dispute resolution procedures, as appropriate. Owner may in its discretion conduct an administrative hearing on Contractor’s claim, in which case Contractor shall appear, participate, answer questions and inquiries, and present any further document, schedules or analysis requested by Owner to evaluate and decide Contractor’s claim.

12.3 **Claim Format**

12.3.1. Contractor shall submit the formal claim(s) with a cover letter and certification of the accuracy of the formal claim.

12.3.2. The formal claim(s) shall list separately each notice of potential claim that Contractor intends to pursue as a formal claim(s), and for each such item separately, Contractor shall provide the following:

1. Summary of the claim, including underlying facts, entitlement, schedule analysis, quantum calculations, contract provisions supporting relief;
2. List of documents relating to claim including Specifications, Drawings, clarifications/reviews for information, schedules, notices of delay, and any others;
3. Chronology of events and correspondence;
4. Analysis of claim merit;
5. Analysis of claim cost; and
6. Attach supporting cost and schedule documents as required in this Article and elsewhere in the Contract Documents (e.g., Section 01320).

12.3.3. For each notice of potential claim that Contractor intends to pursue as a formal claim, Contractor shall establish in the formal claim a direct causal link between the separate item of cost/time requested, the separate notices of potential claim timely issued, and the specific changed Work asserted. Total cost claims shall not be allowed.

12.3.4. Claims shall be calculated in the same manner as Change Orders per Section 01250 (Modification Procedures). EXCEPT WHERE PROVIDED BY LAW, OR ELSEWHERE IN THESE CONTRACT DOCUMENTS (IF APPLICABLE), OWNER SHALL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, AND CONTRACTOR SHALL NOT INCLUDE THEM IN ITS CLAIMS. CONTRACTOR SHALL BE LIMITED IN ITS RECOVERY ON CLAIMS TO THE CHANGE ORDER CALCULATIONS SET FORTH IN SECTION 01250 (MODIFICATION PROCEDURES).

12.4 **Mediation**

12.4.1. If Contractor’s claims submitted in accordance with this Article 12 at Project completion total less than $375,000, then claims resolution shall first proceed in the manner prescribed by Article 1.5, Chapter 1, Part 3 of Division 2 of the California Public Contract Code, found in Section 01410 (Regulatory Requirements).

12.4.2. If Contractor’s claims submitted in accordance with this Article 12 at Project completion exceed $375,000, then, as a condition precedent to litigation (or if otherwise permitted by the Contract Documents, arbitration) thereon, such claims must first be mediated. Mediation shall be non-binding and utilize the services of a mediator mutually acceptable to the parties and, if the parties cannot agree, a mediator selected by the American Arbitration Association from its panel of approved mediators trained in construction industry mediation, having a minimum of twenty (20) years experience in the construction industry. All statutes of limitation shall be tolled from the date of the demand for mediation until a date two weeks following the mediation’s conclusion. All unresolved Contractor claims shall be submitted to the same mediator. The cost of mediation shall be equally shared.

12.5 **Subcontractor Claims**

12.5.1. Contractor shall present as its claims all Subcontractor, sub-Subcontractor and supplier claims of their value, and provide such log to Owner quarterly.
any type, and prove them under the terms of the Contract Documents. Owner shall not be directly liable to any Subcontractor, any supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages or extra costs of any type arising out of or resulting from the Project.

12.6 Waiver

12.6.1. If Contractor fails to comply with this Article 12 as to any claim, then Contractor shall waive its rights to such claim.

12.6.2. All claim(s), Disputed Work items or issue(s) not raised in a timely notice, timely notice of potential claim and then timely claim submitted under this Article 12, may not be asserted in any subsequent Government Code section 910 claim, litigation or legal action.

12.6.3. Contractor may request an extension of time to comply with the claims procedure herein, but must do so in advance of time periods expiring and Owner must give its approval in writing (which approval may be withheld in Owner discretion.) As to any other feature of the claim procedure herein (and its claims waiver feature), it may not be waived or altered absent a written change order signed by both parties and approved as to form by their legal counsel.

12.6.4. Owner shall not be deemed to waive or alter any provision under this Article 12, if at Owner’s sole discretion, a claim is administered in a manner not in accord with this Article 12.

13 LEGAL AND MISCELLANEOUS

13.1 Laws And Regulations

13.1.1. Contractor shall keep fully informed of and shall comply with all laws, ordinances, regulations and orders of any properly constituted authority affecting the Contract Documents, Work and persons connected with Work, and shall, to the greatest extent permitted by law, protect and indemnify Owner and its officers, employees, consultants and agents against any claim or liability, including attorney’s fees, arising from or based on violation of law, ordinance, regulation or order, whether by Contractor or by Subcontractors, employees or agents. Authorized persons may at any time enter upon any part of Work to ascertain compliance of all applicable laws, ordinances, regulations and orders.

13.1.2. Whenever Drawings and Specifications require larger sizes or higher standards than are required by any applicable law, ordinance, regulation or order, Drawings and Specifications shall govern. Whenever Drawings and Specifications require something that will violate such laws, ordinances, regulations or orders, then such laws, ordinances, regulations or orders shall govern.

13.1.3. Contractor shall comply with applicable portions of Title 8 (Industrial Relations), Title 19 (Public Safety), Title 22 (Social Security, Division of Health) and Title 24 (California Building Standards Code), California Code of Regulations (Uniform Building Code) (most recent edition), Public Contract Code. Whenever Contract Documents require larger sizes or higher standards than are required by any applicable law, ordinance, regulation or order, Contract Documents shall govern. Whenever Contract Documents require something that will violate such laws, ordinances, regulations or orders, then such laws, ordinances, regulations or orders shall govern.

13.1.4. [OPTIONAL] Contractor shall maintain in the Project Office a current copy of Title 19 and Title 24 of the California Code of Regulations at all times during construction.

13.2 Permits And Taxes

13.2.1. Contractor shall procure all permits and licenses applicable to the Work (including environmental matters to the extent applicable), pay all charges and fees, including fees for street opening permits, comply with, implement and acknowledge effectiveness of all permits, initiate and cooperate in securing all required notifications or approvals therefore, and give all notices necessary and incident to due and lawful prosecution of Work, unless otherwise provided herein. Owner will pay applicable building permits, school, sanitation and water fees, except as otherwise provided in the Contract Documents. Contractor shall pay all sales and/or use taxes levied on materials, supplies, or equipment purchased and used on or incorporated into Work, and all other taxes properly assessed against equipment or other property used in connection with Work, without any increase in the Contract Sum. Contractor shall make necessary arrangements with proper authorities having
jurisdiction over roads, streets, pipelines, navigable waterways, railroads, and other works in advance of operations, even where Owner may have already obtained permits for the Work.

13.3 Suspension Of Work

13.3.1. Owner may, without cause, order Contractor in writing to suspend, delay or interrupt Work in whole or in part for such period of time as Owner may determine. An adjustment shall be made for increases in cost of performance of Work of the Contract Documents caused by any such suspension, delay or interruption, calculated using the measures set forth in Section 01250 (Modification Procedures). No adjustment shall be made to extent that:

1. Performance is, was or would have been so suspended, delayed or interrupted by another cause for which Contractor is responsible; or
2. An equitable adjustment is made or denied under any other provision of Contract Documents; or
3. The suspension of Work was the direct or indirect result of Contractor’s failure to perform any of its obligations hereunder. Adjustments made in cost of performance may have a mutually agreed fixed or percentage fee; if the parties cannot agree, Contractor may file a claim under Article 12 of this Document 00700.

13.4 Termination Of Contract For Cause

13.4.1. Owner may declare Contractor in default of Contract Documents and Owner may terminate Contractor’s right to proceed under the Contract Documents for cause:

1. Should Contractor make an assignment for the benefit of creditors; admit in writing its inability to pay its debts as they become due; file a voluntary petition in bankruptcy; be adjudged a bankrupt or insolvent; be the subject of an involuntary petition in bankruptcy which is not dismissed within 60 Days; file a petition or answer seeking for itself any reorganization, arrangement, composition, readjustment, liquidation, dissolution, or similar relief under any present or future statute, law, or regulation; file any answer admitting or not contesting the material allegations of a petition filed against Contractor in any such proceeding; or seek, consent to, or acquiesce in, the appointment of any trustee, receiver, custodian or liquidator of Contractor or of all or any substantial part of its properties or if Contractor, its directors or shareholders, take action to dissolve or liquidate Contractor; or
2. Should Contractor commit a material breach of the Contract Documents. If Owner declares Contractor in default due to material breach, however, Owner must allow Contractor an opportunity to cure such breach within ten Days of the date of notice from Owner to Contractor providing notice of the default; or, if such breach is not curable within such ten-Day period, within such period of time as is reasonably necessary to accomplish such cure. (In order for Contractor to avail itself of a time period in excess of ten Days, Contractor must provide Owner within the ten-Day period with a written plan acceptable to Owner to cure said breach which includes, for example, evidence of necessary resources, actual Subcontractor commitments, actual labor commitments, schedules and recovery schedules meeting Contract Document requirements and showing a realistic and achievable plan to cure the breach. Contractor must then diligently commence and continue such cure according to the written cure plan); or
3. Should Contractor violate or allow (by a Subcontractor or other person or entity for which Contractor is responsible) a violation of any valid law, statute, regulation, rule, ordinance, permit, license or order of any governmental agency applicable to the Project or Work and does not cure (or cause to be cured) such violation within ten Days of the date of the notice from Owner to Contractor demanding such cure; or, if such violation is not curable within such ten-Day period, within such period of time as is reasonably necessary to accomplish such cure. (In order for Contractor to avail itself of a time period in excess of ten Days, Contractor shall provide Owner within the ten-Day period with a written plan to cure said violation acceptable to Owner, and then diligently commence and continue performance of such cure according to the written plan.)

13.4.2. If Owner at any time reasonably believes that Contractor is or may be in default under the Contract Documents as provided above, then Owner may in its sole discretion notify Contractor of this fact and request written assurances from Contractor of performance of Contract Documents and a
written plan from Contractor to remedy any default under the terms of Contract Documents which Owner may advise Contractor of in writing. Contractor shall, within 10 Days of Owner’s request, deliver a written cure plan which meets the requirements of the written cure plan deliverable defined above. Failure of Contractor to provide such written assurances of performance and the required written cure plan, within ten Days of request, will constitute a material breach of Contract Documents sufficient to justify termination for cause.

13.4.3. In event of termination for cause, Owner will immediately serve written notice thereof upon Surety and Contractor. Surety shall have the rights and obligations set forth in Document 00610 (Construction Performance Bond). Subject to the Surety’s rights under the Performance Bond (which rights are waived upon a default thereunder), Owner may take over the Work and prosecute it to completion by contract or by any other methods it may deem advisable.

13.4.4. In the event of termination for cause:

(1) Owner will compensate Contractor for the value of the Work delivered to Owner upon termination as determined in accordance with the Contract Documents, subject to all rights of offset and back charges, and provided that Contractor provides Owner with updated as-builds and Project Record Documents showing the Work performed up to the date of termination. However, Owner will not compensate Contractor for its costs in terminating the Work or any cancellation charges owed to third parties.

(2) Contractor shall deliver to Owner possession of the Work in its then condition including, but not limited to, all designs, architectural and engineering, Project records, Project Record Documents, cost data of all types, Drawings and Specifications and contracts with vendors and Subcontractors, all other documentation associated with the Project, and all construction supplies and aids dedicated solely to performing the Work which, in the normal course of construction, would be consumed or only have salvage value at the end of the construction period. Contractor shall remain fully liable for the failure of any Work completed and materials and equipment provided through the date of such termination to comply with the provisions of the Contract Documents. The provisions of this subparagraph shall not be interpreted to diminish any right which Owner may have to claim and recover damages for any breach of Contract Documents or otherwise, but rather, Contractor shall compensate Owner for all loss, cost, damage, expense, and/or liability suffered by Owner as a result of such termination and failure to comply with Contract Documents.

(3) Owner’s rights under this subparagraph shall be specifically enforceable to the greatest extent permitted by law. Owner shall, to the extent applicable, have all other rights and remedies set forth in any Bidding Document.

13.4.5. Owner may terminate portions or parts of the Work for cause, provided these portions or parts (1) have separate geographic areas from parts or portions of the Work not terminated or (2) are limited to the work of one or more specific trades or Subcontractors. In such case, Contractor shall cooperate with a completing contractor as required under Article 6 of this Document 00700.

13.4.6. In the event a termination for cause is later determined to have been made wrongfully or without cause, then Contractor shall have no greater rights than if a termination for convenience had been effected (to include, as appropriate, the recovery rights specified therefore.) Any Contractor claim arising out of a termination for cause, however, shall be made in accordance with Article 12 of this Document 00700. No other loss cost, damage, expense or liability may be claimed, requested or recovered by Contractor.

13.5 Termination Of Contract For Convenience

13.5.1. Owner may terminate for convenience the performance of the Work under the Contract Documents in accordance with this clause in whole, or from time to time in part, whenever Owner shall determine that termination is in Owner’s best interest. Termination for convenience may only be effected by Owner delivering to Contractor a written “Notice of Termination for Convenience”, specifying the extent to which performance of the Work under the Contract Documents is terminated and the effective date of the termination.

13.5.2. After receiving a notice of termination for convenience under this subparagraph, and except as otherwise directed by Owner, Contractor shall:
Stop Work under the Contract Documents on date and to extent specified in notice of termination for convenience;

Place no further orders or subcontracts for materials, services, or facilities except as necessary to complete portion of Work under the Contract Documents which is not terminated;

Terminate all orders and subcontracts to extent that they relate to performance of Work terminated by the notice of termination;

Assign to Owner in manner, at times, and to extent directed by Owner, all right, title, and interest of Contractor under orders and subcontracts so terminated. Owner shall have the right, in its sole discretion, to settle or pay any or all claims arising out of termination of orders and subcontracts;

Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with approval or ratification of Owner to extent Owner may require. Owner’s approval or ratification shall be final for purposes of this subparagraph;

Transfer title to Owner, and deliver in the manner, at the times, and to the extent, if any, directed by Owner, all fabricated or unfabricated parts, Work in process, completed Work, supplies, and all other material produced as part of, or acquired in connection with performance of, Work terminated by the notice of termination, and completed or partially completed drawings, drawings, specifications, information, and other property which, if the Project had been completed, would have been required to be furnished to Owner;

Use its best efforts to sell, in manner, at times, to extent, and at price or prices that Owner directs or authorizes, any property of types referred to in this subparagraph, but Contractor shall not be required to extend credit to any purchaser, and may acquire any such property under conditions prescribed and at price or prices approved by Owner. Proceeds of transfer or disposition shall be applied to reduce payments to be made by Owner to Contractor under the Contract Documents or shall otherwise be credited to the price or cost of Work covered by Contract Documents or paid in such other manner as Owner may direct;

Complete performance of the part of the Work which was not terminated by the notice of termination; and

Take such action as may be necessary, or as Owner may direct, to protect and preserve all property related to Contract Documents which is in Contractor’s possession and in which Owner has or may acquire interest.

13.5.3. After receipt of a notice of termination for convenience, Contractor shall submit to Owner its termination for convenience claim, in form and with all certifications required by Article 12 of this Document 00700. Contractor’s termination for convenience claim shall be submitted promptly, but in no event later than 6 months from effective date of the termination. Contractor and Owner may agree upon the whole or part of the amount or amounts to be paid to Contractor because of a total or partial termination of Work under this subparagraph. If Contractor and Owner fail to agree on the whole amount to be paid to Contractor because of the termination of the Work under this subparagraph, Owner’s total liability to Contractor by reason of the termination shall be the total (without duplication of any items) of:

(1) The reasonable cost to Contractor, without profit, for all Work performed prior to the effective date of the termination, including Work done to secure the Project for termination. Reasonable cost may not exceed the applicable percentage completion values derived from the progress schedule and the schedule of values. Deductions shall be made for cost of materials to be retained by Contractor, cost of Work defectively performed, amounts realized by sale of materials, and for other appropriate credits against cost of Work. Reasonable cost will include reasonable allowance for Project overhead and general administrative overhead not to exceed a total of ten percent of direct costs of such Work. When, in Owner’s opinion, the cost of any item of Work is excessively high due to costs incurred to remedy or replace defective or rejected Work, reasonable cost to be allowed will be the estimated reasonable cost of performing the Work in compliance with requirements of Contract Documents and excessive actual cost shall be disallowed.

(2) A reasonable allowance for profit on actual and allowable cost of Work performed as determined in this subparagraph, provided that Contractor establishes to Owner’s
satisfaction that Contractor would have made a profit had the Project been completed, and provided further that the profit allowed shall not exceed 5 percent of cost.

(3) Reasonable costs to Contractor of handling material returned to vendors, delivered to Owner or otherwise disposed of as directed by Owner.

(4) A reasonable allowance for Contractor’s internal administrative costs in preparing termination claim.

(5) Except as provided in this subparagraph, Owner shall not be liable for costs incurred by Contractor or Subcontractors after receipt of a notice of termination. Such non-recoverable costs include, but are not limited to, anticipated profits on Work not performed as of the date of termination, post-termination employee salaries, post-termination general administrative expenses, post-termination overhead or unabsorbed overhead, costs of preparing and submitting Contractor’s Bid, attorney’s fees of any type, and all costs relating to prosecution of claim or lawsuit.

(6) Owner shall have no obligation to pay Contractor under this subparagraph unless and until Contractor provides Owner with updated and acceptable as-builts and Project Record Documents for Work completed prior to termination.

13.5.4. In arriving at the amount due Contractor under this clause, there shall be deducted in whole (or in the appropriate part[s] if the termination is partial):

(1) All unliquidated advances or other payments on account previously made to Contractor, including without limitation all payments applicable to the terminated portion of Contract Documents;

(2) Any claim which Owner may have against Contractor in connection with Contract Documents; and

(3) The agreed price for, or proceeds of sale of, any materials, supplies, or other things kept by Contractor or sold under provisions of this subparagraph, and not otherwise recovered by or credited to Owner.

13.6 Contingent Assignment Of Subcontracts

13.6.1. Contractor hereby assigns to Owner each Subcontract for a portion of the Work, provided that:

(1) The assignment is effective only after Owner’s termination of Contractor’s right to proceed under the Contract Documents (or portion thereof relating to that Subcontract) pursuant to the termination for cause subparagraphs herein.

(2) The Assignment is effective only for the Subcontracts which Owner expressly accepts by notifying the Subcontractor in writing;

(3) The assignment is subject to the prior rights, if any, of the Surety, obligated by Document 00610 (Construction Performance Bond) provided under the Contract Documents, where the Surety exercises its rights to complete the Contract;

(4) After the effectiveness of an assignment, Contractor shall, at its sole cost and expense, sign all instruments and take all actions reasonably requested by Owner to evidence and confirm the effectiveness of the assignment in Owner; and

(5) Nothing in this subparagraph shall modify or limit any of Contractor’s obligations to Owner arising from acts or omissions occurring before the effectiveness of any Subcontract assignment, including but not limited to all defense, indemnity and hold-harmless obligations arising from or related to the assigned Subcontract.

13.7 Remedies and Contract Integration

13.7.1. Subject to Contract Documents provisions regarding Contractor claims, claim review, and claim resolution, and subject to the limitations therein, the exclusive jurisdiction and venue for resolving all claims, counter-claims, disputes and other matters in question between Owner and Contractor arising out of or relating to Contract Documents, any breach thereof or the Project shall be the Superior Court of the State of California for County of [ENTER APPLICABLE COUNTY]. All Owner remedies provided in the Contract Documents shall be taken and construed as cumulative and not exclusive; that is, in addition to each and every other remedy herein provided; and in all instances Owner shall have any and all other equitable and legal rights and remedies which it would have according to law.

13.7.2. The Contract Documents, any Contract Modifications and Change Orders shall represent the entire
and integrated agreement between Owner and Contractor regarding the subject matters hereof and
thereof and shall constitute the exclusive statement of the terms of the parties’ agreement. The
Contract Documents, and any Contract Modifications and Change Orders, shall supersede any and
all prior negotiations, representations or agreements, written or oral, express or implied, that relate
in any way to the subject matter of the Contract Documents or written modifications. Owner and
Contractor represent and agree that, except as otherwise expressly provided in the Contract
Documents, they are entering into the Contract Documents and any subsequent written modification
in sole reliance upon the information set forth or referenced in the Contract Documents or Contract
Modifications and the parties are not and will not rely on any other information.

13.7.3. In any proceeding to enforce the Contract Documents, Contractor and Owner agree that the finder
of fact shall receive detailed instructions on the meaning and operation of the Contract Documents,
including their conditions, limitations of liability, claims and time extension procedures, and any
other provisions impacting major defenses and theories of liability of the parties. Detailed findings
of fact shall be requested, to verify Contract enforcement.

13.7.4. Either party’s waiver of any breach or failure to enforce any of the terms, covenants, conditions or
other provisions of the Contract Documents at any time shall not in any way affect, limit, modify or
waive that party’s right thereafter to enforce or compel strict compliance with every term, covenant,
condition or other provision hereof; any course of dealing or custom of the trade or oral
representations notwithstanding.

13.8  Patents

13.8.1. Fees or claims for any patented invention, article or arrangement that may be used upon or in any
manner connected with performance of the Work or any part thereof shall be included in the Bid
price for doing the Work. To the greatest extent permitted by law, Contractor shall defend,
indemnify and hold harmless Owner and each of its officers, employees, consultants and agents,
including, but not limited to, the Board, Architect/Engineer and each Owner representative, from all
damages, claims for damages, costs or expenses in law or equity, including attorney’s fees, arising
from or relating to any claim that any article supplied or to be supplied under the Contract
Documents infringes on the patent rights, copyright, royalties, trade name, trademark, service mark,
trade secret or other intellectual property right of any person or persons or that the person or entity
supplying the article does not have a lawful right to sell the same. Such costs or expenses for which
Contractor agrees to indemnify and hold harmless the above indemnities include but are not limited
to any and all license fees, whether such fees are agreed by any indemnities or ordered by a court or
administrative body of any competent jurisdiction.

13.9  Substitution For Patented And Specified Articles

13.9.1. Except as noted specifically in Specifications, whenever in Specifications, material or process is
designated by patent or proprietary name or by name of manufacturer, such designation shall be
deemed to be used for purpose of facilitating description of material and process desired, and shall
be deemed to be followed by the words “or equal” and Contractor may offer any substitute material
or process that Contractor considers equal in every respect to that so designated and if material or
process offered by Contractor is, in opinion of Owner, equal in every respect to that so designated,
its use will be approved. However, Contractor may utilize this right only by timely submitting
Document 00660 (Substitution Request Form) as provided in Document 00200 (Instructions to
Bidders). A substitution will be approved only if it is a true “equal” item in every aspect of its
design and quality, including but not limited to its dimensions, weights, service requirements,
durability, functioning, impact on contiguous construction elements, overall schedule and design.

13.10  Interest Of Public Officers

13.10.1. No representative, officer, or employee of Owner, no member of the governing body of the locality
in which the Project is situated, no member of the locality in which Owner was activated, and no
other public official of such locality or localities who exercises any functions or responsibilities
with respect to the Project, during the tenure of the official or for one year thereafter, shall, as
principal, agent, attorney or otherwise, be directly or indirectly interested, in the Contract
Documents or the proceeds thereof.

13.11  Limit Of Liability
13.11.1. OWNER, AND EACH OF ITS OFFICERS, BOARD MEMBERS, EMPLOYEES, CONSULTANTS AND AGENTS INCLUDING, BUT NOT LIMITED TO, ARCHITECT/ENGINEER AND EACH OTHER OWNER REPRESENTATIVE, SHALL HAVE NO LIABILITY TO CONTRACTOR FOR SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, EXCEPT TO THE LIMITED EXTENT THAT THESE CONTRACT DOCUMENTS OR APPLICABLE PUBLIC CONTRACTING STATUTES MAY SPECIFY THEIR RECOVERY.

13.12  Severability

13.12.1. Any provisions or portions thereof of Contract Documents that are prohibited by, unlawful, or unenforceable under any applicable law of any jurisdiction shall as to such jurisdiction be ineffective without affecting other provisions or portions thereof in the Contract Documents.

14  MODIFICATIONS OF CONTRACT DOCUMENTS

14.1  Alterations, Modifications And Force Account Work

14.1.1. No modification or deviation from the Drawings and Specifications will be permitted except by written addenda, written Change Order or written Supplemental Instruction.

14.1.2. Owner may, without notice to the sureties, make alterations, deviations, additions to, or deletions from Contract Documents; increase or decrease the quantity of any item or portion of the Work; expand, contract or otherwise change the Contract Time; delete any item or portion of the Work; and require extra Work. Contractor shall perform such Work under applicable provisions of the Contract Documents, unless specifically provided otherwise at the time the change is ordered. In the case of any ordered extra Work, Owner reserves the right to furnish all or portions of associated labor, material, and equipment, which Contractor shall accept and use without payment for costs, markup, profit, or otherwise for such Owner-furnished labor, materials, and equipment.

14.1.3. Owner may make changes to the Work during the course of construction to bring the Work into compliance with environmental requirements or standards established by state and federal statutes and regulations enacted after the Contract has been awarded. Contractor shall be compensated for changes affecting the Contract Time or Contract Sum of the Work as set forth in this Article 14 and in Section 01250 (Modification Procedures).

14.1.4. Changes affecting the Contract Time or Contract Sum of the Work shall be set forth in a written Change Order that shall specify:

(1) The Work performed in connection with the change to be made;
(2) The amount of the adjustment of the Contract Sum, if any, and the basis for compensation for the Work ordered; and
(3) The extent of the adjustment in the Contract Time, if any.

14.1.5. A Change Order will become effective when signed by Owner. If Owner exercises its right to decide disputed issues pertaining to changed Work as set forth in Articles 12 and 14 of this Document 00700, then the resulting Change Order shall be effective when signed by Owner, notwithstanding that Contractor has not signed it.

14.1.6. Changes not affecting the Contract Time or Contract Sum of the Work, in Owner’s discretion, may be set forth in a written RFI-Reply executed by Owner. Execution of such an RFI-Reply constitutes Contractor’s agreement to make the specified change without change to the Contract Sum or the Contract Time.

14.1.7. Changes or deviations from Contract Documents affecting the Contract Time or Contract Sum of the Work shall not be made without the authority of an effective Change Order or Construction Change Directive as provided in Section 01250 (Modification Procedures), except in cases of emergency discussed in Document 00700.

14.1.8. If changes ordered in design, workmanship or materials are of such a nature as to increase or decrease the cost of any part of the Work, the price fixed in the Contract Documents shall be increased or decreased by the amount that Contractor and Owner may agree upon as a reasonable and proper allowance for the cost increase or decrease. If an agreement cannot be reached, then Owner will reach a determination, which shall be final, subject to Contractor’s rights under Article 12 of this Document 00700. In all cases Contractor shall perform the changed Work as directed by Owner subject to Contractor’s rights under Article 12 of this Document 00700.
14.1.9. Contractor shall, upon Owner’s request, permit inspection of the original unaltered Bid estimate, subcontract agreements, purchase orders relating to the change, and documents substantiating all costs associated with its cost proposal or claims arising from changes in the Work.

14.1.10. Changes in the Work made pursuant to this Article 14 and extensions of Contract Time necessary by reason thereof shall not in any way release the guaranties and warranties given by Contractor pursuant to provisions of the Contract Documents, nor shall such changes in the Work relieve or release the Sureties of bonds executed pursuant to said provisions. The Sureties, in executing such bonds, shall be deemed to have expressly agreed to any such change in the Work and to any extension of time made by reason thereof.

14.1.11. Procedures for Modifications of Contract Documents and for calculating the cost of extra Work are given in Section 01250 (Modification Procedures). Regarding delay and impact costs of any nature, Contractor may not seek delay compensation for on-Site or off-Site costs based on formulas, e.g., “Eichlay” or other formula. Rather, Contractor shall prove actual costs resulting from such delays. If Contractor requests compensation for delay to the construction, then Contractor shall prove and document actual costs plus markup per the cost categories and procedures in Section 01250 (Modification Procedures) in order to request, claim or prove compensation for delay.

14.1.12. Change Orders and authorization for extra cost must be approved by Owner’s Chief Executive Officer in advance of the work.

14.2 TIME ALLOWANCES

14.2.1. The Contract Time may only be changed by Change Order or by Contract Modification, and all time limits stated in the Contract Documents are of the essence of Contract Documents.

14.2.2. The Contract Time will be adjusted in an amount equal to the time lost due to:

   (1) Changes in the Work ordered by Owner;
   (2) Acts or neglect by Owner, Architect/Engineer, any Owner representative, utility owners or other contractors performing other work, provided that Contractor has fully and completely performed its responsibilities under the Contract Documents; or
   (3) Fires, floods, epidemics, abnormal weather conditions beyond the parameters otherwise set forth in this subparagraph, earthquakes, civil or labor disturbances, strikes or acts of God, provided damages resulting therefrom are not the result of Contractor’s failure to protect the Work as required by Contract Documents.

14.2.3. The Contract Time shall not be extended for any cause identified immediately above, however, unless:

   (1) Contractor actually has been prevented from completing any part of the Work within the Contract Time due to delay that is beyond Contractor’s control and due to reasons for which Contractor is not responsible (delays attributable to and within the control of a Subcontractor, or its subcontractors, or supplier shall be deemed to be delays within the control of Contractor);
   (2) A claim for delay is made as provided herein; and
   (3) Contractor submits a Time Impact Evaluation as required under Section 01320 (Progress Schedules and Reports) that demonstrates actual delay to critical Work activities that actually delay the progress of the Work in the amount of time requested.

14.3 Notice Of Delay

14.3.1. Within seven Days of the beginning of any delay, Contractor shall notify Owner in writing, by submitting a notice of delay that shall describe all anticipated delays resulting from the delay event in question. Any request for extension of time shall include a written schedule document that demonstrates delay to the critical path using a Time Impact Evaluation as specified in Section 01320 (Progress Schedules and Reports). Owner will determine all claims and adjustments in the Contract Time. No claim for an adjustment in the Contract Time will be valid and such claim will be waived if not submitted in accordance with the requirements of this subparagraph.

14.4 Non-Compensable Time Extensions; Adverse Weather Parameters

14.4.1. Where Contractor is prevented from completing any part of the Work within the Contract Time due to delay beyond the control of both Owner and Contractor (including, but not limited to, adverse
weather conditions exceeding Contract Documents parameters, earthquakes, Acts of God and epidemics, acts of other contractors or utilities), an extension of Contract Time, in an amount equal to the time lost due to such delay (without compensation), shall be Contractor’s sole and exclusive remedy for such delay.

14.4.2. Delays due to abnormal or adverse weather conditions will not be allowed for weather conditions that fall within the parameters listed or referenced immediately below in this subparagraph. Adverse weather delays may be allowed only if the number of workdays of adverse weather exceeds these parameters and Contractor proves that adverse weather actually caused delays to work that is on the critical path. Contractor shall give written notice of intent to claim an adverse weather day within one Day of the adverse weather day occurring. Rain parameters are as follows, pro-rated in the individual month Contractor starts and finishes Work:

(1) January, [6];
(2) February, [6];
(3) March, [6];
(4) April, [3];
(5) May, [1];
(6) June, [0];
(7) July, [0];
(8) August, [0];
(9) September, [0];
(10) October, [2];
(11) November, [4]; and
(12) December, [5].

[ENTER PROJECT RAIN PARAMETERS, IF DIFFERENT]

In order to qualify as an adverse weather delay with respect to the foregoing parameters, daily rainfall must exceed .1 of an inch or more at the Newark, California station, as measured by the National Oceanic & Atmospheric Administration, and Contractor shall prove that the rain actually caused delay to the Work, following the procedures in this paragraph and the Contract Documents. Notwithstanding the foregoing allowances, Contractor shall at all times employ all available mitigation measures to enable Work to continue. Delays due to abnormal or adverse weather conditions will not be allowed for weather conditions that fall within the parameters listed above.

14.4.3. Contractor shall include the foregoing precipitation parameters as a monthly activity in its progress schedule. As Work on the critical path is affected by precipitation, Contractor shall notify Owner and request that the days be moved to the affected activities. Any adverse weather days remaining shall be considered Project float.

14.4.4. Adverse weather delay for precipitation shall be recognized for the actual period of time Contractor proves it was delayed by precipitation exceeding the specified parameters. For example, and not by way of limitation, if precipitation exceeding the specified parameters does not in fact delay Contractor’s progress on the critical path, then no time extension shall be recognized; and conversely, if Contractor proves to Owner’s satisfaction that precipitation exceeding the specified parameters causes delay to Contractor for a period longer than the number of precipitation days incurred (e.g., if it rains or snows during grading work), then Contractor shall be entitled to a time extension equal to the actual period of such delay.

14.4.5. Contractor shall take reasonable steps to mitigate potential weather delays, such as dewatering the Site, lime treatment, and covering Work and material that could be affected adversely by weather. Failure to do so shall be cause for Owner to not grant a time extension due to adverse weather, where Contractor could have avoided or mitigated the potential delay by exercising reasonable care.

14.5 Compensable Time Extensions

14.5.1. Contractor may receive a time extension and be compensated for delays caused directly and solely by Owner. Provided Contractor provides proper notice and documentation under Section 01320, such compensation may include extended field or home office overhead, field supervision, escalation charges, acceleration costs and extended subcontractor costs.

14.5.2. Contractor shall not be entitled to any time extension or compensation, however, for any delays
caused in whole or in part by Contractor’s failure to perform its obligations under the Contract Documents, or during periods of delay concurrently caused by Contractor and either Owner or others.

14.5.3. Contractor shall not be entitled to damages for delay to the Work caused by the following reasons:

(1) Owner’s right to sequence the Work in a manner which would avoid disruption to Owner’s tenants and their contractors or other prime contractors and their respective subcontractors, exercised as a result of Contractor’s failure to perform its cooperation and coordination responsibilities required by Contract Documents; Owner’s enforcement of any government act or regulation; or the provisions of the Contract Documents; and

(2) Extensive requests for clarifications to Contract Documents or Contract Modifications thereto, provided such clarifications or Contract Modifications are processed by Owner or its consultants in a reasonable time commensurate with Contract Documents requirements.

14.6 Liquidated Damages

14.6.1. Time is of the essence. Execution of Contract Documents by Contractor shall constitute acknowledgement by Contractor that Contractor understands, has ascertained and agrees that Owner will actually sustain damages in the amount fixed in the Contract Documents for each and every Day during which completion of Work required is delayed beyond expiration of time fixed for completion or extensions of time allowed pursuant to provisions hereof. Contractor and Owner agree that specified measures of liquidated damages shall be presumed to be the damages actually sustained by Owner as defined below, and that because of the nature of the Project, it would be impracticable or extremely difficult to fix the actual damages.

14.6.2. Liquidated damages shall be considered not as a penalty but as agreed monetary damage sustained by Owner for increased Project administration expenses, including extra inspection, construction management and architectural and engineering expenses related to the Project and Contract Documents because Contractor failed to perform and complete Work within time fixed for completion or extensions of time allowed pursuant to provisions hereof. Liquidated damages shall not be deemed to include within their scope additional damages or administrative costs arising from Defective Work, lost revenues, interest expenses, cost of completion of the Work, cost of substitute facilities, claims and fines of regulatory agencies, damages suffered by others or other forms of liability claimed against Owner as a result of delay (e.g., delay or delay related claims of other contractors, subcontractors or tenants), and defense costs thereof. Contractor shall be fully responsible for the actual amount of any such damages it causes, in addition to the liquidated damages otherwise due Owner.

14.6.3. Owner may deduct from any money due or to become due to Contractor subsequent to time for completion of entire Work and extensions of time allowed pursuant to provisions hereof, a sum representing then-accrued liquidated damages. Should Contractor fall behind the approved Progress Schedule, Owner may deduct liquidated damages based on its estimated period of late completion. Owner need not wait until Final Completion to withhold liquidated damages from Contractor’s progress payments. Should money due or to become due to Contractor be insufficient to cover aggregate liquidated damages due, then Contractor forthwith shall pay the remainder of the assessed liquidated damages to Owner.

14.7 Differing Site Conditions

14.7.1. In the event that Contractor encounters underground conditions that exceed the scope of the Work, then Contractor shall promptly give Owner written notice of the condition, and shall give such notice before the conditions are disturbed, to include: (1) material that Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law, and is not within the scope of Work ("hazardous waste"); (2) subsurface or latent physical conditions at the site differing from those indicated by information about the site made available to Bidders prior to the deadline for submitting Bids, that Contractor did not and could not have known about by performing its required pre-Bid investigations, or (3) unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for the contract, that Contractor did not and could not have known about by performing its required pre-Bid
investigations.

(1) Owner shall promptly investigate the underground conditions, and if it finds that (i.) the conditions do materially so differ in a manner Contractor did not anticipate and could not have anticipated, or do involve hazardous waste outside the scope of the Work, and (ii.) cause a decrease or increase in Contractor’s cost of, or the time required for, performance of any part of the Work, then (iii.) Owner shall initiate a change order under the procedures described in the contract, including but not limited to, issuing either a Request for Proposal or a Construction Change Directive under the procedures described in the Contract Documents, including without limitation Section 01250 (Modification Procedures).

(2) If Owner determines that underground conditions at the Site do not materially so differ in a manner Contractor did not anticipate and could not have anticipated, or do not involve hazardous waste outside the scope of the Work, or for any other reason that no change in terms of the Contract Documents is justified, Owner will so notify Contractor in writing, stating reasons.

(3) In the event that a dispute arises between Owner and Contractor whether the conditions do materially so differ, or involve hazardous waste, and cause a decrease or increase in Contractor’s cost of, or the time required for, performance of any part of the Work, Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. The Contractor shall retain any and all rights provided either by the Contract or by law which pertain to the resolution of disputes and protests between contracting parties.

14.7.2. Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time regarding claimed hazardous waste or materials, claimed Latent or materially different Site conditions (whether above or below grade) if:

(1) Contractor knew of the existence of such conditions at the time Contractor submitted its Bid; or
(2) Contractor should have known of the existence of such conditions at the time Contractor submitted its Bid, or should have learned of such conditions and mitigated their impact, as a result of having complied with the requirements of Contract Documents, including without limitation, the investigation requirements herein at Articles 2 and 10 of Document 00700;
(3) The information or conditions claimed by Contractor to be Latent or materially different consist of information, conclusions, opinions or deductions made from underground conditions reports, of the kind that this Document 00700 precludes reliance upon; or,
(4) Contractor was required to give written notice and failed to do so within the time required

14.7.3. If, because of a differing site condition as defined herein, Contractor does not agree to continue with the Work based on a reasonable belief that it is unsafe, or does not agree to resume Work under special conditions, Owner may order the disputed portion of Work deleted from the Work, or performed by others, or Owner may invoke its right to terminate Contractor’s right to proceed under the Contract Documents in whole or in part, for convenience or for cause as the facts may warrant. If Contractor does not agree with Owner’s determination of any adjustment in the Contract Sum or Contract Time as a result, Contractor may make a claim as provided in Article 12 of this Document 00700.

14.8 Change Orders Related to Underground Facilities.

14.8.1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated in the materials supplied by Owner or in information on file at USA or is not otherwise reasonably known to Contractor by performing its obligations in Articles 2 and 10 of this Document 00700, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby (and in no event later than seven Days), and prior to performing any Work in connection therewith (except in an emergency as required by Article 15 of this Document 00700), identify the owner of such Underground Facility and give written notice to that owner and to Owner. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
14.8.2. Contractor shall be allowed an increase in the Contract Sum or an extension of the Contract Time, or both, for Underground Facilities either not shown or inaccurately shown in the Contract Documents, the information supplied pursuant to Document 00320 (Geotechnical Data and Existing Conditions) or in information on file at USA, only where the inaccuracy was (i.) material and outside of the normal experience on projects of this nature, (ii.) was not reasonably inferable from existing information, and (iii.) directly results in a material, justifiable and actual increase in the cost of Contractor’s work. For example, if surface conditions such as pavement repairs, valve covers, or other markings, indicate the presence of an Underground Facility, or if the Underground Facility could be determined or its cost impact mitigated by performing the obligations in Articles 2 and/or 10 of this Document 00700, then an increase in the Contract Price or an extension of the Contract Time will not be due, even if the Underground Facility was not indicated or was shown at a different place or a different elevation in the Contract Documents, in the information supplied to Contractor pursuant to Document 00320 (Geotechnical Data and Existing Conditions), or in information on file at USA.

14.8.3. Main Line and Trunk Line Utilities (Government Code Section 4215). Consistent with Government Code Section 4215, as between Owner and Contractor, Owner will be responsible for the timely removal, relocation, or protection of existing main or trunk line utility facilities located on the Site only if such utilities are not identified in the Contract Documents or Document 00320 (Geotechnical Data and Existing Conditions). Owner will compensate for the cost of locating and repairing damage not due to Contractor’s failure to exercise reasonable care, removing and relocating such main or trunk line utility facilities not indicated in the Contract Documents or Document 00320 (Geotechnical Data and Existing Conditions) with reasonable accuracy, and equipment on the Project necessarily idled during such work. Contractor shall not be assessed liquidated damages for delay in completion of the Project, when such delay was caused by the failure of Owner or the utility to provide for removal or relocation of such utility facilities.

15 WORKING CONDITIONS AND PREVAILING WAGES

15.1 Use Of Site/Sanitary Rules

15.1.1. All portions of the Work shall be maintained at all times in neat, clean and sanitary condition. Contractor shall furnish toilets for use of Contractor’s and Subcontractors’ employees on the Site where needed, and their use shall be strictly enforced. All toilets shall be properly secluded from public observation, and shall be located, constructed and maintained subject to Owner’s approval.

15.1.2. Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Site and land areas identified in and permitted by Contract Documents and other land and areas permitted by applicable laws and regulations, rights of way, permits and easements or as designated by Owner, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, any improvement located thereon, or to the owner or occupant thereof resulting from the performance of Work.

15.1.3. During the progress of the Work, Contractor shall keep the Site and the Project free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, Contractor shall remove all waste materials, rubbish and debris from and about the Site, as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall leave the premises clean and ready for occupancy by Owner at Substantial Completion of Work. Contractor shall restore to original condition all property not designated for alteration by Contract Documents.

15.1.4. Contractor shall not load nor permit any part of any structure or pavement to be loaded in any manner that will endanger the structure or pavement, nor shall Contractor subject any part of Work or adjacent property to stresses or pressures that will endanger it. Contractor shall conduct all necessary existing conditions investigation regarding structural, mechanical, electrical or any other system existing, shall perform Work consistent with such existing conditions, and shall have full responsibility for insufficiencies or damage resulting from insufficiencies of existing systems, equipment or structures to accommodate performing the Work.

15.2 Protection Of Work, Persons, Property And Operations
15.2.1. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with Work. Contractor shall comply with all safety requirements specified in any safety program established by Owner, or required by state, federal or local laws and ordinances. Contractor shall be responsible for all damage to Work, property or structures, all injuries to persons, and all damage and interruptions to Owner’s operations, arising from the performance of Work of the Contract Documents. Except as otherwise expressly approved by Owner in writing, Contractor shall at all times perform all Work in a manner which does not interrupt, damage or otherwise adversely impact any facilities, operations, or real or personal property of Owner, its officers, employees, agents, invitees, licensees, lessees or contractors.

15.2.2. Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property.

15.2.3. Contractor shall remedy all damage, injury, loss or interruption to any property or operations of Owner or continuous owners of property interests, caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, supplier, or any other person or organization directly or indirectly employed by any of them to perform or furnish any Work or anyone for whose acts any of them may be liable. Contractor’s duties and responsibility for safety and for protection of Work shall continue until such time as all the Work is completed and Final Acceptance of the Work. Owner and its agents do not assume any responsibility for collecting any indemnity from any person or persons causing damage to Contractor’s Work. Contractor shall give all notices required by potentially responsible insurance carriers and require that its subcontractors and suppliers do the same.

15.2.4. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

15.2.5. Owner may, at its option, retain such moneys due under the Contract Documents as Owner deems necessary until any and all suits or claims against Contractor for injury to persons, property or operations shall be settled and Owner receives satisfactory evidence to that effect.

15.3 Responsibility For Safety And Health

15.3.1. Contractor shall ensure that its and each tier of Subcontractors’ employees, agents and invitees comply with applicable health and safety laws while at the Site. These laws include the Occupational Safety and Health Act of 1970 and rules and regulations issued pursuant thereto, and Owner’s safety regulations as amended from time to time. Contractor shall comply with all Owner directions regarding protective clothing and gear.

15.3.2. Contractor shall be fully responsible for the safety of its and its Subcontractors’ employees, agents and invitees on the Site. Contractor shall notify Owner, in writing, of the existence of hazardous conditions, property or equipment at the Site that are not under Contractor’s control. Contractor shall be responsible for taking all the necessary precautions against injury to persons or damage to the property of Contractor, Subcontractors or persons from recognized hazards until the responsible party corrects the hazard.

15.3.3. Contractor shall confine all persons acting on its or its Subcontractors’ behalf to that portion of the Site where Work under the Contract Documents is to be performed: Owner designated routes for ingress and egress thereto and any other Owner designated area. Except those routes for ingress and egress over which Contractor has no right of control, within such areas, Contractor shall provide safe means of access to all places at which persons may at any time have occasion to be present.

15.4 Emergencies

15.4.1. In emergencies affecting the safety or protection of persons or Work or property at the Site or adjacent thereto, Contractor, without special instruction or authorization from Owner, is obligated to act to prevent threat and damage, injury or loss, until directed otherwise by Owner. Contractor
shall give Owner prompt written notice if Contractor believes that any significant changes in Work or variations from Contract Documents have been caused thereby. If Owner determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Order or Construction Change Directive will be issued to document the consequences of such action.

15.5 Use Of Roadways And Walkways

15.5.1. Contractor shall not unnecessarily interfere with use of any roadway, walkway or other facility for vehicular or pedestrian traffic. Before beginning any interference and only with Owner’s prior concurrence, Contractor may provide detour or temporary bridge for traffic to pass around or over the interference, which Contractor shall maintain in satisfactory condition as long as interference continues. Unless otherwise provided in the Contract Documents, Contractor shall bear the cost of these temporary facilities.

15.6 Nondiscrimination

15.6.1. No person or entity shall discriminate in the employment of persons upon public works because of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, marital status, sexual preference, or gender of such persons, except as provided in Section 12940 of the Government Code. Every contractor for public works violating the provisions of Section 1735 of the Labor Code is subject to all the penalties imposed for a violation of Chapter 1, Part 7, Division 2 of the Labor Code.

15.7 Prevailing Wages

15.7.1. Contractor shall pay to persons performing labor in and about Work provided for in the Contract Documents an amount equal to or more than the general prevailing rate of per diem wages for (1) work of a similar character in the locality in which the Work is performed and (2) legal holiday and overtime work in said locality. The per diem wages shall be an amount equal to or more than the stipulated rates contained in a schedule that has been ascertained and determined by the Director of the State Department of Industrial Relations and Owner to be the general prevailing rate of per diem wages for each craft or type of workman or mechanic needed to execute this Contract. Contractor shall also cause a copy of this determination of the prevailing rate of per diem wages to be posted at each Site.

15.7.2. Contractor shall forfeit, as a penalty to Owner, Fifty Dollars ($50.00) for each laborer, workman, or mechanic employed in performing labor in and about the Work provided for in the Contract Documents for each Day, or portion thereof, that such laborer, workman or mechanic is paid less than the said stipulated rates for any work done under the Contract Documents by him or her or by any Subcontractor under him or her, in violation of Articles 1 and 2 of Chapter 1 of Part 7 of Division II of the California Labor Code. The sums and amounts which shall be forfeited pursuant to this subparagraph and the terms of the Labor Code shall be withheld and retained from payments due to Contractor under the Contract Documents, pursuant to this Document 00700 and the Labor Code, but no sum shall be so withheld, retained or forfeited except from the final payment without a full investigation by either the State Department of Industrial Relations or by Owner. The Labor Commissioner pursuant to Labor Code Section 1775 shall determine the final amount of forfeiture.

15.7.3. Contractor shall insert in every subcontract or other arrangement which Contractor may make for performance of work or labor on Work provided for in the Contract, provision that Subcontractor shall pay persons performing labor or rendering service under subcontract or other arrangement not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the Work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed in the Labor Code.

15.7.4. Contractor stipulates that it shall comply with all applicable wage and hour laws, including without limitation Labor Code Sections 1776 and 1810-1815. Failure to so comply shall constitute a default under this Contract.
15.7.5. Contractor and its Subcontractors shall be responsible for compliance with Labor Code Sections 1810-1815.

(1) Eight hours of labor performed in execution of the Contract constitutes a legal day’s work. The time of service of any workman employed on the Project is limited and restricted to 8 hours during any one calendar day, and 40 hours during any one calendar week.

(2) Contractor and its Subcontractors shall keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each worker employed by him or her in connection with the Project. The record shall be kept open at all reasonable hours to the inspection Owner and to the Division of Labor Standards Enforcement.

(3) Contractor or its Subcontractors shall, as a penalty to Owner, forfeit twenty-five dollars ($25) for each worker employed in the execution of the Contract Documents by the respective Contractor or Subcontractor for each calendar day during which the worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of Labor Code §§ 1810-1815.

(4) Work performed on the Project by employees of Contractor or its Subcontractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon compensation for all hours worked in excess of 8 hours per day at not less than 1 1/2 times the basic rate of pay.

15.7.6. Contractor and its Subcontractors shall be responsible for compliance with Labor Code Section 1776.

(1) Contractor and Subcontractors must keep accurate payroll records, showing the name, address, social security number, Work classification, straight time and overtime hours worked each Day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the Work of the Contract documents. Each payroll record shall contain or be verified by a written declaration as required by Labor Code Section 1776.

(2) The payroll records enumerated above must be certified and shall be available for inspection at all reasonable hours at the principal office of Contractor as required by Labor Code Section 1776.

   a. Contractor shall inform Owner of the location of records enumerated above, including the street address, city and county, and shall, within five working Days, provide a notice of a change of location and address.

   b. Contractor or Subcontractor has 10 Days in which to comply subsequent to receipt of a written notice requesting the records enumerated above. In the event that Contractor or Subcontractor fails to comply with the ten-Day period, he or she shall, as a penalty to Owner on whose behalf the contract is made or awarded, forfeit $25.00 for each calendar Day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. Contractor is not subject to a penalty assessment pursuant to this subparagraph due to the failure of a Subcontractor to comply with this subparagraph.

(3) Contractor shall also deliver certified payrolls to Owner with each Application for Payment as described in Section 001200 (Measurement and Payment).

15.8 Environmental Controls

15.8.1. Contractor shall comply with all rules, regulations, ordinances, and statutes that apply to any work performed under the Contract Documents including, without limitation, any toxic, water and soil pollution controls and air pollution controls specified in Government Code, Section 11017. Contractor shall be responsible for insuring that Contractor’s employees, Subcontractors and the public are protected from exposure to airborne hazards or contaminated water, soil or other toxic materials used during or generated by activities on the Site or associated with the Project.

15.9 Shoring Safety Plan
SUMMARY

1.1 This Document 00801 includes requirements that supplement the paragraphs of Document 00700 (General Conditions) as they apply to naturally occurring asbestos at the Site or at some other location which makes compliance with applicable naturally occurring asbestos requirements relevant to the Project.

SUPPLEMENTS TO PARAGRAPH 5.G, PRECEDENCE OF DOCUMENTS.

2.1 Add to end of Paragraph 5.G the following clause, which reads:

Notwithstanding anything to the contrary above, should any provision or requirement of any Contract Document conflict with another provision or requirement in the Contract Documents on subject matters of naturally occurring asbestos, then the most stringent provision or requirement shall control.

SUPPLEMENTS TO PARAGRAPH 13.A, LAWS AND REGULATIONS

3.1 Add new clauses to the end of Paragraph 13.A, Laws and Regulations which read:

5. Without limiting the foregoing, Contractor shall comply with all applicable requirements of the BAAQMD and any other applicable governmental requirements pertaining to naturally occurring asbestos, including without limitation all obligations to limit dust thereof. These requirements include, but may not be limited to, the following:

a. Title 17 CCR, Section 93105, Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations.

b. Title 17 CCR, Section 93106, Asbestos Airborne Toxic Control Measure for Surfacing Operations.

6. Contractor has the sole responsibility for determining compliance with all matters related to naturally occurring asbestos. Without limiting the foregoing, Contractor shall develop and implement dust control measures during construction and mitigation of all disturbed areas completed which are acceptable to Owner.

SUPPLEMENTS TO PARAGRAPH 13.G, TERMINATION OF CONTRACT FOR CAUSE.

4.1 Add a new Paragraph to Paragraph 13.G, which reads:

7. Notwithstanding anything in Paragraph 13.G to the contrary, Owner shall have an absolute right to terminate for default immediately without notice and without an opportunity to cure should Contractor knowingly or recklessly commit a material breach of the terms of the Contract Documents on any matter involving the exposure of persons or property to naturally occurring asbestos. However, if the breach exposing persons or property to naturally occurring asbestos is due solely to an ordinary, unintentional and non-reckless failure to exercise reasonable care, then the procedures in Paragraph 13.G for termination for default shall apply without modification.

END OF DOCUMENT
INSURANCE REQUIREMENTS

1.1 At or before the date specified in Document 00200 (Instructions to Bidders), Contractor shall furnish to Owner satisfactory proof that Contractor has in force continuously for the entire period covered by the Contract the following classes of insurance in the form and with limits and deductibles specified below:

1.1.1 Comprehensive or Commercial General Liability Insurance covering claims for personal injury, bodily injury and property damage arising out of the Work and in a form providing coverage not less than that of a standard Commercial General Liability Insurance policy (“Occurrence Form”). Such insurance shall provide for all operations and include independent contractors, products liability, completed operations for one year after Final Completion of the last Phase to be completed and acceptance of the final payment for the Work, contractual liability, and coverage for explosion, collapse and underground hazards. The limits of such insurance shall not be coverage of less than [$5,000,000] each occurrence, [$5,000,000] general aggregate limit, and [$5,000,000] aggregate for products and completed operations. The policies shall be endorsed to provide Broad Form Property Damage Coverage.

1.1.2 Comprehensive Automobile Liability Insurance covering all owned, non-owned, and hired vehicles. Such insurance shall provide coverage not less than the standard Comprehensive Automobile Liability policy with limits not less than [1,000,000] each person Bodily Injury, [1,000,000] each occurrence Bodily Injury and [1,000,000] each occurrence Property Damage (or [1,000,000] combined single limit, each accident).

1.1.3 All-Risk Course of Construction Insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws, water damage, flood, and damage caused by frost and freezing, in the amount of 100 percent of the completed value of the Work to be performed under this Contract. Deductible shall not exceed [25,000]. Each loss shall be borne by Contractor.

1.1.4 Workers’ Compensation and Employer’s Liability Insurance for all persons whom the Contractor may employ in carrying out Work contemplated under Contract Documents, in accordance with the Act of Legislature of State of California, known as “Workers’ Compensation Insurance and Safety Act,” approved May 26, 1913, and all acts amendatory or supplemental thereto, in the statutory amount.

1.2 All policies of insurance shall be placed with insurers acceptable to Owner. The insurance underwriter(s) must be duly licensed to do business in the State of California and (other than for workers’ compensation) must have an A. M. Best Company rating of [A, VII] or better. Required minimum amounts of insurance may be increased should conditions of Work, in opinion of Owner, warrant such increase. Contractor shall increase required insurance amounts upon direction by Owner.

1.3 Required Endorsements:

1.3.1 The policies required under paragraphs 1.1.1, 1.1.2 and 1.1.3 of this Document 00821 shall be endorsed, in a form and manner acceptable to Owner, as follows:

(1) Name Owner, its Board of Trustees and their employees, representatives, consultants (including without limitation Architect and its consultants), and agents, as additional insureds, but only with respect to liability arising out of the activities of the named insured.

(2) Each such policy shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limit of the insurance company’s liability required under paragraphs 1.1.1, 1.1.2 and 1.1.3 of this Document 00821.
(3) Insurance shall be primary and no other insurance or self-insured retention carried or held by Owner shall be called upon to contribute to a loss covered by insurance for the named insured.

(4) Insurance shall contain a provision requiring the insurance carriers to waive their rights of subrogation against Owner and all additional insureds, as well as other insurance carriers for the Work.

(5) Declarations Pages Required. Contractor or its insurance broker shall submit a copy of the Declarations page for each policy under Sections 1.1.1, 1.1.2 and 1.1.3 above. The page shall include the name of the carrier, the policy number, the types of coverage and limits, the effective dates of the policy, and the broker’s name and license number.

(6) Certificates of insurance and endorsements shall have clearly typed thereon Owner Contract Number and title of Contract Documents. Written notice of cancellation, non-renewal, or reduction in coverage of any policy shall be mailed to Owner (Attention: Facilities Project Manager at the address listed in Document 00520 (Agreement), 30 Days in advance of the effective date of the cancellation, non-renewal, or reduction in coverage. Contractor shall maintain insurance in full force and effect during entire period of performance of Contract Documents. Contractor shall keep insurance in force during warranty and guarantee periods, except that Contractor may discontinue All-Risk Course of Construction Insurance after Final Payment. At time of making application for extension of time, and during all periods exceeding the Contract Time resulting from any cause, Contractor shall submit evidence that insurance policies will be in effect during requested additional period of time. Upon Owner’s request, Contractor shall submit to Owner, within 30 Days, copies of the actual insurance policies or renewals or replacements.

1.4 Contractor shall pay all insurance premiums, including any charges for required waivers of subrogation or the endorsement of additional insureds. If Contractor fails to maintain insurance, Owner may take out comparable insurance, and deduct and retain amount of premium from any sums due Contractor under Contract Documents.

1.5 If injury occurs to any employee of Contractor, Subcontractor or sub-subcontractor for which the employee, or the employee’s dependents in the event of employee’s death, is entitled to compensation from Owner under provisions of the Workers’ Compensation Insurance and Safety Act, as amended, or for which compensation of any kind is claimed from Owner, Owner may retain out of sums due Contractor under Contract Documents, amount sufficient to cover such compensation, as fixed by the Act, as amended, until such compensation is paid, or until it is determined that no compensation is due. If Owner is compelled to pay compensation, Owner may, in its discretion, either deduct and retain from the Contract Sum the amount so paid, or require Contractor to reimburse Owner.

1.6 Nothing in this Document 00821 shall be construed as limiting in any way the extent to which Contractor or any Subcontractor may be held responsible for payment of damages resulting from their operations.

1.7 All Subcontractors shall maintain the same insurance required to be maintained by Contractor with respect to their portions of the Work, and Contractor shall cause the Subcontractors to furnish proof thereof to Owner within ten Days of Owner’s request. (However, Subcontractors need obtain only $1,000,000 of Comprehensive General Liability insurance.)

1.8 If required by Owner, Contractor shall obtain and maintain Contractor’s Pollution Legal Liability Insurance in a form, with limits, and from an insuring entity reasonably satisfactory to Owner.

1.9 The following provisions apply to any licensed professional engaged by Contractor to perform portions of the Work (“Professional”).

1.9.1 Each Professional shall maintain the following insurance at its sole cost and expense:

(1) Provided such insurance is customarily required by Owner when professionals engaged in the profession practiced by Professional directly contract with Owner, Professional Liability Insurance, insuring against professional errors and omissions arising from Professional’s work on the Project, in an amount not less than $1,000,000 combined
single limit for each occurrence. If Professional cannot provide an occurrence policy, Professional shall provide insurance covering claims made as a result of performance of Work on this Project and shall maintain such insurance in effect for not less than three years following Final Completion of the Project.

(2) All insurance required by paragraphs 1.1.1, 1.1.2 and 1.1.4 of this Document 00821. Professional shall satisfy all other provisions of this Document 00821 relating to that insurance, including without limitation providing required insurance certificates (containing the required endorsements) and declarations pages before commencing its Work on the Project.

2 RESPONSIBILITY OF CONTRACTOR AND INDEMNIFICATION

2.1 Contractor’s Responsibility For The Work

2.1.1 Except for damage caused by the sole negligence, willful misconduct or active negligence of Owner or its agents, Contractor shall be solely responsible for any loss or damage that may happen to any part of the Work, materials or other things used in performing the work, injury, sickness, disease, or death of any person as a result of the Work, or resulting damage to property.

2.1.2 Owner and each of its officers, employees, consultants and agents including, but not limited to the Board, Architect/Engineer and each Owner Representative, shall not be liable or accountable in any manner for loss or damage that may happen to any part of the Work; loss or damage to materials or other things used or employed in performing the Work; injury, sickness, disease, or death of any person as a result of the Work; or damage to property resulting from any cause whatsoever except their sole negligence, willful misconduct or active negligence, and Contractor releases all of the foregoing persons and entities from any and all such claims.

2.1.3 With respect to third-party claims against Contractor, Contractor waives any and all rights to any type of express or implied indemnity against Owner and each of its officers, employees, consultants and agents including, but not limited to Owner, the Board, Architect and its consultants, and each Owner representative.

2.1.4 Contractor also waives subrogation rights under applicable insurance policies, to the greatest extent permitted by law, and will require this same waiver of subrogation by its subcontractors, in all policies of insurance, against all other project participants, to include Contractor, subcontractors, Owner, the Architect, IOR, government agencies, engineers and inspectors.

2.2 Claims Arising From The Work

2.2.1 To the furthest extent permitted by law (including without limitation California Civil Code Section 2782), Contractor shall assume defense of, and indemnify and hold harmless, Owner and each of its officers, employees, consultants and agents, including but not limited to the Board, Architect/Engineer and each Owner representative, from claims, suits, actions, losses and liability of every kind, nature and description, including but not limited to claims and fines of regulatory agencies and attorney’s fees and consultant’s fees, directly or indirectly arising out of, connected with or resulting from performance of the Work, failure to perform the Work, or condition of the Work which is caused in whole or part by any act or omission of Contractor, Subcontractors, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

2.2.2 Contractor’s indemnity obligation shall not apply to any indemnified party to the extent of its sole negligence or willful misconduct; nor shall it apply to Owner or other indemnified party to the extent of its active negligence.
2.3 **Scope Of Indemnification Obligation**

2.3.1 Approval or purchase of any insurance contracts or policies shall in no way relieve from liability nor limit the liability of Contractor, its Subcontractors of any tier, or the officers or agents of any of them. In the event of loss, however, Contractor shall give all required notices to all insurance carriers, and shall require its subcontractors to do the same. Owner may, in its discretion, request evidence of such notices from Contractor.

2.4 **Scope Of Contract Limitations Of Liability**

2.4.1 To the furthest extent permitted by law (including, without limitation, Civil Code Section 2782), the indemnities, releases of liability and limitations of liability, claims procedures, and limitations of remedy expressed throughout Contract Documents shall apply even in the event of breach of contract, negligence (active or passive), fault or strict liability of the party(is) indemnified, released, or limited in liability, and shall survive the termination, rescission, breach, abandonment, or completion of the Work or the terms of the Contract Documents.

**END OF DOCUMENT**
DOCUMENT 00822

APPRENTICESHIP PROGRAM

1 COMPLIANCE REQUIRED

1.1 Contractor and Subcontractors shall comply with the requirements of California Labor Code §§1776, 1777.5, and 1777.6 concerning the employment of apprentices by Contractor or Subcontractors. Willful failure to comply may result in penalties, including loss of the right to Bid on or receive public works contracts.

2 CERTIFICATION OF APPROVAL

2.1 California Labor Code §1777.5, as amended, requires a Contractor or Subcontractor employing tradespersons in any apprenticeable occupation to apply to the joint apprenticeship committee nearest the site of a public works project and which administers the apprenticeship program in that trade for a certification of approval. The certificate shall also fix the ratio of apprentices to journeypersons that will be used in performance of the Contract. The ratio of work performed by apprentices to journeypersons in such cases shall not be less than one hour of apprentices work for every five hours of labor performed by journeypersons (the minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeypersons), except:

2.1.1 When unemployment for the previous three month period in the area exceeds an average of 15 percent;
2.1.2 When the number of apprentices in training in the area exceeds a ratio of one to five;
2.1.3 When a trade can show that it is replacing at least 1/30 of its membership through apprenticeship training on an annual basis state-wide or locally; or
2.1.4 Assignment of an apprentice to any work performed under a public works contract would create a condition which would jeopardize his or her life or the life, safety, or property of fellow employees or the public at large or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyperson.

3 FUND CONTRIBUTIONS

3.1 Contractor is required to make contributions to funds established for administration of apprenticeship programs if Contractor employs registered apprentices or journeypersons in any apprenticeable trade on such contracts and if other contractors on the public works site are making such contributions.

4 APPRENTICESHIP STANDARDS

4.1 Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of the California Department of Industrial Relations, or from the Division of Apprenticeship Standards and its branch offices.

END OF DOCUMENT
See attached.
PERALTA COMMUNITY COLLEGE DISTRICT

CONSTRUCTION PROJECT LABOR AGREEMENT

MAY 26, 2008

July 21, 2009
PROJECT LABOR AGREEMENT
TABLE OF CONTENTS

Preamble............................................................................................................. 2
Recitals .............................................................................................................. 2

ARTICLE 1
Definitions ........................................................................................................ 3

ARTICLE 2
Purpose ........................................................................................................... 5

ARTICLE 3
Scope of Agreement ........................................................................................ 5

ARTICLE 4
Effect of Agreement ....................................................................................... 8

ARTICLE 5
Subcontracts .................................................................................................... 9

ARTICLE 6
Work Stoppages, Strikes, Sympathy Strikes and Lockouts ......................... 10

ARTICLE 7
Prejob Meeting ............................................................................................... 13

ARTICLE 8
Nondiscrimination .......................................................................................... 13

ARTICLE 9
Union Recognition .......................................................................................... 14

ARTICLE 10
Referral ........................................................................................................... 14

ARTICLE 11
Wages and Benefits ....................................................................................... 15

ARTICLE 12
Grievance Arbitration Procedure ................................................................. 17

ARTICLE 13
Safety & Health .............................................................................................. 18

ARTICLE 14
Compliance ..................................................................................................... 18

ARTICLE 15
Jurisdictional Disputes ................................................................................ 19

ARTICLE 16
Local Hiring Program .................................................................................... 21

ARTICLE 17
Management Rights ....................................................................................... 24

ARTICLE 18
Savings Clause .............................................................................................. 25

ARTICLE 19
Miscellaneous Provisions ............................................................................ 25

ARTICLE 20
Term ................................................................................................................ 26
Signature Page .................................................................................................. 26

Attachment A
Letter of Assent ............................................................................................... 30
PERALTA COMMUNITY COLLEGE DISTRICT

CONSTRUCTION
PROJECT LABOR AGREEMENT

PREAMBLE

This Project Labor Agreement ("Agreement") is entered into this 21st day of July, 2009 by and between the Peralta Community College District (hereinafter, the "District") and the Building and Construction Trades Council of Alameda County, AFL-CIO (the "Council") and the Unions signatory to this Agreement, collectively referred to as the "Unions" or "Signatory Unions", with respect to the new construction work within the scope of this Agreement as hereinafter defined.

It is understood by the parties to this Agreement that when this Agreement is executed by the Chancellor after authorization by the District’s Governing Board, it will become the policy of the District that the construction work covered by this Agreement shall be contracted exclusively to Contractors who agree to be bound by the terms of this Agreement through execution of it or the Letter of Assent (Attachment A). No practice, understanding or agreement between Contractor(s) and a Union party which is not provided for in this Agreement will be binding on any other party or Projects covered by this Agreement unless endorsed in writing by the District PLA Program Manager.

This Agreement is not intended to replace, interfere, abrogate, diminish or modify existing local or national collective bargaining agreements in effect during the duration of the Program, insofar as a legally binding agreement exists between the Contractor/Employer(s) and the affected Union(s) except to the extent that the provisions of this Agreement are inconsistent with said collective bargaining agreements, in which event, the provisions of this Agreement shall prevail.

The District, through its District PLA Program Manager, on staff or under contract, shall administer this Agreement and shall monitor compliance with it by all Contractors. For purposes of this Agreement, each Contractor recognizes and appoints the District PLA Program Manager as its agent, with full, independent authority to implement and administer this Agreement, and, when and if appropriate or necessary, negotiate amendments to this Agreement. Together with the Union parties, the District shall be considered a "negotiating party" of this Agreement. None of the terms of this Agreement, including specifically this agency designation and the Recitals set out below, shall be interpreted to cause or have the effect of creating a joint or single employer relationship between the District and any Contractor or between Contractors on this Project.

RECITALS

WHEREAS, the Peralta Community College District ("District") is considering the development and construction of various project(s) throughout the District in connection with its PLA covered Projects; and

WHEREAS, it is essential that the construction work required in connection with the PLA covered Projects be done in an efficient and economical manner so as to secure optimum
productivity and to eliminate delays in the construction operations, thus ensuring timely completion in the work undertaken by the contractors; and

WHEREAS, the District desires to enter into a project labor agreement ("Project Labor Agreement") with appropriate building and construction trade councils and related unions to be implemented and enforced on certain projects covered by the PLA; and

WHEREAS, it is the District's intent to negotiate and enter into a Project Labor Agreement with the appropriate building and construction trades council and related unions to ensure all contractors performing work on the project(s) comply with all requirements under the California Labor Code applicable to the project(s), including, but not limited to, prevailing wages and apprenticeship; and

WHEREAS, it is the intent and purpose of the Project Labor Agreement to provide, establish and put into practice effective methods for the settlement of labor disputes which may arise on the project(s) covered without strike, lockout, work stoppage, or slowdown, to the end that the project(s) shall be assured continuity of operation; and

WHEREAS, the District desires to authorize its Chancellor or his designee to negotiate and execute a Project Labor Agreement with the appropriate building and construction trades council and related unions to take any and all action necessary to further the District's interests in negotiating the Project Labor Agreement; and

WHEREAS, The parties agree that one of the primary purposes of this Agreement is to avoid the tensions that might arise on the Project if union and nonunion workers of different employers were to work side by side on the Project thereby leading to labor disputes that could delay completion of the Project, and

WHEREAS, the District reserves the right to control the site at which the Project will be constructed, and the right to coordinate project construction work and scheduling, including, where appropriate, setting uniform start times, and approving the necessity for and the times of shift work.

NOW, THEREFORE, IT IS AGREED BETWEEN AND AMONG THE PARTIES HERETO, AS FOLLOWS:

ARTICLE 1
DEFINITIONS

1.1 "Agreement" means this Project Labor Agreement.

1.2 "District" means the Peralta Community College District and the administrative staff under its Chancellor.

1.3 "Contractor(s)" means any individual, firm, partnership or corporation, or combination thereof, including joint ventures, which is an independent business enterprise and has entered into a contract with the District or any of its Contractors or subcontractors of any tier, with respect to the construction of any part of the PLA Program under contract terms and conditions approved by the District and which incorporate this Agreement.
1.4 "Construction Contract" means the public works or improvement contracts which have been approved and signed by the District and which are part of the PLA Program.

1.5 "PLA Program " means the PLA-eligible Project(s) that are all Covered Work which are all those construction contracts funded in whole or in part by bond funding, State grants, tax increment funding and all other funding that is allocated for construction and may be more generally known as public funding and identified by the District as part of the PLA Program and the construction of which was awarded to a contractor during the term of this Agreement.

1.6 "Project" is an individual construction Project that is a part of the PLA Program and designated to be covered by this Agreement.

1.7 "Union(s)" means the Building and Construction Trades Council of Alameda County, AFL-CIO ("Council") and any other labor organization signatory to this Agreement, acting in their own behalf and on behalf of their respective affiliates and member organizations whose names are subscribed hereto and who have through their officers executed this Agreement ("Signatory Unions").

1.8 "Master Agreement" means the Master Collective Bargaining Agreement of each craft Union signatory hereto covering the corresponding work between a bona fide contractor group or representative and the signatory Unions having jurisdiction over the work on the Project and that are identified and agreed to by the District PLA Program Manager and the Unions.

1.9 "District PLA Program Manager" means the person(s) and/or business entity designated by the District to oversee all phases of construction on the PLA Program and is:

1.10 "District Project Manager(s)" means the person(s) selected by the District on one or more campuses to oversee and/or inspect construction activity, as agents of the District. They will not be engaged in construction work, and their relationship to this Agreement, if any, will be through the District.

The initial term of this Agreement shall be for five (5) years, commencing with the acceptance of this agreement by both parties. At the end of this initial period, this Agreement will be reviewed and considered for extension or renewal with modifications if appropriate. The term of this Agreement will be automatically extended for additional successive five (5) year terms unless the District, prior to the expiration of any such term and, after meeting with the Council and the Unions, finds in a public hearing that the work performed has been unsatisfactory, and gives the Council and Unions notice that it will not renew this Agreement.

1.11 This Agreement shall remain in effect for any Construction Contract awarded under this Agreement but not completed by the end of the term for the duration of that Contract.

1.12 "Local area resident" means Alameda County residents of Alameda, Albany, Berkeley, Emeryville, Piedmont and especially the City of Oakland.
ARTICLE 2
PURPOSE

2.1 The purpose of this Agreement is to promote efficiency of construction operations and provide for peaceful, efficient, and binding procedures for settlement of labor disputes and grievances without strikes or lockouts, thereby promoting the public interest in assuring the timely and economical completion of the PLA covered Projects. The PLA Program is intended to increase the educational opportunities and raise student achievement through the improvement of academic learning and health and safety conditions on the campuses of the District by the development of campus facilities for students, faculty and staff.

2.2 Further, the purpose of this Agreement is to ensure that all Contractors performing work on all PLA-covered Projects will comply with all requirements under the California Labor Code and utilize resources available in the local area, including those provided by minority and women-owned enterprises.

2.3 In so doing, the parties to this Agreement establish the foundation to promote the public interest, to provide a safe work place, to ensure high quality construction, to ensure uninterrupted construction, and to secure optimum productivity, on-schedule performance and the satisfaction of the Peralta Community College District.

ARTICLE 3
SCOPE OF AGREEMENT

3.1 Covered Work: This Agreement covers, without limitation, all on-site construction, demolition, alteration, painting or repair of buildings, structures and other works and related activities for a Project that is within the craft jurisdiction of one of the Unions and that is directly or indirectly part of the Project, including, without limitation, pipelines (including those in linear corridors built to serve the Project), site preparation, survey work, soils and material inspection and testing, demolition of existing structures, and all construction, demolition or improvements required to be performed as a condition of approval by any public agency. On-site work includes work done or necessary for a Project or in temporary yards or areas adjacent to and dedicated to the Project, and at any on-site batch plant constructed solely to supply materials to the Project, when those sites are dedicated exclusively to the project. The furnishing of supplies, equipment or materials which are stockpiled for later use shall in no case be considered subcontracting, however, this Agreement shall cover and the appropriate Prevailing Wage Rate shall be paid to those workers delivering ready-mix concrete, asphalt, aggregate, sand or other fill materials that will be directly incorporated into the construction process as well as the off-hauling of debris and excess fill and/or mud shall be covered by the terms and conditions of this Agreement. Employers (including brokers), of drivers hauling such materials shall provide certified payroll records to the awarding body within ten (10) days of written request or as required by the bid specifications.

3.2 Project Description: The Agreement shall govern the award of all Construction Contracts and applies to all Covered Work which are all those construction contracts funded in whole or in part by bond funding, State grants, tax increment funding and all other funding that is allocated for construction and may be more generally known as
public funding and identified by the District as part of the PLA Program. "Exhibit A", attached to this Agreement and incorporated herein by reference, is a list of covered Projects of the current Construction Contracts covered by this Agreement and such list shall be supplemented from time to time, when necessary during the term of this Agreement. The District has the absolute right to combine, consolidate, add, or cancel Project(s) or portions of Project(s) identified as part of the PLA Program. Should the District remove any Project listed in "Exhibit A" from the Program and thereafter authorize that construction work be commenced on the Project, the Project shall be performed under the terms of this Agreement. Once a construction Project is completed, it is no longer covered by this Agreement. For the purposes of this Agreement, a Project shall be considered completed upon the filing by the District of a Notice of Completion to the Contractor.

Further, the District may prohibit some or all work on certain days or during certain hours of the day to accommodate the ongoing operations of the District’s education facilities and/or to mitigate the effect of the ongoing Project work on the businesses and residents in the neighborhood of the Project site; and/or require such other operational or schedule changes that it may deem necessary, in its sole judgment, to effectively maintain its primary mission and to remain a good neighbor to those in the area of its campuses. Such schedule changes shall be in accordance with the Master Agreement requirements. In order to permit the Contractor(s) and Union(s) to make appropriate scheduling plans, the District will provide the PLA Program Manager, the affected Contractor(s) and Union(s) with reasonable notice of any changes it requires pursuant to this Article.

3.3 **Most Favored Nations Clause:** No provision not contained within this Agreement shall be recognized or applied if it may be construed to apply exclusively or predominantly to work covered by this Agreement only.

3.4 **Exclusions:**

(a) The Agreement shall be limited to construction work on the PLA Program and is not intended to, and shall not govern any construction work performed at the District at anytime prior to the effective date, or after the expiration or termination of the Agreement, except as noted in Section 1.11 above that this Agreement shall continue in effect on any Project awarded under this Agreement but not completed by the end of the term of this Agreement for the duration of that Contract.

(b) The Parties acknowledge that the District may utilize $500,000 of funding annually to perform maintenance work on maintenance and operations projects for the duration of this Agreement.

Contractors or subcontractors with “excluded contracts” shall not be subject to the terms of this Agreement but shall meet all State and Federal laws and regulatory requirements governing construction for the project where they are performing work. All excluded contractors will meet the Certified Payroll requirements within the 10 day period required by State Law for submittal of requested Certified Payroll information. The District shall supply the Union(s) with the
inspector's log and all other documents used for oversight of the project when such information is requested.

It is further agreed that, other than the $500,000 per year maintenance exclusion, the following seven projects are the only projects that shall be excluded from the Agreement.

1. Laney: Smart Media, Project # 02314
2. Laney: Buildings F&G Computer Labs, Project # 02314
3. Laney: Photo Lab Gallery Lighting, Project # 02314
4. Merritt: Swing Space (A129), Project #
5. Merritt: Horticulture Department Improvements, Project # 02303-110
6. District Wide: ADA Upgrades, Project # unassigned
7. District Wide: Elevator Cabs, controls and finishes upgrades, Project # 02326

(c) The Agreement is not intended to, and shall not affect the operation or maintenance of the District.

(d) This Agreement shall not apply to a Contractors' executives, managerial employees, engineering employees, supervisors above the classification of general foreman, or any office and clerical employees.

(e) This Agreement shall not apply to employees of the District.

(f) This Agreement is not intended to, and shall not affect equipment and machinery owned or controlled and operated by the District for work not covered by this Agreement.

(g) This Agreement excludes all off-site manufacture and handling of equipment, machinery or materials (except for aggregates, sand or other fill material which are either directly incorporated into the construction process, or directly removed from the site of construction)

(h) Offsite maintenance of leased equipment and on-site supervision of such work is excluded from the Agreement.

(i) The Agreement is not intended to, and shall not affect any work by employees of the District or its contractors involved in general maintenance, emergency repair, and/or cleaning work, except as specifically covered by this Agreement.

(j) In accordance with 3.4(b) and in emergency situations, at the sole option of the District, the Agreement shall not apply to contracts awarded under the Public Contracts Code §20654 and §20655, or any emergency public works resolutions or any project using federal funds where prohibited by law.

(k) Work covered by the Agreement within the craft jurisdiction of the Elevator Constructors will be performed under the terms of the National Agreement of the International Union of Elevator Constructors except that Articles 6, 10,14 and 15 of the Agreement shall prevail and be applied to such work.
(I) It is the legal obligation of the District to obtain the most competitive bids while maintaining the conditions of the Agreement. To ensure that a competitive bid is received from a range of general contractors, the Building and Construction Trades Council of Alameda County, AFL-CIO shall assist the District in soliciting interested parties in bidding on the Project(s). Additionally, the District recognizes that multiple subcontractor quotations of bids ensure the most competitive overall bid. The Building and Construction Trades Council of Alameda County, AFL-CIO shall assist the District in encouraging and soliciting local and other subcontractors in bidding to interested general contractors. The District reserves the right, without reservation, to reject all bids and re-bid the Project.

ARTICLE 4
EFFECT OF AGREEMENT

4.1 By executing this Agreement, the Unions and the District agree to be bound by each and all of the provisions of this Agreement. The provisions of this Agreement shall apply to all covered work, notwithstanding the provisions of any other local, area and/or national agreements which may conflict with or differ from the terms of this Agreement. The District and each Signatory Union shall agree upon the local collective bargaining agreement to be designated as the applicable Master Agreement for work covered by this Agreement. Where a subject covered by the provisions of this Agreement is also covered by a Master Agreement, the provisions of this Agreement shall prevail. Where a subject is covered by the provisions of a Master Agreement and is not covered by this Agreement, the provisions of the Master Agreement shall prevail. Any dispute as to the applicable source between this Agreement and any Master Agreement for determining the wages, hours and working conditions of employees on this Project shall be resolved under the procedures established in Article 12. This Agreement represents the complete understanding of the parties, and no Contractor is or will be required to sign any other agreement with a signatory union as a condition of performing work within the scope of this Agreement. No practice, understanding or agreement between a Contractor and a Union party which is not specifically set forth in this Agreement will be binding on any other party unless endorsed in writing by the District or the District’s PLA Program Manager.

4.2 This Agreement shall only be binding on the signatory parties hereto and shall not apply to the parents, affiliates, subsidiaries, or other ventures of any such party.

4.3 Each Contractor(s) shall alone be liable and responsible for its own individual acts and conduct and for any breach or alleged breach of this Agreement.

4.4 It is mutually agreed by the parties that any liability by a Signatory Union(s) to this Agreement shall be several and not joint. Any alleged breach of this Agreement by a signatory Union(s) shall not affect the rights, liabilities, obligations and duties between the signatory Contractor(s) and the other Union(s) party to this Agreement.
ARTICLE 5
SUBCONTRACTS

5.1 The District, PLA Program Manager, and/or Contractors, as appropriate, have the absolute right to award contracts or subcontracts on this Project notwithstanding the existence or non-existence of any collective bargaining agreements between the prospective contractor and any union party, and provided that such contractor is willing, ready and able to comply with this Agreement. Such contractor shall execute a Letter of Assent, should it be awarded work covered by this Agreement.

5.2 Subcontractors of any tier shall become a party to this Agreement by signing the Letter of Assent (Attachment A). By signing the Letter of Assent, a subcontractor to a Contractor does not thereby establish any contractual relationship with the District, except for this Agreement, and the District shall not become party to nor become responsible for the performance of the construction subcontract between the Contractor and its subcontractor(s).

5.3 The District and each Contractor(s) agree that neither it nor any of its subcontractors will subcontract any work to be done on PLA covered Projects except to a person, firm, or corporation who is or becomes party to the Agreement. Any Contractor(s) working on the Project shall, as a condition to working on the Project, become signatory to and perform all work under the terms of this Agreement.

5.4 A subcontractor is defined as any person, firm or corporation who agrees under contract with the Contractor(s), or a subcontractor of the Contractor, to perform on the Project, any part or portion of the construction work covered by the Construction Contract, including the operating of construction equipment, performance of labor and/or installation of materials. Trucking firms are included as subcontractors when hauling materials in the execution of the Project as provided for in Article 3.1.

5.5 The Contractor(s) has the primary obligation for performance of all conditions of this Agreement. This obligation cannot be relieved, evaded or diminished by subcontracting. Should the Contractor(s) elect to subcontract, the Contractor(s) shall continue to have such primary obligation.

5.6 A Contractor(s) who provides in the subcontract that the subcontractor will pay the wages and benefits and will observe the hours and all other terms and conditions of this Agreement and who requires its subcontractor(s) to execute a Letter of Assent, shall not be liable for any delinquency by such subcontractor in the payment of any wages or fringe benefits provided herein, except as may be required by State or Federal law.

(a) The Contractor(s) will give written notice and a copy of the Letter of Assent to the Council of any subcontract involving the performance of work covered by this Agreement within either five (5) days of entering such subcontract or before the subcontractor commences work on the Project, whichever occurs first, and shall specify the name and address of the subcontractor. Written notice at a Preconstruction Conference shall be deemed written notice under this provision for those subcontractors listed at the Prejob Meeting only.
Thereafter, if such subcontractor should become delinquent in the payment of any wages or benefits as above specified, the Trust Fund shall immediately give written notice thereof to the Contractor(s) and to the subcontractor specifying the nature and amount of such delinquency.

The provision of this Section 5.6 shall be applied only to the extent permitted by law and, notwithstanding any other provision of the Agreement, no aspect of the subcontractors’ clause, including its enforcement, may be enforced by or subject to strike or picketing.

If the Contractor(s) selects the subcontractor(s) and is signatory to a Master Agreement that provides the higher level contractor shall remain liable for the defaults of the subcontractor, nothing in this Agreement shall interfere with the Contractor(s)' responsibilities and liabilities under the Master Agreement.

5.7 (a) With regard to any employer that is independently signed to any Master Labor Agreement ("MLA"), this Project Labor Agreement shall in no way supersede or prevent the enforcement of any subcontracting clause contained in such MLA, except as specifically set forth in subsection (b) of this section. Any such subcontracting clause in an MLA shall remain and be fully enforceable between each Union and its signatory employers, and no provision of this Project Labor Agreement shall be interpreted and/or applied in any manner that would give this Project Labor Agreement precedence over subcontracting obligations and restrictions that exist between Unions and their respective signatory employers under an MLA, except as specifically set forth in subsection (b) of this section.

(b) If a Union (hereafter "aggrieved union") believes that an assignment of work on this Project has been made improperly by a contractor or subcontractor, even if that assignment was as a result of another Union’s successful enforcement of the subcontracting clause in its MLA, as permitted by subsection (a) of this section, the aggrieved union may submit a claim under the jurisdictional resolution process contained in Article 15 of this Project Labor Agreement, and the decision rendered as part of that process shall be enforceable to require the contractor or subcontractor that made the work assignment to assign that work prospectively to the aggrieved union. An award made to a Union under the subcontracting clause of its MLA, as permitted pursuant to subsection (a) of this section, shall be valid and fully enforceable by that Union unless it conflicts with a jurisdictional award made pursuant to this Project Labor Agreement. If the award made under the MLA conflicts with the jurisdictional award, the award of any damages under the former shall be null and void ab initio.

ARTICLE 6
WORK STOPPAGES, STRIKES, SYMPATHY STRIKES AND LOCKOUTS

6.1 The Unions, District and Contractor(s) agree that for the duration of this Agreement:

(a) There shall be no strikes, sympathy strikes, work stoppages, picketing, handbilling or otherwise advising the public that a labor dispute exists, or slowdowns or disruptions of any kind, for any reason, by the Union(s) or employees employed on a Project, at the job site of the Project or at any other facility of the District because of a dispute on a Project or other projects involving
a contractor or subcontractor, of any tier, or due to any labor dispute arising at the project site or any other District site. Disputes arising between the Union(s) and Contractor(s) on other District projects are not governed by the terms of this Agreement, except that the existence of such disputes or actions taken in furtherance of such disputes may not be used to affect work on projects covered by this Agreement. A Union may withhold labor (but not picket) due to a Contractor's or subcontractor's failure to make Trust Fund contributions or failure to meet its payroll on this Project, and such withholding of labor shall not be considered a violation of this Article. In the case of non-payment of Trust Fund contributions, a Union shall give the General Contractor and the District Representative five (5) business days notice prior to withholding labor from the Contractor or Sub-contractor during which time, the General Contractor shall have the opportunity to cure the default.

(b) As to employees employed on a Project, there shall be no lockout of any kind by a Contractor(s) covered by the Agreement.

(c) If a Master Agreement between a contractor(s) and the Union(s) expires before the Contractor(s) completes the performance of a Construction Contract and the Union or contractor(s) gives notice of demands for a new or modified Master Agreement, the Union(s) agrees that it will not strike the Contractor(s) on said contract for work covered under the Agreement and the Union(s) and the Contractor(s) agree that the expired collective bargaining agreement shall continue in full force and effect for work covered under the Agreement until a new or modified Master Agreement is reached between the Union(s) and Contract Employer. If the new or modified Master Agreement reached between the Union(s) and contractor(s) provides that any terms of compensation of the Master Agreement shall be uniformly retroactive for all contractors bound to the Master Agreement, the Contractor(s) agrees to comply with any retroactive terms of the new or modified Master Agreement which is applicable to employees employed on a Project during the interim period within seven (7) days.

6.2 Any party to the Agreement may institute the following procedure, in lieu of or in addition to any other action at law or equity, when a breach of this Article is alleged to have occurred:

(a) A party invoking this procedure shall notify Gerald McKay, as the permanent arbitrator, or, Thomas Angelo, as the alternate under this procedure. In the event that the permanent arbitrator is unavailable at any time, the alternate will be contacted. If neither is available, then a selection shall be made from the list of arbitrators in Article 12.2. Notice to the arbitrator shall be by the most expeditious means available, with notices by e-mail, facsimile or telephone to the party alleged to be in violation and to the Building and Construction Trades Council of Alameda County, AFL-CIO.

(b) Upon receipt of said notice, the designated arbitrator named above or his/her alternate will designate a place for, schedule and hold a hearing within twenty-four (24) hours.
(c) The arbitrator shall notify the parties by facsimile or telephone of the place and
time for the hearing. Said hearing shall be completed in one session, which, with
appropriate recesses at the arbitrator's discretion, shall not exceed twenty-four
(24) hours unless otherwise agreed upon by all parties. A failure of any party to
attend said hearings shall not delay the hearing of evidence or the issuance of
any award by the arbitrator.

(d) The sole issue at the hearing shall be whether or not a violation of this Article of
the Agreement has occurred. The arbitrator shall have no authority to consider
any matter of justification, explanation or mitigation of such violation or to award
damages, which issue is reserved for court proceedings, if any. The award shall
be issued in writing within three (3) hours after the close of the hearing, and may
be issued without a written opinion. If any party desires a written opinion, one
shall be issued within fifteen (15) days, but its issuance shall not delay
compliance with or enforcement of the award. If the arbitrator determines there
exists a violation of this Article the arbitrator shall order cessation of the violation
of this Article and other appropriate relief and such award shall be served on all
parties by hand or registered mail upon issuance.

(e) The award shall be final, binding and non-revisable as to the merits. Such award
may be enforced by any Court of competent jurisdiction upon the filing of this
Agreement and all other relevant documents referred to above in the following
manner. Written notice of the filing of such enforcement proceedings shall be
given to the other party in the proceeding to obtain a temporary order enforcing
the arbitrator's award as issued under Section 6.2 (d) of this Article, all parties
waive the right to a hearing and agree that such proceedings may be ex parte.
Such agreement does not waive any party's right to participate in a hearing for a
final order or enforcement. The Court's order or orders enforcing the arbitrator's
award shall be served on all parties by hand or delivered by certified mail.

(f) Any rights created by statute or law governing arbitration proceedings
inconsistent with the above procedure or which interfere with compliance are
waived by the parties.

(g) The costs of the arbitration, including the fee and expenses of the Arbitrator, shall
be borne by the losing party.

(h) The District PLA Program Manager is a party of interest in all proceedings arising
under this Article and shall be sent contemporaneous copies of all notifications
required by these Articles, and at its option, may participate as a full party in any
proceeding initiated under these articles.

(i) If the arbitrator determines in accordance with this article that a work stoppage
has occurred, the respondent Union(s) shall, within eight (8) hours of receipt of
the award, direct all the employees they represent on the Project to immediately
return to work. If the craft(s) involved does not return to work by the beginning of
the next regularly scheduled shift following such eight (8) hour period after
receipt of the arbitrator's award, and the respondent Union(s) have not complied
with their obligation to immediately instruct, order, and use their best efforts to
cause a cessation of the violation and return of the employees they represent to
work, the respondent Union(s) shall each pay a sum as liquidated damages to the District, and each shall pay an additional sum per shift for each shift thereafter on which the craft(s) has not returned to work.

Similarly, if the arbitrator determines in accordance with this article that a lock-out has occurred, the respondent Contractor(s) shall, within eight (8) hours of receipt of the award, return all of the affected employees to work on the Project, or otherwise correct the violation as found by the arbitrator. If the respondent Contractor(s) do not take such action by the beginning of the next regularly scheduled shift following the eight (8) hour period, each respondent Contractor(s) shall pay a sum as liquidated damages to the affected Union(s) (to be apportioned among the affected employees and the benefit funds to which contributions are made on their behalf, as appropriate and designated by the Arbitrator) and each shall pay an additional sum per shift for each shift thereafter in which compliance by the respondent Contractor(s) has not between completed.

The Arbitrator shall retain jurisdiction to determine compliance with this article and to establish the appropriate sum of liquidated damages, which shall not be less than one thousand dollars ($1,000.00) nor more than fifteen thousand dollars ($15,000.00) for each shift.

**ARTICLE 7**
**PRE-JOB MEETING**

7.1 A pre-job meeting shall be held at the Building Trades offices prior to the commencement of each Construction Contract to establish the scope of work in each Contractor's Construction Contract. It shall be the responsibility of the Prime Contractor(s) to set such meeting. The District will notify the Union(s) of award of all covered projects prior to commencement of work. Such pre-job meeting shall be attended by a representative each from the participating Contractor(s) and Union(s) and the District PLA Program Manager. When a Construction Contract has been let to a Contractor, a pre-job meeting shall be required unless waived by agreement of the Council, the Contractor and the District.

7.2 All work assignments shall be disclosed by each Contractor at the pre-job meeting. The Contractor(s) shall notify the District PLA Program Manager at least two weeks before starting work under the Agreement, and the District PLA Program Manager shall coordinate the scheduling of the pre-job meeting with the Council, the Contractor(s) and the affected Union(s).

**ARTICLE 8**
**NONDISCRIMINATION**

8.1 The Union(s) and Contractor(s) shall not discriminate against any employee or applicant for employment because of race, creed, color, sex, sexual orientation, national origin, age, religion, disability as identified in the Americans with Disabilities Act, union or non-union membership or any other basis recognized by law.
ARTICLE 9
UNION RECOGNITION

9.1 The Contractor(s) recognize the Union(s) as the sole bargaining representative of all craft employees working within the scope of the Agreement. The Parties acknowledge that the collective bargaining relationship so established is a “pre-hire” relationship permitted by Section 8(f) of the National Labor Relations Act, except that this provision does not change any pre-existing Section 9(a) collective bargaining relationship that exists between any Contractor and Union parties to this Agreement.

9.2 No employee covered by the Agreement can be required to join any Union as a condition of being first employed on the Project; provided, however, that an employee who is a member of the referring Union at the time of the referral shall maintain that membership while employed on a Project subject to this Agreement. All employees shall, however, on or before the 8th day of consecutive or cumulative employment on the Project pay the uniform initiation fees and dues of the applicable craft Union and shall comply with the Union Recognition provision for the period during which they are performing Project construction work on the property of the District. The Contractor(s) agree to deduct initiation fees, Union dues or representation fees from the pay of any employee who executes a voluntary authorization for such deductions and to remit the dues and fees to the applicable Union or Council.

ARTICLE 10
REFERRAL

10.1 The selection of craft foremen and general foremen shall be entirely the responsibility of the Contractor(s), it being understood that in the selection of such foremen, the Contractor(s) will give first consideration to the qualified individuals available in the local area. Foremen and general foremen shall take orders from the designated Contractor(s) representatives.

The Unions shall be the first source of referral of employees to the Project and the contractor(s) agree to be bound by the lawful hiring hall rules and procedures of the respective Union(s). Contractors agree to be bound by the hiring practices of the respective Unions, including the hiring of apprentices, and to utilize their registration facilities and referral systems when workers are available, capable and willing to work on PLA covered projects.

10.2 The Contractor(s) shall have the unqualified right to select and hire directly all supervisors above general foreman it considers necessary and desirable, without such persons being referred by the Union(s).

10.3 In the event that referral facilities maintained by the Unions are unable to fill the requisition of a Contractor(s) for employees within a forty-eight (48) hour period (Saturday, Sundays and Holidays excluded) after such requisition is made by the Contractor(s), the Contractor(s) shall be free to obtain work persons from any source. Unions will exert their utmost efforts to recruit sufficient numbers of skilled craft persons to fulfill the requirements of the Contractor(s). The parties to this Agreement support the development of increased numbers of skilled construction workers from the residents of Alameda County; residents of Alameda, Albany, Berkeley, Emeryville, Piedmont and especially
the City of Oakland; to meet the needs of the PLA Program and the requirements of the industry generally. Toward that end, the Unions agree to encourage the referral and utilization, to the extent permitted by law and the hiring hall procedures, of qualified Alameda County residents as journeymen and apprentices on this PLA Program and, consistent with the State-approved Apprenticeship Standards, encourage entrance into such apprenticeship and training programs as may be offered by the Peralta Community College District or operated by the signatory Unions.

10.4 The Parties recognize the District's commitment to provide opportunities to participate on the Project to emerging small business enterprises that may not have previously had a relationship with the Unions signatory to this Agreement. To ensure that such enterprises will have an opportunity to employ their "core" employees on this Project, the parties agree that in those situations where a Contractor not a party to a current collective bargaining agreement with the signatory Union having jurisdiction over the affected work is a successful bidder, the Contractor may request by name, and the local will honor, referral of persons who have applied to the local union for Project work and who demonstrate the following qualifications:

(a) possess any license required by state or federal law for the Project work to be performed;

(b) have worked a total of at least one thousand (1000) hours in the construction craft during the prior three (3) years;

(c) were on the Contractor's active payroll for at least ninety (90) out of the one-hundred eighty (180) calendar days prior to the contract award; and

(d) have the ability to perform safely the basic functions of the applicable trade.

(e) The Union will refer to such Contractor one journeyman employee from the hiring hall out-of-work list for the affected trade or craft, and will then refer one of such Contractor's "core" employees as a journeyman and shall repeat the process, one and one, until such Contractor's crew requirements are met or until such Contractor has hired five (5) "core" employees, whichever occurs first. Thereafter, all additional employees in the affected trade or craft shall be hired exclusively from the hiring hall out-of-work list(s). For the duration of the Contractor's work the ratio shall be maintained and when the Contractor's workforce is reduced, employees shall be reduced in the same ratio of core employees to hiring hall referrals as was applied in the initial hiring.

ARTICLE 11
WAGES AND BENEFITS

11.1 All Contractors, agree to pay contributions to the established vacation, pension and other form of deferred compensation plan, apprenticeship, and health benefit Trust Funds established by the applicable Master Agreement(s) for each hour worked on the Project in the amounts designated in the Master Agreements of the appropriate local Unions for all of those benefits and contributions contained in the applicable prevailing wage determination. The Contractor(s) shall not be required to pay contributions to any
other trust funds that are not contained in the published prevailing wage determination to satisfy their obligation under this Article except those Contractor(s) who are signatory to the Master Agreements with the respective trades shall continue to pay all trust fund contributions as outlined in such Master Agreements.

11.2 By signing a Letter of Assent binding this Agreement, the Contractor(s) adopt and agree to be bound by the written terms of the legally established Trust Agreements, specifying the detailed basis on which payments are to be made into, and benefits paid out of, such Trust Funds.

11.3 **Wages, Hours, Terms and Conditions of Employment:** The wages, hours, classifications and other terms and conditions of employment on a Project shall be governed by the Master Agreement of the respective craft Unions, copies of which shall be on file with the District, to the extent such Master Agreement is consistent with the applicable prevailing wage determination and this Agreement.

(a) At all times while working under the Agreement, the Contractor(s) is obligated to make compensation payments and benefit contributions to or on behalf of the employee in a total amount no less than required by the applicable prevailing wage.

(b) Each Contractor and subcontractor shall be required to certify in writing that it has paid all wages and benefit contributions due and owing prior to receipt of its final payment and/or retention.

(c) Contractors of whatever tier shall make regular and timely contributions required by this section in the amounts set forth in the appropriate prevailing wage determination and on the time schedule required by the Master Agreement. Delinquency in remission of contributions is a breach of this Agreement. If a Contractor or subcontractor is delinquent in any such contributions, the Union or the Trust Fund shall provide timely notification to District or the District PLA Program Manager after efforts by the Fund to resolve the delinquency have been exhausted, and provide documentary evidence of the delinquency endorsed by the Fund. Upon such notification, the District or the District PLA Program Manager will attempt to resolve the delinquency among the Contractor or subcontractor, the Union and the Fund. If the delinquency is not resolved within ten (10) working days thereafter, the Contractor, in the case of a delinquent subcontractor, shall withhold an amount to cover the delinquency from any retained funds otherwise due and owing to the subcontractor and shall not release such withholding until the subcontractor is in compliance, provided, however, that if the delinquent amount is undisputed in whole or in part between the Fund and the delinquent subcontractor, the Contractor shall issue a joint check payable to the Fund and the subcontractor in the amount of the undisputed delinquency. In the case of a delinquent prime Contractor, the District or the District PLA Program Manager shall withhold, in an appropriate amount, any funds due and owing to the Contractor. Pursuant to the announced commitment of the District, and to the extent permitted by law, the Contractor shall be subject to withholding of retained amounts which may only be released upon the Contractor’s resolution of the delinquency as evidenced by a written statement endorsed by the Fund. Where there is no dispute as to the amount of the delinquency, retained amounts may be released by a joint check payable to the Contractor and the Fund in the amount of any undisputed delinquency.
ARTICLE 12
GRIEVANCE ARBITRATION PROCEDURE

12.1 Any dispute alleging violation of this Agreement, including the applicable Master Agreement, but excluding jurisdictional disputes and alleged violations of Article 6, shall be considered a grievance and resolved in accordance with the procedures set forth herein. A signatory Contractor and Union shall agree to resolve a grievance that involves solely the interpretation of the Master Agreement under the grievance and arbitration provisions of the Master Agreement. A grievance shall be considered null and void if not brought in writing and delivered to both the involved party and Program Manager within ten (10) working days after the incident that initiated the alleged grievance was discovered. The term 'working days' as used in this section shall exclude Saturdays, Sundays or holidays regardless of whether any work is actually performed on such days.

12.2 Grievances shall be settled according to the following procedures:

Step 1: Within five (5) business days after the receipt of the written notice of the grievance, the Business Representative of the involved Local Union or Council, or its designee, or the representative of the employee, and the representative of the involved Contractor(s) shall confer and attempt to resolve the grievance.

Step 2: In the event that the representatives are unable to resolve the dispute within the five (5) business days after its referral to Step 1, either involved party may submit it within five (5) business days to the Grievance Committee, which shall meet within five (5) business days after such referral (or such longer time as is mutually agreed upon by all representatives on the Grievance Committee), to confer in an attempt to resolve the grievance.

The Grievance Committee shall be comprised of one (1) representative of the District; one (1) representative of the District PLA Program Manager; and two (2) representatives of the Alameda County Building and Construction Trades Council. If the dispute is not resolved within such time (five (5) business days after its referral or such longer time as mutually agreed upon), it may be referred within five (5) business days thereafter by either party to Step 3.

Step 3: Within five (5) business days after referral of a dispute to Step 3, the representatives shall choose a mutually agreed upon arbitrator for final and binding arbitration. The parties agree that an arbitrator shall be selected by the alternate striking method from the following list noted. The selection party who shall strike the first name shall be selected by the toss of a coin.

1. Barbara Kong-Brown
2. Thomas Angelo
3. William Riker
4. Gerald McKay
5. Jerri-Lou Cossack

The decision of the Arbitrator shall be binding on all parties. The Arbitrator shall have no authority to change, amend, add to or detract from any provisions of the Agreement. The expense of the Arbitrator shall be borne by the losing party. The Arbitrator shall arrange for a hearing on the earliest available date from the date of his/her selection. A decision shall be given to the parties within five (5) calendar days after completion of the hearing unless such time is extended by mutual agreement. A written opinion may be requested by a party from the presiding Arbitrator.

The time limits specified in any step of the Grievance Procedure set forth in Section 12.2 may be extended by mutual agreement of the parties initiated by the written request of one party to the other, at the appropriate step of the Grievance Procedure. However, failure to process a grievance, or failure to respond in writing within the time limits provided above, without an agreed upon extension of time, shall be deemed a waiver of such grievance without prejudice, or without precedent to the processing of and/or resolution of like or similar grievances or disputes.

In order to encourage the resolution of disputes and grievances at Steps 1 and 2 of this Grievance Procedure, the parties agree that such settlements shall not be precedent setting.

ARTICLE 13
SAFETY AND HEALTH

13.1 In accordance with the requirements of the Occupational Safety and Health Act, it shall be the exclusive responsibility of each Contractor on the job site to ensure safe working conditions for its employees and their compliance with any safety rules contained herein or established by the District, its representatives, and/or the Contractor(s). Nothing in this Agreement shall be interpreted to make the Unions liable for safety violations that may occur on the Project. It is understood that the employees have an individual obligation to use diligent care to perform their work in a safe manner and to protect themselves and the property of the Contractor(s) and the District. An employee’s failure to satisfy his/her obligation under this article will subject him/her to corrective action.

13.2 In order to minimize any disturbance to the student population, Contractors’ employees are to restrict their presence to the Project site and not visit other areas of the campus to the extent possible of carrying out their duties.

ARTICLE 14
COMPLIANCE

14.1 It shall be the responsibility of the Contractor(s) and Union(s) to investigate and monitor compliance with the provisions of the Agreement contained in Article 11. Nothing in this agreement shall be construed to interfere with or supersede the usual and customary
legal remedies available to the Unions and/or employee benefit Trust Funds to collect delinquent Trust Fund contributions from Contractors on the Project.

14.2 The District, through the services of the District PLA Program Manager, shall monitor compliance enforcement measures to ensure the Contractor(s) compliance with the Construction Contract conditions of the Agreement.

14.3 The parties to this Agreement intend to ensure the best possible harmony in labor-management relations on the Project and recognize that the Administrator shall strive to encourage the Parties toward that end.

In an effort to achieve that labor-management harmony the Parties shall establish a four (4) person Joint Administrative Committee. This Committee shall be comprised of two (2) representatives selected by the Administrator and two (2) from the Unions, one of whom will be a representative from the Council. Each representative shall designate an alternate who shall serve in his or her absence for any purpose contemplated by this Agreement. The Committee will be co-chaired by the Administrator and the representative from the Council.

The Joint Administrative Committee shall meet as required to review the implementation of the Agreement and the progress of the Project and resolve problems and/or grievances by majority vote with such resolutions to be binding on all signatories of the Agreement as provided herein. Any question regarding the meaning, interpretation, or application of the provisions of this Agreement shall be first referred directly to the Joint Administrative Committee for resolution. The Joint Administrative Committee will meet upon the call of either co-chair, upon provision of sufficient notice of the issue to be discussed.

ARTICLE 15
JURISDICTIONAL DISPUTES

15.1 The Contractor/Employer(s) shall assign work on the basis of traditional craft jurisdictional lines.

15.2 There shall be no strikes, picketing, sympathy strikes, leafleting or work disruption or stoppages of any kind because of jurisdictional disputes.

15.3 When conflicting claims for work on the Project are submitted to a Contractor/Employer, the dispute shall be resolved pursuant to agreed upon Jurisdictional Dispute Procedures, as adopted by the National Building & Construction Trades Department, or by the Mechanical Allied Crafts (MAC), or by the Northern California Basic Crafts Alliance (NCBCA) Jurisdictional Dispute Resolution Procedures. It is understood by the parties that these Procedures might be amended from time to time. In the event a jurisdictional dispute arises between two or more Unions affiliated with the National Building & Construction Trades Department, such dispute shall be resolved by the procedure set forth in the Plan for the Settlement of Jurisdiction Disputes in the Construction Industry. In the event a jurisdictional dispute arises between two or more Unions affiliated with the MAC, such dispute shall be resolved under the MAC Procedure. In the event a jurisdictional dispute arises between two or more Unions affiliated with the NCBCA, such dispute shall be resolved under the NCBCA Procedure.
15.4 In the event a jurisdictional dispute arises between two or more Unions that are not
stipulated to the same jurisdictional dispute resolution procedure, the dispute shall be
handled in accordance with and resolved as follows:

15.5 In the event a jurisdictional dispute arises while the parties are attempting to negotiate
an alternative resolution mechanism either party may refer the jurisdictional dispute to
the General Presidents of the affected unions, and if the General Presidents cannot
resolve the dispute within five (5) business days of the dispute being referred to them for
resolution, the dispute shall be resolved as follows:

15.6 The dispute shall be submitted to arbitration before an arbitrator selected from the Panel
of Permanent Arbitrators for resolution. The Panel of Permanent Arbitrators shall be
composed of: David Nevins, Gerald McKay, Robert Hirsch, William Riker and Barry
Winograd. The Arbitrator shall be selected by alternately striking the names of
Arbitrators from the list of five (5) permanent Arbitrators. The order of striking names
from the list of arbitrators shall be determined by a coin toss, the winner of which shall
decide whether they wish to strike first or second. Such striking shall take place within
three (3) days. If a party does not respond within three (3) days, this means any
Arbitrator from the list is acceptable. The remaining Arbitrator shall serve as the
Arbitrator who shall hear the dispute on an expedited basis, but in no case longer than
seven (7) days, and resolve the dispute. The Arbitrator shall render his decision within
three (3) days of the hearing.

15.7 **In rendering his decision, the Arbitrator shall determine:**

1. First, whether a previous agreement of record or applicable agreement, including a
disclaimer agreement, between the National and International Unions to the dispute
governs;

2. Only if the Arbitrator finds that the dispute is not covered by an appropriate or
applicable agreement of record or agreement between the crafts to the dispute, he shall
then consider the established trade practice in the industry and prevailing practice in the
locality. Where there is a previous decision of record governing the case, the Arbitrator
shall give equal weight to such decision of record, unless the prevailing practice in the
locality in the past ten (10) years favors one craft. In that case, the Arbitrator shall base
his decision on the prevailing practice in the locality. Except, that if the Arbitrator finds
that a craft has improperly obtained the prevailing practice in the locality through raiding,
the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely
on the decision of record and established trade practice in the industry rather than the
prevailing practice in the locality.

3. Only if none of the above criteria is found to exist, the Arbitrator shall then consider
that because efficiency, cost or continuity and good management are essential to the
well being of the industry, the interests of the consumer or the past practices of the
employer shall not be ignored.

4. The Arbitrator shall comply with the Code of Professional Responsibility for
Arbitrators of Labor Management Disputes jointly adopted by the National Academy of
Arbitrators, the American Arbitration Association and the Federal Mediation and
Conciliation Service. The Arbitrator shall set forth the basis for his decision and shall explain his findings regarding the applicability of the above criteria. If lower-ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the job in dispute.

5. Agreements of record are applicable only to the parties signatory to such agreements. Decisions of record are applicable to all trades.

6. The Arbitrator is not authorized to award back pay or any other damages for a misassignment of work. Nor may any party to this Plan bring an independent action for back pay or any other damages, based upon a decision of an Arbitrator.

7. Each party to the arbitration shall bear its own expense for the arbitration and agrees that the fees and expenses of the Arbitrator shall be borne by the losing party or parties.

15.8 ENFORCEMENT

1. Any decision or interpretation rendered by an arbitrator shall be immediately accepted and complied with by all parties subject to this Agreement. If a party fails to accept and comply with a decision or interpretation rendered by an arbitrator, any party to the dispute may seek court enforcement of the decision or ruling.

2. The Arbitrator shall have no authority to undertake any action to enforce his decision after a hearing beyond informing the affected parties of his decision. Rather, it shall be the responsibility of the prevailing party to seek appropriate enforcement of a decision. The prevailing party in any enforcement proceeding shall be entitled to recover its reasonable costs and attorney fees from the non-prevailing party. In the event the Arbitrator is made a party to, or is otherwise required to participate in any such enforcement proceedings for whatever reason, the non-prevailing party shall bear all reasonable costs, attorney fees, and any other expenses incurred by the Arbitrator in those proceedings.

15.9 If there is a strike, sympathy strike, work stoppage, slowdown, picketing or otherwise advising the public that a labor dispute exists or interference with the progress of the Project by reason of a jurisdictional dispute, the Contractor/Employer (who has complied with the Arbitrator's decision) affected by said Union conduct, shall have the right to seek full legal redress in the Courts of California, including injunctive relief and damages.

16.1 The objective of the District in creating a Local Hiring Program is to enhance and encourage employment opportunities for local area residents to enable effective pathways into the construction industry and into Union Apprenticeship programs. To that end, as part of the Agreement, the District establishes goals for the hiring and retention of local area residents.
16.2 **Local Hiring Program Goals**

(a) Hiring Priority:

1. Fifty percent (50%) of all hours worked on covered projects, on a craft by craft basis will be worked by local area residents as defined in Article 1, Section 1.12, if such workers are available, capable and willing to work on the project and dispatched through the utilization of the normal hiring hall procedures.

2. (i) Subject to any restrictions contained in law, the Parties agree to a goal that apprentices will perform twenty percent (20%) of the total craft work hours unless an applicable Schedule A provides for a greater percentage. The Union agrees to cooperate with the Contractor in furnishing apprentices as requested and they shall be properly supervised and paid in accordance with provisions contained within the Schedule A.

(ii) The parties agree to a goal that only local area residents as defined in Article 1, Section 1.12 shall be utilized as apprentices. The Contractor shall make good faith efforts to reach this goal through the utilization of normal hiring hall and apprentice procedures and, when appropriate, the identification of potentially qualified apprentices through community-based organizations working in collaboration with the apprentice programs. The Unions are committed to working with the contractors and community-based organizations to reach these goals.

(iii) All apprentices referred to Contractors under this Agreement shall be enrolled in State of California approved Joint Apprenticeship Programs.

16.3 (a) Contractors may achieve up to fifty percent (50%) compliance with these local hiring goals and timelines through the employment, of local area resident journeymen, existing apprentices and newly indentured resident apprentices on non-District projects during the time period that the Contractors are working on District Projects.

16.4 **Good Faith Efforts:**

A Contractor and its subcontractors must take the following good faith steps to demonstrate that it has made every effort to reach the local hiring goals of the District. The contractor shall attend scheduled pre-job meetings held by the PLA Program Manager pertaining to work they will performed. The contractor must submit written workforce projections and projected work hours on a craft by craft basis.

(a) Within seven calendar days after the Notice to Proceed, the Contractor shall meet with the PLA Program Manager to present its plan for reaching the local hiring goals.

(b) The Contractor shall notify the PLA Program Manager by US mail or email, if a Union hiring hall cannot, upon request of the contractor, dispatch local area residents, as defined herein. It shall be the responsibility of the contractor to retain all evidence of such good faith efforts.
(c) The contractor shall use the "Name Call," "Rehire" or other available hiring hall procedures to reach goals.

(d) The contractor shall use local CBOs working in collaboration with the apprentice programs for recruiting local residents to apprentice programs specified in section 16.2,(c), if a union cannot provide local area residents as requested, and in conformity with the collectively bargained union hiring hall agreement.

16.5 Consequences for Non-Compliance with Goals

(a) The PLA Program Manager in coordination with District staff and the Local Hiring Committee shall consider allegations of non-conformance with the goals. If there is a determination that a Contractor has not complied with the goals or demonstrated good faith efforts to do so, the PLA Program Manager will refer the issue to the Local Hiring Committee for review.

(b) If the Local Hiring Committee (see 16.6) finds a Contractor to be in apparent non-compliance, it will be referred to arbitration in accordance to step 3 of the grievance arbitration procedure upon direction by the Committee.

(c) At any time during the process of compliance review, the Contractor can negotiate a settlement with the Local Hiring Committee.

16.6 Local Hiring Committee

(a) The Parties agree to various provisions of the Agreement to attempt to achieve the inclusion of local area residents in the employment opportunities created by the covered work. In order to implement and monitor the progress of these provisions, the District and the Unions, in recognition of their mutual commitment to and the partnership they have established, to achieve those goals, shall form a Local Hiring Committee composed of participants mutually agreed upon by both Parties.

(b) The Local Hiring Committee will serve as the central forum and deliberative body for representatives of all interested or affected parties to exchange information and ideas concerning the operation and results of the District’s local hiring program and the ongoing role of this Agreement as an integral component of the local hire program. As part of these responsibilities, the Committee will assess the obstacles to success for achieving inclusion of local workers in the construction opportunities. The Committee shall make program recommendations to overcome obstacles to effective local hiring.

(c) The Local Hiring Committee will be comprised of three (3) representatives of the community one of whom will be primarily involved in preparatory training for prospective construction applicants, three (3) representatives from the Unions, three (3) Contractor representatives, one (1) representative from the PLA Program Manager and one (1) representative from the Council.

(d) The Committee shall establish its rules of procedure.

(e) Committee meeting will by chaired by the District and the Council on a rotating basis.

16.7 Local Hiring Committee Meetings

(a) The Committee will meet monthly at the call of the Chair.
(b) The PLA Program Manager will establish agenda topics with input from the Committee and send notices of meetings with the agenda in advance of the meetings.

(c) The Committee will receive reports and consider work progress and practices, pre-apprentice recruitment, training and referral, apprentice development and utilization, contractor compliance with local hire goals and other issues of concern to the Program.

(d) The PLA Program Manager and the contractors shall report monthly on progress for these issues and provide ongoing workforce projections for each trade.

16.8 Monitoring and Reporting

The PLA Program Manager will assist the District in monitoring compliance with all local hiring policies and will report to the Local Hiring Committee. This monitoring will include attending progress meetings, site visits, monitoring of progress payments, utilization and verification of performance forms. Forms specific to this monitoring process will be developed. Monthly reports will be submitted to the District.

ARTICLE 17
MANAGEMENT RIGHTS

17.1 The Contractor retains the full and exclusive authority for the management of its operations and shall be responsible for the management and prosecution of the work consistent with the provisions of this Agreement. Except as expressly limited by other provisions of this Agreement and the attached applicable Master Agreement(s), the Contractor retains the right to direct the workforce, including the hiring, promotion, transfer within a contract, layoff, discipline or discharge for just cause of its employees; the selection of foremen; the assignment and schedule of work; the promulgation of reasonable work rules; and, the requirement of overtime work, the determination of when it will be worked and the number and identity of employees engaged in such work. No rules, customs, or practices which limit or restrict productivity, efficiency or the individual and/or joint working efforts of employees shall be permitted or observed. The Contractor may utilize any methods or techniques of construction. The lawful manning provisions of the applicable Master Agreement shall be recognized.

17.2 There shall be no limitation or restriction by a signatory Union upon a Contractor's choice of materials or design, nor, regardless of source or location, upon the full use and utilization of equipment, machinery, packaging, pre-cast, pre-fabricated, pre-finished, or pre-assembled materials, tools, or other labor saving devices. This Agreement covers all on-site fabrication work over which the District, Contractor(s) or subcontractor(s) possess the right of control (including work done for the Project in any temporary yard or area near the Project.) This Agreement also covers all off-site fabrication work traditionally performed by any of the Unions, that is directly or indirectly part of the Project, provided such off-site fabrication work is covered by a provision of a local Master Labor Agreement or local addenda to a national agreement of the applicable Union(s). All of the work described in this paragraph is within the scope of this Agreement and is referred to as "Covered Work."

The on-site installation, incorporation or application of all items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that
installation of manufactured items may be performed by employees employed under this Agreement who may be directed by other personnel of the manufacturer in a supervisory role. For any work performed pursuant to this provision, the Contractor shall provide copies of the written warranty requirement to the Union and the District's PLA Program Manager prior to the commencement of work.

17.3 The use of new technology, equipment, machinery, tools and/or laborsaving devices and methods of performing work may be initiated by the Contractor from time-to-time during the Project. The Union agrees that it will not in any way restrict the implementation of such new devices or work methods. If there is any disagreement between the Contractor and the Union concerning the manner or implementation of such device or method of work, the implementation shall proceed as directed by the Contractor, and the Union shall have the right to grieve and/or arbitrate the dispute as set forth in Article 12 of this Agreement.

ARTICLE 18
SAVINGS CLAUSE

18.1 The parties agree that in the event any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void as being in contravention of any applicable law, by a court of competent jurisdiction such as the Department of Industrial Relations, the Division of Apprenticeship Standards, and other applicable labor related governmental agencies the remainder of the Agreement shall remain in full force and effect. The parties further agree that if any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void, by a court of competent jurisdiction or other labor related governmental authorities, the parties shall substitute, by mutual agreement, in its place and stead, an article, provision, clause, sentence or work which will meet the objections to its validity and which will be in accordance with the intent and purpose of the article, provision, clause, sentence or work in question.

18.2 The parties also agree that in the event that a decision of a court of competent jurisdiction materially alters the terms of the Agreement such that the intent of the parties is defeated, then the entire Agreement shall be null and void.

18.3 If a court of competent jurisdiction determines that all or part of the Agreement is invalid and/or enjoins the District from complying with all or part of its provisions and the District accordingly determines that the Agreement will not be required as part of an award to a Contractor(s), the Union(s) will no longer be bound by the provisions of Article 6.

ARTICLE 19
MISCELLANEOUS PROVISIONS

19.1 Counterparts: This Agreement may be executed in counterparts, such that original signatures may appear on separate pages, and when bound together all necessary signatures shall constitute an original. Facsimile signature pages transmitted to other parties to this Agreement shall be deemed equivalent to original signature.

19.2 Warranty of Authority: Each of the persons signing this Agreement represents and warrants that such person has been duly authorized to sign this Agreement on behalf of
the party indicated, and each of the parties by signing this Agreement warrants and represents that such party is legally authorized and entitled to enter into this Agreement.

19.3 **Ratification by Governing Board:** This Agreement shall not be binding on the District until it is approved by the Peralta Community College District Governing Board.

**ARTICLE 20**

**TERM**

20.1 The Agreement shall be included as a condition of the award of all Construction Contracts that are part of the PLA Program.

20.2 This Agreement shall become effective on the day the District Governing Board ratifies the Agreement and shall continue in full force and effect for a period of five (5) years, at which time this Agreement will be reviewed and considered for extension or renewal with modifications if appropriate. The term of this Agreement will be automatically extended for additional successive five (5) year terms unless the District, prior to the expiration of any such term and, after meeting with the Council and the Unions, finds in a public hearing that the work performed has been unsatisfactory, and gives the Council and Unions notice that it will not renew this Agreement. After the expiration of any term of this Agreement, the provisions of the Agreement shall continue to apply to those Projects subject to this Agreement until construction is completed. The parties may mutually agree in writing to amend, extend or terminate this Agreement at any time.

20.3 The parties agree to meet and confer annually, subsequent to approval of this Project Labor Agreement by the Peralta Community College District Governing Board, regarding the status of and experience with Projects covered by the Agreement and future projects to be covered by the Agreement.

**Peralta Community College District**

By: __________________________
Elihu Harris
Chancellor

DATE: 7/21/69

**Boilermakers, Local 549**

By: __________________________
Frank Secreet

**Alameda County Building & Construction Trades Council AFL-CIO (Council)**

By: __________________________
Barry Luboviski
Secretary-Treasurer

DATE: __________________________

**Asbestos Workers, Local 16**

By: __________________________

____________________________
Bricklayers & Allied Craftsmen, Local 3

By: Tom Spear

Northern California Regional Council of Carpenters on behalf of, Carpenters, Local 713, Carpenters, Local 2236, Lathers, Local 68L, Pile Drivers, Local 34, Millwrights, Local 102

By: Robert Alvarado

District Council of Plasterers and Cement Masons of Northern California

By: ______________

Steve Scott

Cement Masons, Local 300

By: ______________

Steve Scott

Plasterers, Local 66

By: ______________

Chester Murphy, Jr.

Electrical Workers, Local 595

By: ______________

Victor Uno

Elevator Constructors, Local 8

By: ______________

Pat McGarvey

Laborers District Council on behalf of, Hod Carriers, Local 166, Laborers, Local 67, Laborers, Local 304

By: ______________

Jose Moreno
Hod Carriers, Local 166
By: Sam Robinson

Laborers, Local 67
By: Victor Para

Laborers, Local 304
By: Jose Zapien

Operating Engineers, Local 3
By: Russ Burns

District Council Ironworkers of the State of California and Vicinity
By: Joe Standley

Ironworkers, Local 378
By: Emilio Rivera

District Council 16, Painters & Allied Trades on behalf of Auto & Marine Painters, Local 1176, Carpet & Linoleum Layers, Local 12, Glaziers, Architectural Metal & Glassworkers, Local 169, Painters & Tapers, Local 3

Roofers and Waterproofers, Local 81
By: ____________________________        By: ____________________________

Doug Christopher                        Doug Ziegler

Sheet Metal Workers, Local 104

By: ____________________________        By: ____________________________

Bruce Word                                Mike Hardeman

Sprinkler Fitters, Local 483

By: ____________________________        By: ____________________________

Stan Smith, Jr.                           Rome Aloice

United Association of Steamfitters,      United Association of Journeyman &
Pipefitters, Plumbers & Gasfitters,       Apprentices of the Pipe Fitting
Local 342                                 Industry, Underground Utility /
                                           Landscape, Local 355

By: ____________________________        By: ____________________________

Jay Williams                               Dennis Soares
LETTER OF ASSENT

PROJECT LABOR AGREEMENT

The undersigned, as a Contractor on the Peralta Community College Project, ("Project"), subject to the Project Labor Agreement ("Agreement"), for and in consideration of the award to it of a contract to perform work on said Project, and in further consideration of the promises made in the Agreement and all attachments a copy of which was received and is acknowledged, hereby:

1.) Accepts and agrees to be bound by the terms and conditions of the Agreement, together with any and all amendments and supplements now existing or which are later made thereto only for the duration and scope of the Contractor’s work on the Project.

2.) The Contractor agrees to be bound by the legally established trust agreements designated in local master collective bargaining agreements. The Contractor authorizes the parties to such local trust agreements to appoint trustees and successor trustee to administer the trust funds and hereby ratifies and accepts the trustees so appointed as if made by the Contractor.

3.) Certifies that it has no commitments or agreements which would preclude its full and complete compliance with the terms and conditions of said Agreement.

4.) Agrees to secure from any Contractor(s) (as defined in said Agreement) which are or become a subcontractor (of any tier) to it, a duly executed Agreement to be Bound in a form identical to this document.

DATED: ______________ Name of Contractor ________________________________

(Authorized Officer & Title) ______________________________

Contractor’s State License #______________________________

Project Name _______________________________________

Contract Number ________________________________

Name of Prime Contractor or Higher Level Subcontractor ________________________________
We, the undersigned parties agree to the two side letters, dated July 21, 2009:

"Term of Project Labor Agreement Side Letter" and
"Helmets to Hardhats Program Side Letter"

These two side letters are addendum to the Project Labor Agreement, and shall constitute the entire Agreement. The effective date of the Agreement is July 21, 2009. Mr. Barry Luboviski, Secretary-Treasurer confirms that all parties agree to the side letters, along with the Project Labor Agreement, and all Union Signatories will confirm their agreement below.

Peralta Community College District Construction

BY: \(\text{Signature}\)
Elihu Harris
Chancellor

DATE: 7/21/09

Alameda County Building & Trades Council AFL-CIO (Council)

BY: \(\text{Signature}\)
Barry Luboviski
Secretary-Treasurer

DATE: ______________

Asbestos Workers, Local 16
Boilermakers, Local 549

By: ____________________________  By: ____________________________

Steve Steele  Frank Secreet

Bricklayers & Allied Craftsmen, Local 3
Northern California Regional Council of Carpenters on behalf of, Carpenters, Local 713, Carpenters, Local 2236, Lathers, Local 68L, Pile Drivers, Local 34, Millwrights, Local 102

By: ____________________________  By: ____________________________

Tom Spear  Robert Alvarado

District Council of Plasterers and Cement Masons of Northern California  Cement Masons, Local 300
By: ______________________  By: ______________________

Steve Scott

Plasterers, Local 66

By: ______________________  By: ______________________

Chester Murphy, Jr.

Elevator Constructors, Local 8

By: ______________________  By: ______________________

Pat McGarvey

Hod Carriers, Local 166

By: ______________________  By: ______________________

Sam Robinson

Laborers, Local 304

By: ______________________  By: ______________________

Jose Zapien

Laborers District Council on behalf of, Hod Carriers, Local 166, Laborers, Local 67, Laborers, Local 304

By: ______________________  By: ______________________

Victor Para

Operating Engineers, Local 3

By: ______________________  By: ______________________

Russ Burns
District Council Ironworkers of the State of California and Vicinity

Ironworkers, Local 378

By:

Joe Standley

By:

Emilio Rivera

District Council 16, Painters & Allied Trades on behalf of Auto & Marine Painters, Local 1176, Carpet & Linoleum Layers, Local 12, Glaziers, Architectural Metal & Glassworkers, Local 169, Painters & Tapers, Local 3

Roofers and Waterproofers, Local 81

By:

Doug Christopher

By:

Doug Ziegler

Sheet Metal Workers, Local 104

Sign Display & Allied Crafts, Local 510

By:

Bruce Word

By:

Mike Hardeman

Sprinkler Fitters, Local 483

Teamsters, Local 853
By: ________________________________  By: ________________________________

Stan Smith, Jr.  
Rome Aloice

United Association of Steamfitters,  
Pipefitters, Plumbers & Gasfitters,  
Local 342

United Association of Journeyman &  
Apprentices of the Pipe Fitting  
Industry, Underground Utility /  
Landscape, Local 355

By: ________________________________  By: ________________________________

Jay Williams  
Dennis Soares
Term of Project Labor Agreement Side Letter

Chancellor Elihu Harris
Peralta Community College District
333 East 8th Street
Oakland, CA 94606

Re: Peralta Community College District Construction Project Labor Agreement: Term of Agreement

Dear Chancellor Harris:

In our negotiations of the captioned Project Labor Agreement, the District and the Unions came to agreement on the Term of the Project Labor Agreement, in Article 1, Definitions and Article 20, Term. It is clearly understood by the Unions and the District that the parties agree that Section 20.2 shall be modified as follows:

20.2 This Agreement shall become effective on the day the District Governing Board ratifies the Agreement and shall continue in full force and effect for a period of five (5) years, at which time this Agreement will be reviewed and considered for extension or renewal with modifications if appropriate. The term of this Agreement will be extended for additional successive five (5) year terms unless the District, 60 to 90 days prior to the expiration of any such term, after meeting with the Council and the Unions, gives written notice to the Council that it wishes to re-open the contract and make proposals to amend, modify, add to, or delete from the Agreement. After the expiration of any term of this Agreement, the provisions of the Agreement shall continue to apply to those Projects subject to this Agreement until construction is completed. The parties may mutually agree in writing to amend, extend or terminate this Agreement at any time.

Sincerely,

Barry Luboviski, Secretary-Treasurer,
Alameda County Building and Construction Trades Council
on behalf of the signatory Unions and Councils to the Project Labor Agreement

Acknowledged and agreed to this 21st day of July 2009
Helmets to Hardhats Program Side Letter

Chancellor Elihu Harris  
Peralta Community College District  
333 East 8th Street  
oakland, CA 94606

Re: Peralta Community College District Construction Project Labor Agreement: Helmets to Hard Hats

Dear Chancellor Harris:

In our negotiations of the captioned Project Labor Agreement, the District and the Unions discussed career pathways. To insure that all avenues are available to effectively reach out to potential applicants and to insure entry into the building and construction trades of men and women veterans who have served their Country and are interested in careers in the building and construction industry, we subscribe to the following:

When appropriate, the Employers and Unions will agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter “Center”) and the Center’s “Helmets to Hardhats” program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

We further agree that the Unions and Employers will, as a consequence of signing the Letter of Assent, coordinate with the Center to create and maintain an integrated database of veterans interested in working on Projects covered by this Agreement and which of them are interested in apprenticeship and employment opportunities made available by such Projects. To the extent permitted by law, the Unions will give credit to such veterans for bona fide, provable past experience.

Sincerely,

Barry Luboviski, Secretary-Treasurer,  
Alameda County Building and Construction Trades Council  
on behalf of the signatory Unions and Councils to the Project Labor Agreement

Chancellor Elihu Harris  
Peralta Community College District

Acknowledged and agreed to this 21st day of July 2009.

SECTION 01 10 00

PART 1 GENERAL

1.01 PROJECT
   A. Project Name: Chilled Water Infrastructure.
   B. District’s Name: Peralta Community College District
   C. Engineer’s Name: Salas O’Brien Engineers, Inc.
   D. The Project consists of the alteration of Building F, and underground chilled water infrastructure with connections to Building L, and Building Q. Work includes the installation of a chilled water plant in Building F, with cooling tower yard, including new electrical service. Also included is stubout service to future Science Building. Building F alterations include converting the existing entrance into a chiller room, installing second floor stair exiting and lower room addition with acoustical louvers, a cooling tower yard with site screen chain link fences & gates, pumps and new electrical substation to serve the new central chilled water plant equipment. Exposed pipes to have outdoor box enclosures on exterior walls and low roofs. See 01 23 00 Alternates for Concrete Cooling Tower Yard Enclosure and third chiller.

1.02 CONTRACT DESCRIPTION
   A. Contract Type: A single prime contract based on a Stipulated Price as described in the Invitation to Bid.

1.03 DESCRIPTION OF ALTERATIONS WORK
   A. Scope of demolition and removal work is shown on drawings.
   B. Scope of alterations work is shown on drawings.
   C. HVAC: Alter existing system and add new construction, keeping existing in operation.
   D. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
   E. Relocation of storage container currently located in future cooling tower area at Bldg F to an on site area designated by the District.
   F. District will remove the following items before start of work:
      2. Contents of storage container for the installation of the cooling tower pad and piping near Building F.
      3. All stored/loose items currently inside the future chiller room in Building F.

1.04 FUTURE WORK
   A. Project is designed for future chilled water connection to future Science Building. Proposed building outline is shown on Contract Drawings.

1.05 OWNER OCCUPANCY
   A. District intends to continue to occupy portions of the existing buildings during the entire construction period.
   B. District intends to occupy the Project upon Substantial Completion.
   C. Cooperate with District to minimize conflict and to facilitate District’s operations.
   D. Schedule the Work to accommodate District occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES
   A. Construction Operations: Limited to areas noted on Drawings.
   B. Arrange use of site and premises to allow:
      1. District occupancy.
      2. Work by Others.
      3. Work by District.
4. Use of site and premises by the public.
5. Use of site by Students, Staff and Employees.

C. Provide access to and from site as required by law and by District:

D. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

E. Existing building spaces may not be used for storage.

F. Limit shutdown of utility services to 4 hours at a time, arranged at least two weeks in advance with District.
   1. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

A. Coordinate construction schedule and operations with District.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
1 PART 1 GENERAL

1.1 Summary

1.1.1 Section includes:
(1) Description of general procedural requirements for alterations, modifications, and extras.

1.1.2 Reference
(1) Public Contract Code Section 7105 (d)(2).

1.2 General

1.2.1 Any change in scope of Work or deviation from Contract Documents including, without limitation, extra work, or alterations or additions to or deductions from the original Work, shall not invalidate the original Contract, and shall be performed under the terms of the Contract Documents.

1.2.2 Only Contractor or Owner may initiate changes in scope of Work or deviation from Contract Documents.
(1) Contractor may initiate changes by submitting a Change Order Request (COR), Notice of Concealed or Unknown Conditions, or Notice of Hazardous Waste Conditions.
   a. A COR shall be submitted to request changes in the Contract Documents. (see attached form at the end of this Section 1250)
   b. Notices of Concealed or Unknown Conditions shall be submitted in accordance with Document 00700 (General Conditions).
   c. Notices of Hazardous Waste Conditions shall be submitted in accordance with Document 00700 (General Conditions).

(2) Contractor shall submit RFI’s for clarifications in the Contract Documents and the Contractor shall be responsible for its costs to implement and administer RFIs throughout the Contract duration. (see attached form at the end of this Section 1250). Regardless of the number of RFIs submitted, Contractor shall not be entitled to additional compensation for the effort required to submit the RFIs. Contractor shall be responsible for both Owner and its Architect/Engineer’s administrative costs for answering RFIs where the answer could reasonably be found by reviewing the Contract Documents, as determined by Owner; at Owner discretion, such costs may be deducted from progress payments or final payment.

(3) Owner may initiate changes by issuing a Supplemental Instruction, which may revise, add to or subtract from the Work.

(4) Owner may initiate changes in the Work or Contract Time by issuing an RFQ to Contractor. Such RFQs will detail all proposed changes in the Work and request a quotation of changes in Contract Sum and Contract Time from Contractor. (see attached form at end of this Section 1250)

(5) Owner may also, by Construction Change Directive (“CCD”), order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly. A CCD shall be used in the absence of total agreement on the terms of a Change Order and may, upon express written notice designating it as a CCD, consist of a Change Order executed by Owner only.

1.3 Procedures

1.3.1 Cost Proposal and Procedures: Whenever Contractor is required in this Section 01250 to prepare a Cost Proposal, and whenever Contractor is entitled to submit a Cost Proposal and elects to do so, Contractor shall prepare and submit to Owner for consideration a Cost Proposal using the form attached to this Section 01250. All Cost Proposals must contain a complete breakdown of costs of credits, deducts and extras; itemizing materials, labor, taxes, overhead and profit and any requested changes to Contract Time. All Subcontractor Work shall be so indicated. Individual entries on the Cost Proposal form shall be determined as provided in paragraphs 1.4 and 1.5 of this Section 01250. After receipt of a Cost Proposal with a detailed breakdown, Owner will act promptly thereon.
(1) If Owner accepts a Cost Proposal, Owner will prepare Change Order for Owner and Contractor signatures.

(2) If Cost Proposal is not acceptable to Owner because it does not agree with cost and/or time included in Cost Proposal, Owner will submit in a response what it believes to be a reasonable cost and/or adjustment, if any. Except as otherwise provided in this Section 01250, Contractor shall have seven (7) Days in which to respond to Owner with a revised Cost Proposal.

(3) When necessity to proceed with a change does not allow Owner sufficient time to conduct a proper check of a Cost Proposal (or revised Cost Proposal), Owner may order Contractor to proceed on basis to be determined at earliest practical date. In this event, value of change, with corresponding equitable adjustment to Contract, shall not be more than increase or less than decrease proposed.

1.3.2 Request for Information: Whenever Contractor requires information regarding the Project or Contract Documents, or receives a request for information from a Subcontractor, Contractor may prepare and deliver an RFI to Owner. Contractor shall use RFI format provided by Owner. Contractor must submit time critical RFIs at least 30 days before scheduled start date of the affected Work activity. Contractor shall reference each RFI to an activity of Progress Schedule and shall note time criticality of the RFI, indicating time within which a response is required. Contractor’s failure to reference RFI to an activity on the Progress Schedule and note time criticality on the RFI shall constitute Contractor’s waiver of any claim for time delay or interruption to the Work resulting from any delay in responding to the RFI.

(1) Owner will respond within ten (10) Days from receipt of RFI with a written response to Contractor. Contractor shall distribute response to all appropriate Subcontractors.

(2) If Contractor is satisfied with the response and does not request change in Contract Sum or Contract Time, then the response shall be executed without a change.

(3) If Contractor believes the response is incomplete, Contractor shall issue another RFI (with the same RFI number with the letter “A” indicating it is a follow-up RFI) to Owner clarifying original RFI. Additionally, Owner may return RFI requesting additional information should original RFI be inadequate in describing condition.

(4) If Contractor believes that the response results in change in Contract Sum or Contract Time, Contractor shall notify Owner with the issuance of a COR within twenty-one (21) Days of receiving the response. If Owner disagrees with Contractor, then Contractor may give notice of intent to submit a Claim as provided in Article 12 of Document 00700 (General Conditions), and submit its Claim as provided therein. If Owner agrees with Contractor, then Contractor must submit a Cost Proposal within twenty-one (21) Days of receiving the response to the RFI and COR. Contractor’s failure to deliver either the foregoing notice and Claim or Cost Proposal by the respective deadlines stated in the foregoing sentences shall result in waiver of the right to file a Cost Proposal or Claim.

1.3.3 Supplemental Instruction: Owner may issue Supplemental Instruction to Contractor.

(1) If Contractor is satisfied with Supplemental Instruction and does not request change in Contract Sum or Contract Time, then Supplemental Instruction shall be executed without a Change Order.

(2) If Contractor believes that Supplemental Instruction results in change in Contract Sum or Contract Time, then Contractor must submit a COR with the appropriate Cost Proposal to Owner within twenty-one (21) Days of receiving the Supplemental Instruction.

1.3.4 Construction Change Directives: If at any time Owner believes in good faith that a timely Change Order will not be agreed upon using the foregoing procedure, Owner may issue a CCD with its recommended cost and/or time adjustment. Upon receipt of CCD, Contractor shall promptly proceed with the change of Work involved and concurrently respond to Owner’s CCD within ten (10) Days.

(1) Contractor’s response must be any one of following:
   a. Return CCD signed, thereby accepting Owner response, time and cost.
   b. Submit a (revised if applicable) Cost Proposal with supporting documentation (if applicable, reference original Cost Proposal number followed by letter A, B, etc. for each revision), if Owner so requests.
   c. Give notice of intent to submit a claim as described in Article 12 of Document 00700 (General Conditions), and submit its claim as provided therein.

(2) If the CCD provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
Modification Procedures

1.3.5 Owner Requested RFQ: In response to an RFQ, Contractor shall furnish a Cost Proposal within twenty-one (21) Business Days of Owner RFQ. Upon approval of Cost Proposal, Owner will issue a Change Order directing Contractor to proceed with extra Work. If the parties do not agree on the price for an RFQ, Owner may either issue a CCD or decide the issue per Article 12 of Document 00700 (General Conditions). Contractor shall keep and present an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this paragraph shall be limited to those provided in paragraphs 1.4 and 1.5 of this Section 01250.

1.3.6 Differing Site Conditions and/or Hazardous Waste Conditions: Contractor shall submit Notices of Differing Site Conditions and/or Hazardous Waste Conditions to resolve problems regarding differing underground Site conditions encountered in the execution of the Work pursuant to Article 14 of Document 00700 (General Conditions). If Owner determines that a change in Contract Sum or Contract Time is justified, Owner will issue RFQ or CCD.

1.3.7 All Changes:

(1) Documentation of Change in Contract Sum and Contract Time:
   a. Contractor shall document each proposal for a change in cost or time with sufficient data to allow evaluation of the proposal.
   b. Contractor shall, on request, provide additional data to support computations for:
      (i) Quantities of products, materials, labor and equipment.
      (ii) Taxes, insurance, and bonds.
      (iii) Overhead and profit.
      (iv) Justification for any change in Contract Time and new Progress Schedule showing revision due, if any.
      (v) Credit for deletions from Contract, similarly documented.
   c. Contractor shall support each claim for additional cost, and for Work performed on a cost-and-percentage basis, with additional information including:
      (i) Credit for deletions from Contract, similarly documented.
      (ii) Origin and date of claim.
      (iii) Dates and times Work was performed and by whom.
      (iv) Time records and wage rates paid.
      (v) Invoices and receipts for products, materials, equipment and subcontracts, similarly documented.

1.3.8 Correlation of Other Items:

(1) Contractor shall revise Schedule of Values and Application for Payment forms to record each authorized Change Order or CCD as a separate line item and adjust the Contract Sum as shown thereon prior to the next monthly pay period.

(2) Contractor shall revise the Progress Schedules prior to the next monthly pay period.

(3) Contractor shall enter changes in Project Record Documents prior to the next monthly pay period.
1.3.9 Responses: For all responses for which the Contract Documents, including without limitation this Section 01250, do not provide a specific time period, recipients shall respond within a reasonable time.

1.3.10 Disputes: For all disputes arising from the procedures herein, Contractor shall follow Article 12 of Document 00700.

1.4 Cost Determination

1.4.1 Total cost of extra Work or of Work omitted shall be the sum of actually incurred labor costs, material costs, equipment rental costs and specialist costs as defined herein plus overhead and profit as allowed herein. This limit applies in all cases of claims for extra Work, whether calculating Cost Proposals, Change Orders or CCDs, or calculating claims of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including strict liability or negligence. Contractor may recover no other costs arising out of or connected with the performance of extra Work, of any nature. No special, incidental or consequential damages may be claimed or recovered against Owner, its representatives or agents, whether arising from breach of contract, negligence or strict liability, unless specifically authorized in the Contract Documents.

1.4.2 Overhead and Profit: (Overhead shall be as defined in paragraph 1.8 of this Section 01250)

(1) Overhead and profit on labor for extra Work shall be 15 percent.
(2) Overhead and profit on materials for extra Work shall be 15 percent.
(3) Overhead and profit on equipment rental for extra Work shall be 10 percent.
(4) When extra Work is performed by a first tier Subcontractor, Contractor shall receive a 5 percent markup on Subcontractors’ total costs of extra Work. First tier Subcontractor’s markup on its Work shall not exceed 15 percent.
(5) When extra Work is performed by a lower tier Subcontractor, Contractor shall receive a total of 5 percent markup on the lower tier Subcontractors’ total costs of extra Work. Contractor and first tier Subcontractors and lower tier Subcontractors shall divide the 10 percent markup as mutually agreed.
(6) Notwithstanding the foregoing, in no case shall the total markup on any extra Work exceed 20 percent of the direct cost, notwithstanding the actual number of contract tiers.
(7) On proposals covering both increases and decreases in Contract Sum, overhead, profit, and commission shall be allowed on the net increase only as determined in paragraph 1.4 above. When the net difference is a deletion, no percentage for overhead profit and commission shall be allowed, but rather an appropriate percentage deduction shall be issued in the amount of the net difference.
(8) The markup shall include profit, small tools, cleanup, engineering, supervision, warranties, cost of preparing the cost proposal, jobsite overhead, and home office overhead. No markup will be allowed on taxes, insurance, and bonds.

1.4.3 Taxes:

(1) All State sales and use taxes, County and applicable City sales taxes, shall be included.
(2) Federal and Excise tax shall not be included.

1.4.4 Owner-Operated Equipment: When owner-operated equipment is used to perform extra Work, Contractor will be paid for operator as follows:

(1) Payment for equipment will be made in accordance with paragraph 1.5.3 of this Section 01250.
(2) Payment for cost of labor will be made at no more than rates of such labor established by collective bargaining agreements for type of worker and location of Work, whether or not owner-operator is actually covered by such an agreement.

1.4.5 Accord and Satisfaction: Every Change Order and accepted CCD shall constitute a full accord and satisfaction, and release, of all Contractor (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay and any other type of claim. Contractor may elect to reserve its rights to disputed claims arising from or relating to the changed Work at the time it signs a Change Order or approves a CCD, but must do so expressly in a writing delivered concurrently with the executed Change Order or approved CCD, and must also submit a Claim for the reserved disputed items pursuant to Article 12 of Document 00700 no later than thirty (30) days of Contractor’s first written notice of its intent to reserve rights.

1.5 COST BREAKDOWN

Error! Unknown document property name. 01250 - 4

Modification Procedures
1.5.1 **Labor:** Contractor will be paid cost of labor for workers (including forepersons when authorized by Owner) used in actual and direct performance of extra Work. Labor rate, whether employer is Contractor, Subcontractor or other forces, will be sum of following:

(1) **Actual Wages:** Actual wages paid shall include any employer payments to or on behalf of workers for health and welfare, pension, vacation, and similar purposes.

(2) **Labor surcharge:** Payments imposed by local, county, state, and federal laws and ordinances, and other payments made to, or on behalf of, workers, other than actual wages as defined in paragraph 1.5.1(1) of this Section 01250, such as taxes and worker’s compensation insurance. Such labor surcharge shall not exceed that set forth in California Department of Transportation official labor surcharges schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein.

1.5.2 **Material:** Only materials furnished by Contractor and necessarily used in performance of extra Work will be paid for. Cost of such materials will be cost, including sales tax, to purchaser (Contractor, Subcontractor or other forces) from supplier thereof, except as the following are applicable:

(1) If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to Owner notwithstanding fact that such discount may not have been taken.

(2) For materials salvaged upon completion of extra Work, salvage value of materials shall be deducted from cost, less discounts, of materials.

(3) If cost of a material is, in opinion of Owner, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in paragraph 1.5.2(1) of this Section 01250.

1.5.3 **Equipment Rental:** For Contractor- or Subcontractor-owned equipment, payment will be made at rental rates listed for equipment in California Department of Transportation official equipment rental rate schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein. If there is no applicable rate for an item of equipment, then payment shall be made for Contractor- or Subcontractor-owned equipment at rental rate listed in the most recent edition of the Association of Equipment Distributors (AED) book. For rented equipment, payment will be made based on actual rental invoices. Equipment used on extra Work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type, as determined by Owner. Rental rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Unless otherwise specified, manufacturer’s ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rental rates. Individual pieces of equipment or tools not listed in said publication and having a replacement value of $100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor as payment is included in payment for labor. Rental time will not be allowed while equipment is inoperative due to breakdowns.

(1) For equipment on Site, rental time to be paid for equipment shall be time equipment is in operation on extra Work being performed or on standby as approved by Owner. The following shall be used in computing rental time of equipment:
   a. When hourly rates are listed, less than 30 minutes of operation shall be considered to be ½ hour of operation.
   b. When daily rates are listed, less than four hours of operation shall be considered to be ½ Day of operation.

(2) For equipment that must be brought to Site to be used exclusively on extra Work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:
   a. Owner will pay for costs of loading and unloading equipment.
   b. Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.
   c. Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission.
   d. Owner will not make any payment for transporting and loading and unloading equipment if equipment is used on Work in any other way than upon extra Work.
Rental period may begin at time equipment is unloaded at Site of extra Work and terminate at end of the performance of the extra Work or Day on which Owner directs Contractor to discontinue use of equipment, whichever first occurs. Excluding Saturdays, Sundays, and Owner legal holidays, unless equipment is used to perform extra Work on such Days, rental time to be paid per Day shall be four hours for zero hours of operation, six hours for four hours of operation and eight hours for eight hours of operation, time being prorated between these parameters. Hours to be paid for equipment that is operated less than eight hours due to breakdowns, shall not exceed eight less number of hours equipment is inoperative due to breakdowns.

1.5.4 Work Performed by Special Forces or Other Special Services: When Owner and Contractor, by agreement, determine that special service or item of extra Work cannot be performed by forces of Contractor or those of any Subcontractors, service or extra Work item may be performed by specialist. Invoices for service or item of extra Work on basis of current market price thereof may be accepted without complete itemization of labor, material, and equipment rental costs when it is impracticable and not in accordance with established practice of special service industry to provide complete itemization. In those instances wherein Contractor is required to perform extra Work necessitating a fabrication or machining process in a fabrication or machine shop facility away from Site, charges for that portion of extra Work performed in such facility may, by agreement, be accepted as a specialist billing. Owner must be notified in advance of all off-Site Work. In lieu of overhead and profit provided in paragraph 1.4.2 of this Section 01250, 15 percent will be added to specialist invoice price, after deduction of any cash or trade discount offered or available, whether or not such discount may have been taken.

1.6 Force-Account Work

1.6.1 If it is impracticable because of nature of Work, or for any other reason, to fix an increase or decrease in price definitely in advance, the Contractor may be directed to proceed at a not-to-exceed (NTE) maximum price which shall not under any circumstances be exceeded. Subject to such limitation, such extra Work shall be paid for at actual necessary cost for Force-Account Work or at the negotiated cost, as determined by Owner. The cost for Force-Account Work shall be determined pursuant to paragraphs 1.4 and 1.5 of this Section 01250.

1.6.2 Force-Account Work shall be used when it is not possible or practical to price out the changed Work prior to the start of that Work. In these cases, Force-Account Work will be utilized during the pricing and negotiation phase of the change. Once negotiations have been concluded and a bilateral agreement has been reached, the tracking of the Work under Force-Account is no longer necessary. Force-Account Work shall also be used when negotiations between Owner and Contractor have reached an impasse and a bilateral agreement on the value of the changed Work cannot be reached. Owner may approve other uses of Force-Account Work.

1.6.3 Whenever any Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner each Business Day in writing in detail amount and cost of labor and material used, and any other expense incurred in Force-Account Work on preceding Day, by using the Cost Proposal form attached hereto. No claim for compensation for Force-Account Work will be allowed unless report shall have been made.

1.6.4 Whenever Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner when 75 percent of the NTE amount has been expended.

1.6.5 Force-Account Work shall be paid as extra Work under this Section 01250. Methods of determining payment for Work and materials provided in this paragraph 1.6 shall not apply to performance of Work or furnishings of material that, in judgment of Owner, may properly be classified under items for which prices are otherwise established in Contract Documents.

1.7 Owner-Furnished Materials

1.7.1 Owner reserves right to furnish materials as it deems advisable, and Contractor shall have no claims for costs and overhead and profit on such materials.

1.8 Overhead Defined

1.8.1 The following constitutes charges that are deemed included in overhead for all Contract Modifications, including Force-Account Work or CCD Work, whether incurred by Contractor, Subcontractors, or suppliers, and Contractor shall not invoice or receive payment for these costs separately:

   (1) Drawings: field drawings, Shop Drawings, etc., including submissions of drawings
   (2) Routine field inspection of Work proposed
(3) General Superintendence
(4) General administration and preparation of cost proposals, schedule analysis, change orders and other supporting documentation as necessary
(5) Computer services
(6) Reproduction services
(7) Salaries of project Architect/Engineer, superintendent, timekeeper, storekeeper and secretaries
(8) Janitorial services
(9) Temporary on-Site facilities:
   a. Offices
   b. Telephones
   c. Plumbing
   d. Electrical: Power, lighting
   e. Platforms
   f. Fencing, etc.
   g. Water
(10) Home office expenses
(11) Insurance and Bond premiums
(12) Procurement and use of vehicles and fuel used coincidentally in Work otherwise included in the Contract Documents
(13) Surveying
(14) Estimating
(15) Protection of Work
(16) Handling and disposal fees
(17) Final cleanup
(18) Other incidental Work

1.9 RECORDS AND CERTIFICATION

1.9.1 Force-Account (cost reimbursement) charges shall be recorded daily and summarized in Cost Proposal form attached hereto. Contractor or authorized representative shall complete and sign form each day. Contractor shall also provide with the form: the names and classifications of workers and hours worked by each; an itemization of all materials used; a list by size type and identification number of equipment and hours operated; and an indication of all Work performed by specialists.

1.9.2 No payment for Force-Account Work shall be made until Contractor submits original invoices substantiating materials and specialists charges.

1.9.3 Owner shall have the right to audit all records in possession of Contractor relating to activities covered by Contractor’s claims for modification of Contract, including Force-Account Work and CCD Work. Further, Owner will have right to audit, inspect, or copy all records maintained in connection with this Contract, including financial records, in possession of Contractor relating to any transaction or activity occurring or arising out of, or by virtue of, the Contract. If Contractor is a joint venture, right of Owner shall apply collaterally to same extent to records of joint venture sponsor, and of each individual joint venture member. This right shall be specifically enforceable, and any failure of Contractor to voluntarily comply shall be deemed an irrevocable waiver and release of all claims then pending that were or could have been subject to the Article 12 of Document 00700.

2 PART 2 PRODUCTS – NOT USED

3 PART 3 EXECUTION – NOT USED

END OF SECTION

COST PROPOSAL FORM FOLLOWS ON NEXT PAGE
COST PROPOSAL (CP)

PROJECT
Contract Number ___

CP Number: ______

Date: _________________

In Response To _________________ RFP #, etc.

To: [ENTER NAME OF OWNER]

Attention: _________________

[ENTER OWNER ADDRESS]

Telephone (___) [_________]

Fax: (___) [_________]

From: [INSERT CONTRACTOR'S NAME/ADDRESS]

This Cost Proposal is in response to the above-referenced _______ [insert RFP, etc. as applicable].

Brief description of change(s): ____________________________

<table>
<thead>
<tr>
<th>ITEM DESCRIPTION</th>
<th>PRIME CONTR.</th>
<th>SUB 1</th>
<th>SUB 2</th>
<th>SUB 3</th>
<th>SUB 4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 MATERIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Labor Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 EQUIPMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Overhead</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcontractor’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead &amp; Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead &amp; Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead &amp; Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to Contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for Subcontractor’s Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 percent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(percent of Total Cost above not including any OIP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REQUESTED CHANGE IN CONTRACT TIME (DAYS)

By Contractor: ____________ Signature: ____________ Date: ____________

END OF SECTION
SECTION 01 13 00
PROJECT COORDINATION

PART 1 GENERAL

1.01 GENERAL COORDINATION

A. The requirements of this Section relate to various requirements of the Agreement, General and Special Conditions, specifications, drawings, and all modifying documents which are part of the construction contract. Responsibility for coordination of all such applicable requirements shall be that of the Contractor.

B. The Contractor shall coordinate and cooperate with the District and other Contractors, and shall execute the work of this contract in a timely manner so as to cause no delay in the work of other contracts.

C. The Contractor shall be responsible for the coordination of all Work, including but not limited to, all trades including specialized trades to accomplish all aspects of the Work.

D. The Contractor shall coordinate scheduling, submittals, and work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items to be installed later.

E. Contractor shall verify that utility requirement characteristics of operating equipment are compatible with building utilities. Contractor shall coordinate work of various Sections having interdependent functions and be responsible for installing, connecting to, and placing in service, related equipment.

F. Contractor shall coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. This shall include, but not be limited to: following routing shown for pipes, ducts, and conduit, as closely as practicable; placing runs parallel with line of building, and utilizing spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

G. In finished areas except as otherwise indicated, Contractor shall ensure that pipes, ducts, and wiring are concealed within the construction.

H. Contractor shall coordinate locations of fixtures and outlets with finish elements.

I. Contractor shall coordinate daily clean up of Work in each area of work and at the end of each work shift.

J. Contractor shall coordinate completion and clean up of Work of separate Sections in preparation for substantial completion and for portions of Work designated for District's occupancy.

K. Contractor shall coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of District activities.

L. In addition to the above requirements and requirements of the General Conditions, Contractor shall be responsible for the coordination of the following:
   1. Provisions for future installation of work not included in the contract as shown or specified.
   2. Primary, major and accessory materials, and items necessary to complete the installation.
   3. Labor operations and material items reasonably incidental for finishing.
   4. Performing of Work and delivery of materials in accordance with established construction schedules.
   5. Development of procedures for implementation of all utility shutdowns, pathway closures; wayfinding signage and directives; development and construction of alternative pathways, barricading and related signage.
   6. Coordination of and obtaining approval for all schedules, schedule modifications, Work Plans, utility shutdowns, pathway closures, wayfinding and alternative pathways, barricading, and all signage with District.
   7. Submittal of Access Request Forms and development, coordination and submittal of other forms as appropriate for communicating work efforts, changes or clarifications to the District and impacted personnel.

DSA Re-submittal 6/21/2012

01 13 00 - 1

PROJECT COORDINATION
8. Coordination with Campus Facilities and Trades personnel as regards on-going support of peripheral equipment and systems (e.g. electric panels, manhole access, central plant shutdown, fire water and fire alarm system shutdown or relocation, security/alarm system shutdown or relocation, etc.).

M. Contractor shall coordinate all aspects of his construction operations, generally, and specifically as required under various Articles of this Section and other parts of the Contract Documents, to provide the District with a complete and operable facility. Other Contractors working at the project site, including those delivering materials or equipment, shall coordinate their operations with each other to provide the District with a complete and operable facility.

1. Any dispute over coordination, or failure to coordinate, shall be brought to the District for resolution.

2. If any part of the work depends on proper execution or on proper results of the work or systems or equipment of any other provider or of the District, Contractor shall inspect and promptly report to the District, any defects in the work that render it unsuitable for such proper execution and necessary results. Failure to so inspect the providers’ or District’s work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the provided work, system or equipment. This requirement is waived only to the extent that defects develop in the other providers’ or District’s work or systems or equipment after the execution of subsequent work.

3. Contractor shall cooperate with other Contractors on the project site and with the District so that completion of all work may proceed with all possible speed. Contractor shall attend a monthly Campus project coordination meeting and shall furnish other Contractors, whose work is fitted to this work, details and erection drawings giving full information regarding the scheduling, fabrication and assembly of this Work. So far as possible, drawings shall indicate checked field measurements. Contractor shall cooperate in timing this work to join with the work of other Contractors or the District.

4. Contractor shall check the drawings of other Contractors for interferences with this work and promptly report, in writing, any such interferences to the District. In addition, Contractor shall submit complete information, including drawings, descriptions, sketches, marked prints, etc., as required for District coordination of drawings by others which are not a part of this work.

5. To ensure the proper evaluation of subsequent work of this contract, Contractor shall measure work already in place and report to the District any discrepancy between the executed work and the contract documents. Failure to so measure work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the available space(s).

6. Contractor shall do all cutting and fitting of this work and of other work that may be required to properly fit this work to receive, or be received by, the work of other Contractors as shown on or reasonably implied by, the contract documents. Contractor shall properly finish and complete this work after other Contractors have finished. Any costs for additional cutting and fitting caused by defective work shall be borne by the party responsible thereof. Contractor shall not endanger any work by cutting, fitting or otherwise, and shall not cut or alter the work of other Contractor without the consent of the District.

1.02 INCIDENTAL COSTS

A. Contractor shall furnish at his own cost and expense all tools, consumable supplies, appliances, equipment, etc. necessary for the execution of his work, and shall be responsible for care and guarding thereof.

B. Contractor shall be entirely responsible for professional trade, business, or other licenses required by State statute or local government.

1.03 CORRESPONDENCE AND NOTICES

A. Contractor shall clearly identify correspondence, notices, requests for information (RFI’s) and submittals with project name, subject, and detailed references to drawings and specifications.

DSA Re-submittal 6/21/2012

01 13 00 - 2

PROJECT COORDINATION
In order to properly track and document all correspondences and notices, a unique sequential numbering system shall be applied for each type of correspondence or notice.

B. Contractor shall notify the District’s representatives in writing 6 working days, unless otherwise specified, in advance of all required inspections.

1.04 MISCELLANEOUS PROVISIONS

A. Contractor shall immediately refer to the District, any requirement shown or specified which Contractor finds or believes:
   1. Is not equal to industry standards for achieving the intended results.
   2. Is excessive in cost or effort to effect the intended results.
   3. Is below standard for proper enforcement of the guaranties required.
   4. Is at variance with governing laws, regulations, codes or standards.

B. Failure to so inform the District, in advance of Work, shall constitute acceptance by the Contractor for resolution of the requirements at Contractor’s expense.

C. Contractor shall shop fabricate and preassemble interrelated parts where possible.

D. Closing up of walls, partitions or furred spaces, backfilling, or other “covering up” operations shall not proceed until all required tests and inspections have been completed.

E. Prior to starting a particular type or kind of work, Contractor shall:
   1. Examine for relevant information all contract documents and subsequent data issued to the project.
   2. Check accepted submittals and verify dimensions at job site.
   3. Consult manufacturers for instructions applicable to conditions under which work is to be installed.
   4. Inspect areas, surfaces, or any construction location receiving the work. Start of work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory condition to achieve proper installations and first quality workmanship as intended under these specifications.

1.05 WORK ON OCCUPIED FACILITIES

A. This section shall apply to all modifications or additions to work on all occupied facilities. In this case, all buildings and all grounds are considered fully occupied.

B. Contractor shall cooperate with the District to sequence his work so as not to unnecessarily interfere with operation of occupied facilities. Prior to demolition or construction work, Contractor shall consult with the District as a part of the Work Plan process and Contractor shall develop a construction schedule and Work Plan which will permit the existing users (staff, students, administrators) to function without interruption; while remaining in compliance with the schedules and limitations as delineated in other portions of the Contract Documents. This includes power outages, noise levels greater than 85dB, dislocation, or other interruptions as would cause intrusion to users or disruption of the user environment.

C. Campus operations cannot be impacted by the Contractor without prior written approval from the District’s representatives. Requests to perform activities which potentially impact campus operation, or occur in occupied buildings, shall be made by utilizing the Access Request Form. The Contractor shall sequentially number each access request and maintain a log of the requests issued. After receiving approval for Contractor’s 3 week Work Plan, Contractor will submit properly completed Access Requests to the District’s representative. Each Access Request shall occur a minimum of two weeks prior to the proposed date of the work. Submittal of the Access Request Form shall provide the District a minimum of 4 days during which the District may coordinate with campus personnel and ongoing campus activities; and subsequently suggest changes to the requested Access. Such changes to the requested access time shall not form a basis for Contract time extensions regardless of the critical nature of the proposed activity. For this reason, Contractor shall always have one or more “spare” locations or operations planned for construction as a part of the Work Plan process.

D. In planning and performing the work, every effort shall be made to control the noise, dirt and fugitive dust levels as required by these contract specifications.

DSA Re-submittal 6/21/2012

01 13 00 - 3

PROJECT COORDINATION
E. Ingress and egress to and from existing buildings shall be continuously maintained for purposes of normal personnel access (i.e. to classes, offices, administrative events and social events), fire and emergency entrances and escape, loading and delivery, and building maintenance, to the satisfaction of the District, and the local fire and building departments. Contractor shall determine and install all necessary wayfinding signage as indicated on the Work Plan and approved in advance by the District. Said signage shall be installed prior to any shutout or interruption of access to a room, pathway, system, building, doorway or hallway.

F. All utilities shall be protected against interruption, damage, or contamination during construction. Temporary utilities shall be installed, if necessary, to maintain services continuously. Such utilities shall include but shall not be limited to electricity, water, gas, sewerage, chilled water, steam, telephone and data.

G. Contractor shall limit equipment and vehicles in ingress and egress and use of service areas to the minimum essential to Contractor's operations. Other vehicles and equipment shall be kept out of such areas. In the event of unavoidable conflict with Contractor's equipment in such areas, upon request of the District, Contractor shall remove such equipment immediately.

PART 2 PRODUCTS
2.01 NOT USED

PART 3 EXECUTION
3.01 GENERAL

A. Because of the sensitive nature of campus operations, due to the extent that unplanned outages create unreplaceable loss of time, and operation deficiencies, the planning and execution of work procedures to reduce outages to an absolute minimum is of prime importance in this project. Such planning and execution is the full responsibility of the Contractor performing the work under these contract documents.

3.02 POWER OUTAGES

A. Interruption of the power to any electrical system for performing the construction work shall be scheduled in advance by use of an Access Request and approval will be at the convenience of the District.

B. Time of outages in individual buildings shall be scheduled for the times that the classrooms are not in session. Contractor to mobilize required work force and equipment to be able to accomplish individual tasks within permitted Work sequences.

C. Scheduling of any power outages shall be performed and approved as a part of the Work Plan and Scheduling process. In all cases, approval of power outages and procedures shall be obtained in writing by use of an Access Request at least two weeks prior to the Work. Request to be filed on Access Request Forms. This includes shut down of any equipment, system or system(s).

D. The work to any area with power outages shall be performed and proceed on a continuous, non-stopping basis until power is restored to all areas.

E. Contractor to consider all costs associated with difficulty of performing the work under restricted conditions in its bid price. Contractor shall also be responsible for any damages to District properties resulting from lack of performance in accordance with the requirements of this section and these contract documents.

3.03 FIELD INVESTIGATION OF INFORMATION

A. The information regarding each feeder and feeding each individual building as appear on the existing single line diagrams, is based on the best information available. However, it was considered impractical to verify the data by test outages prior to the actual need. The Contractor shall thus verify all buildings power sources, feeders data and initiate the work accordingly.
3.04 SPECIAL REQUIREMENTS FOR TRENCHING/EXCAVATING

A. To minimize access interference and facility disruption, open trench headings shall be limited to a maximum of 300 feet of trench. District may, upon written request allow additional headings to be open concurrently, if acceptable access and wayfinding means are provided by contractor.

B. Existing utilities shall be located by contractor through the contractor provided utility locating service subcontractor. USA will not locate utilities that are not within the public right of way (ie, no locating on campuses or private property). Utilities shall be clearly marked with non-permanent paint with depth estimates provided by the locating subcontractor.

C. Contractor shall pothole a minimum of 10' in advance of any powered trenching or excavating operations. Potholing shall locate and expose any and all utilities in the path of trenching or excavating activities. Potholing shall be by vacuum excavating equipment or hand digging. All utilities encountered shall be clearly marked, and hand excavated to prevent damage. (Exception: irrigation utilities are usually not readily located with underground survey equipment, and breakage is expected to occur - see Section 01 21 12 Allowances, for special allowances).

D. All utilities located, whether or not shown on contract drawings are to be marked on the project record drawings, as to size and service, with either a reference to station number or reference to permanent surface features, and elevations noted (referenced to sea level). At completion of the project, all such located utilities shall be incorporated in the electronic As-Built drawings required to be provided by this contract. Regardless of other requirements (or lack thereof) for As-Built Drawings, contractor shall provide As-Built, electronic documentation of ALL utilities crossed or exposed, indicating location, size, service and elevation, whether shown on contract documents or not.

3.05 SAFETY - (REGARDING POWER OUTAGES)

A. Contractor shall coordinate through the District, and implement a procedure to prevent accidental shut-down or injury. The procedure shall include a systematic method of tagging and locking the circuit breakers and switches. All circuit breakers and switches which can energize a circuit wherein work needs to be performed must be opened, tagged with warning signs and locked. Temporary grounding of the circuit and locking the circuit breaker(s)/switch(es) is required for all long circuits and for all circuits with operating voltage above 480 volts. Proper isolation of circuits on which work is to be performed shall be required for safety of the workers. The Contractor shall be fully responsible for implementing all required safety procedures to protect personnel.

B. The Contractor shall never assume, no matter how obvious the circumstances, that any conductor or piece of equipment is de-energized before it is handled by the workman, without actually testing for de energization. Primary conductors shall be tested with hot stick or similar means.

END OF SECTION
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01315

PROJECT MEETINGS

1 PART 1 GENERAL

1.1 Summary

1.1.1 Section includes descriptions of the required Project meetings for the Work. These meetings include:

(1) Preconstruction Conference.
(2) Schedule Review Meetings.
(3) Weekly Progress Meetings.
(4) Progress Schedule and Billing Meetings.
(5) Safety Meetings.

1.2 Preconstruction Conference

1.2.1 Owner or its representative will call for and administer Preconstruction Conference at time and place to be announced (usually the week prior to start of Work at the Site).

1.2.2 Contractor, all major Subcontractors, and major suppliers shall attend Preconstruction Conference.

1.2.3 Agenda will include, but not be limited to, the following items.

(1) Schedules
(2) Personnel and vehicle permit procedures
(3) Use of premises
(4) Location of the Contractor’s on-Site facilities
(5) Security
(6) Housekeeping
(7) Submittal and RFI procedures
(8) Inspection and testing procedures, on-Site and off-Site
(9) Utility shutdown procedures
(10) Control and reference point survey procedures
(11) Injury and Illness Prevention Program
(12) Contractor’s Initial Schedule
(13) Contractor’s Schedule of Values
(14) Contractor’s Schedule of Submittals
(15) Project Directory
(16) Contractor’s Emergency Contact List
(17) Environmental, Safety and Health procedures

D. Owner will distribute copies of minutes to attendees. Attendees shall have seven (7) Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Preconstruction Conference.

1.3 Initial Schedule Review Meetings

1.3.1 Pre-Construction Review of Initial Draft Schedules. Contractor shall meet with Owner prior to Start Date of the Work under Contract Documents and conduct initial review of Contractor’s draft Shop Drawing and Sample Submittal Schedule, draft Schedule of Values, and Initial Schedule. Authorized representative in Contractor’s organization, designated in writing, who will be responsible for working and coordinating with Owner relative to preparation and maintenance of Progress Schedule shall attend the initial schedule review meeting.

1.3.2 Pre-Payment Review of Second Draft Schedules.

(1) Unless otherwise provided in the Contract Documents, at least fifteen (15) Days before submission of the first application for payment, a conference attended by Contractor, Owner, and others as appropriate, will be held to review acceptability of the schedules submitted in accordance with this Paragraph, first reviewed at the Preconstruction Conference. Contractor shall have an additional seven (7) Days to make corrections and adjustments and to complete and resubmit the schedules. Schedules shall be updated and completed as required by Sections 01200.
(Measurement and Payment), 01320 (Progress Schedules and Reports) and 01300 (Contractor Submittals).

(2) Contractor shall have its manager, superintendent, scheduler, and key Subcontractor representatives, as required by Owner, in attendance. The meeting will take place over a continuous one (1) Day period. Owner review will be limited to submittal conformance to Contract Documents’ requirements including, but not limited to, coordination requirements. Owner review may also include:
   b. Directions to include activities and information missing from submittal.
   c. Requests of Contractor to clarify its schedule.

(3) Within five (5) Days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by Owner at the meeting.

1.3.3 Owner will administer Schedule Review Meetings and shall distribute minutes of Schedule Review Meetings to attendees. Attendees shall have five (5) Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Schedule Review Meetings.

1.4 Weekly Progress Meetings

1.4.1 Owner will schedule and administer weekly progress meetings throughout duration of Work. Progress meetings will be held weekly unless otherwise directed by Owner.
   (1) Meetings shall be held at Contractor’s on-Site office unless otherwise directed by Owner.
   (2) A Contractor's representative will prepare agenda and distribute it four (4) days in advance of meeting the Contractor.
   (3) Owner or its representative will record meeting notes of the Weekly Progress Meeting. Within three (3) Days after the meeting, Owner will distribute minutes to Contractor through e-mail, who will distribute to those affected by decisions made at meeting. Attendees can either submit comments or additions to minutes prior to the next progress meeting, or may attend the next progress meeting and submit comments or additions there. Minutes will constitute final memorialization of results of meeting.

1.4.2 Progress meetings shall be attended by Contractor’s job superintendent, major Subcontractors and suppliers, Owner, and others as appropriate to agenda topics for each meeting.

1.4.3 Agenda will contain the following items, as appropriate:
   (1) Review, revise as necessary, and approve previous meeting minutes
   (2) Review of Work progress since last meeting
   (3) Status of Construction Work Schedule, delivery schedules, adjustments
   (4) Submittal, RFI, and Change Order status
   (5) Review of the Contractor’s safety program activities and results, including report on all serious injury and/or damage accidents
   (6) Other items affecting progress of Work

1.5 Progress Schedule and Billing Meetings

1.5.1 A meeting will be held on approximately the 25th of each month or as otherwise agreed to with Owner (but no more than once every thirty {30} days) to review the schedule update submittal and progress payment application.
   (1) At this meeting, at a minimum, the following items will be reviewed:
      a. Percent complete of each activity;
      b. Time impact evaluations for Change Orders and Time Extension Request;
      c. Actual and anticipated activity sequence changes;
      d. Actual and anticipated duration changes; and
      e. Actual and anticipated Contractor delays.
   (2) These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, Contractor’s General Superintendent and Scheduler shall attend these meetings.
   (3) Contractor shall set aside sufficient time to review the progress schedule and the monthly pay application, and plan on the meeting taking no less than two hours.

1.6 Special Meetings
1.6.1 Any party may call special meetings by notifying all desired participants and Owner five (5) Days in advance, giving reason for meeting. Special meetings may be held without advance notice in emergency situations.

1.6.2 At any time during the progress of Work, Owner shall have authority to require Contractor attend meeting of any or all of the Subcontractors engaged in Work or in other work, and notice of such meeting shall be duly observed and complied with by Contractor.

1.6.3 Contractor shall schedule and conduct coordination meetings as necessary to discharge coordination responsibilities in Document 00700 (General Conditions). Contractor shall give Owner five (5) Days written notice of coordination meetings. Contractor shall maintain minutes of coordination meetings. Attendees shall have seven (7) Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of coordination meetings.

1.6.4 Contractor to submit minutes of meetings to all attendees within three (3) Days of the meeting.

1.7 Safety Meetings

1.7.1 Conduct monthly Contractor Safety Committee meetings.

1.7.2 Conduct weekly toolbox safety talks.

2 PART 2 PRODUCTS – NOT USED

3 PART 3 EXECUTION – NOT USED

END OF SECTION
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01320

PROGRESS SCHEDULES AND REPORTS

1 PART 1 GENERAL

1.1 Summary

1.1.1 Perform scheduling of Work under this Contract in accordance with requirements of this Section 01320.

1.1.2 Upon Award of Contract, immediately commence development of Initial Schedule to ensure compliance with schedule submittal requirements.

1.1.3 Contractor’s obligations under this Section 01320 are hereby deemed material obligations justifying Owner remedies for default if Contractor fails to perform. Nothing in this paragraph 1.1.3 of this Section 01320 or the lack of an express statement that any other Contract Documents provision is or is not material shall be considered in determining whether any such other provision is material.

1.1.4 Employ competent scheduling personnel or a schedule consultant with experience performing scheduling required herein on a minimum of two prior, similar projects, and with first-hand knowledge of this Project.

1.2 General

1.2.1 Progress Schedule shall be based on, and incorporate milestone and completion dates specified, in Contract Documents.

1.2.2 Overall time of completion and time of completion for each milestone shown on Progress Schedule shall adhere to times in Document 00520 (Agreement), unless an earlier (advanced) time of completion is requested by Contractor and agreed to by Owner. A Change Order shall formalize any such agreement.

1.2.3 Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.
1.2.4 Failure of Progress Schedule to include any element of the Work or any inaccuracy in Progress Schedule will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. Owner acceptance of Schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests, and shall not, in any manner, impose a duty of care upon Owner, or act to relieve Contractor of its responsibility for means and methods of construction.

1.2.5 Transmit to Owner by email, no less than monthly, current progress schedule in electronic form, to include the entire electronic file without abridgment, inclusive of all updates.

1.3 Initial and Original Progress Schedule

1.3.1 Initial Schedule submitted for review at the Preconstruction Conference shall serve as Contractor’s schedule for up to thirty (30) Days after the Notice to Proceed.

1.3.2 Initial Schedule must indicate detailed plan for the Work to be completed in first thirty (30) Days of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; and procurement of materials and equipment. Show Work beyond thirty (30) Days in summary form.

1.3.3 Contractor shall submit its Original Schedule for review no later than first progress payment. Original Schedule and all updates shall comply with all standards herein.

1.3.4 All Schedules shall be time-scaled.

1.3.5 All Schedules shall be cost-and resource-loaded. Accepted cost-and resource-loaded Schedule will be used as basis for monthly progress payments. Use of Initial Schedule for progress payments shall not exceed thirty (30) Days.

1.3.6 Except as otherwise expressly provided in this Section 01320, meet with Owner to review and discuss each Schedule (i.e., Initial, Original and monthly updates) within seven (7) Days after each Schedule has been submitted to Owner.

   (1) Owner review and comment on any Schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements).

   (2) Contractor shall make corrections to Schedule necessary to comply with Contract requirements and shall adjust Schedule to incorporate any missing information requested by Owner. Resubmit Initial Schedule if requested by Owner.

1.3.7 Initial Schedule shall identify the following milestone events:

   (1) Notice to Proceed date
   (2) Substantial completion and project completion at each construction phase
   (3) Start and completion dates for Work in each occupied space
   (4) Utility connections
   (5) Inspections

1.3.8 Original Schedule and all updates shall identify all Work activities by DSA, Permit Package (Bid Items), in proper sequence for the completion of the Work. Work activities shall include the following:

   (1) Major Contractor-furnished equipment, materials, and building elements, and scheduled activities requiring submittals or Owner prior approval.
      a. Show dates for the submission, review, and approval of each submittal. Dates shall be shown for the procurement, fabrications, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by Owner.
      b. A minimum of fifteen (15) working days shall be allotted for Owner review for each submittal.

   (2) System test dates
   (3) Dates Contractor request designated working spaces, storage areas, access, and other facilities to be provided by Owner
   (4) Dates Contractor requests orders and decisions from Owner
   (5) Dates Contractor requests Owner-furnished equipment
   (6) Dates Contractor requests Owner-furnished utilities
   (7) Connection and relocation of existing utilities
   (8) Connecting to or penetrating existing structures
   (9) Dates Contractor requests access to areas requiring removal of Asbestos containing materials by Owner
1.3.9 If Contractor is of the opinion that any of the Work included on its Schedule has been impacted, submit to Owner a written Time Impact Evaluation (TIE) in accordance with paragraph 1.8 of this Section 01320. The TIE shall be based on the most current update of the Initial Schedule.

1.4 Schedule Format and Level of Detail

1.4.1 Utilize Primavera computer-scheduling software, for all scheduling including schedule updates, and employ scheduling personnel experienced and competent in it. For all activities or impacts shown in schedule, Contractor shall complete all data points in the software to specifically include the activities, their durations, their logic ties and their resources.

1.4.2 Each Schedule (Initial, Original and updates) shall indicate all separate fabrication, procurement and field construction activities required for completion of the Work, including but not limited to the following:

(1) All Contractor, Subcontractor, and assigned Contractor work shall be shown in a logical work sequence that demonstrates a coordinated plan of work for all contractors. The intent is to provide a common basis of acceptance, understanding, and communication, as well as interface with other contractors.

(2) Activities related to the delivery of Contractor and Owner-furnished equipment to be Contractor-installed per Contract shall be shown.

(3) All activities shall be identified through codes or other identification to indicate the building (i.e. buildings, Site work) and Contractor/Subcontractor responsibility to which they pertain.

(4) Break up the Work schedule into activities of durations of approximately twenty-one (21) Work Days or less each, except for non-field construction activities or as otherwise deemed acceptable by Owner.

(5) Show the critical path in red. For each activity, show early start, late start, early finish, late finish, durations measured in Days, float, resources, predecessor and successor activities, planned workday/week for the activity, material quantities, and scheduled/actual progress payments.

1.4.3 Seasonal weather conditions (which do not constitute a delay as defined herein) shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures or presence of high moisture for the completion of the Work within the allotted Contract Time.

1.4.4 Failure by Contractor to include any element of Work required for performance of the Work on the detailed construction schedule shall not excuse Contractor from completing all Work required within the Contract Time.

1.4.5 A three-week “look ahead,” detailed daily bar chart schedule shall be updated and issued weekly in hard copy and electronically.

1.4.6 Monthly updates shall include schedule sorts in hard copy, by bid item (geographic work area) with critical items shown in red float and with early/late start and finish dates, to facilitate meaningful review and assessment of schedule.

1.5 Monthly Schedule Update Submittals

1.5.1 Following acceptance of Contractor’s Initial Schedule, Contractor shall monitor progress of Work and adjust Schedule each month to reflect actual progress and any anticipated changes to planned activities.

(1) Each Schedule update submitted shall be complete, including all information requested for the Initial Schedule and Original Schedule submittal.

(2) Each update shall continue to show all Work activities including those already completed. These completed activities shall accurately reflect “as built” information by indicating when activities were actually started and completed, and Contractor warrants the accuracy of as-built information as shown.

1.5.2 A meeting will be held on approximately the 25th of each month to review the Schedule update submittal and progress payment application.

(1) At this meeting, at a minimum, the following items will be reviewed: Percent complete of each activity; TIEs for Change Orders and Time Extension Request; actual and anticipated activity sequence changes; actual and anticipated duration changes; and actual and anticipated Contractor delays and critical issues.

(2) These meetings are considered a critical component of overall monthly schedule update submittal; have appropriate personnel attend. At a minimum, Contractor’s General Superintendent and
Scheduler shall attend these meetings.

(3) Plan on the meeting taking no less than four hours.

1.5.3 Within five Days after monthly Schedule update meeting, Contractor shall submit on CD the updated Schedule, and reports and charts, both in hard copy and on a CD.

1.5.4 Within five (5) Days of receipt of above-noted revised submittals, Owner will either accept or reject monthly schedule update submittal.

(1) If accepted, percent complete shown in monthly update will be basis for Application for Payment by Contractor. The schedule update shall be submitted as part of Contractor’s Application for Payment and a basis of such payment.

(2) If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.

1.5.5 Neither updating, changing or revising of any report, curve, schedule or narrative submitted to Owner by Contractor under this Contract, nor Owner review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying, in any way, the Contract Substantial Completion date or milestone dates or of modifying or limiting, in any way, Contractor’s obligations under this Contract.

1.6 Schedule Revisions

1.6.1 Updating the Schedule (Initial and Original) to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, however, revisions to activity durations and sequences are expected on a monthly basis.

1.6.2 To reflect revisions to the Schedule, provide Owner with a written narrative with a full description and reasons for each Work activity that is revised. For revisions affecting the sequence of Work, provide a schedule diagram that compares the original sequence to the revised sequence of Work. Contractor shall clearly show and discuss any changes in the critical path, and provide the written narrative and schedule diagram for revisions three (3) Days in advance of the monthly schedule update meeting.

1.6.3 Schedule revisions shall not be incorporated into any schedule update until Owner has reviewed the revisions. Owner may request further information and justification for schedule revisions and, within three (3) Days, provide Owner with a complete written narrative response to Owner request.

1.6.4 If Owner does not accept Contractor’s revision, and Contractor disagrees with Owner position, Contractor has seven (7) Days from receipt of Owner letter rejecting the revision, to provide a written narrative providing full justification and explanation for the revision. Contractor’s failure to respond in writing within seven (7) Days of Owner written rejection of a schedule revision shall be contractually interpreted as acceptance of Owner position, and Contractor waives its rights to subsequently dispute or file a claim regarding Owner position. If Contractor files a timely response as provided in this paragraph, and the parties are still unable to agree, then Owner and Contractor’s rights shall be as provided in Document 00700 (General Conditions), Article 12.

1.6.5 At Owner discretion, Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

1.7 Recovery Schedule

1.7.1 If a Schedule update shows a substantial completion date twenty-one (21) Days beyond any Contract Substantial Completion date, or individual Milestone completion dates, Contractor shall submit to Owner within seven (7) Days the proposed revisions to recover the lost time. As part of this submittal, Contractor shall provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of Work. If Owner requests, Contractor shall show the intended critical path; secure appropriate Subcontractor and supplier consent to the recovery Schedule; submit a narrative explaining trade flow and construction flow changes, duration changes, added/deleted activities, critical path changes and identify all near critical paths and man hour loading assumptions for major Subcontractors.

1.7.2 The revisions shall not be incorporated into any Schedule update until Owner has reviewed the revisions.

1.7.3 If Owner does not accept Contractor’s revisions, Owner and Contractor shall follow the procedures in paragraphs 1.6.3, 1.6.4 and 1.6.5 of this Section 01320.

1.7.4 At Owner discretion, Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.
1.8  Time Impact Evaluation for Change Orders and Other Delays

1.8.1  When Contractor is directed to proceed with changed work or otherwise requests a time extension, Contractor shall prepare and submit, within fourteen (14) Days from the direction to proceed, a TIE that includes both a written narrative and a schedule diagram depicting how the changed work affects other schedule activities. The schedule diagram shall show how Contractor proposes to incorporate the changed work in the schedule, and how it impacts the current Schedule update critical path or otherwise. Contractor is also responsible for requesting time extensions based on the TIE’s impact on the critical path. The diagram shall be tied to the main sequence of scheduled activities to enable Owner to evaluate the impact of changed work to the scheduled critical path. Use attached form.

1.8.2  Comply with the requirements of paragraph 1.8.1 of this Section 01320 for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.

1.8.3  Contractor is responsible for all costs associated with the preparation of TIEs, and the process of incorporating TIEs into the current schedule update. Provide Owner with four copies of each TIE both in hard copy and CD.

1.8.4  Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount Owner allows, and Contractor may submit a claim for additional time claimed by Contractor as provided in Document 00700 (General Conditions).

1.9  Time Extensions

1.9.1  Contractor is responsible for requesting time extensions for time impacts that, in the opinion of Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accordance with Document 00700 (General Conditions).

1.9.2  Where an event for which Owner is responsible impacts the projected Substantial Completion date, Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. Contractor shall also include a detailed cost breakdown of the labor, equipment, and material Contractor would expend to mitigate Owner-caused time impact. Contractor shall submit mitigation plan to Owner within fourteen (14) Days from the date of discovery of said impact. Contractor is responsible for the cost to prepare the mitigation plan.

1.9.3  Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.

1.9.4  No time will be granted under the Contract Documents for cumulative effect of changes.

1.9.5  Owner will not be obligated to consider any time extension request unless requirements of Contract Documents are complied with.

1.9.6  Failure of Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.

1.9.7  Notwithstanding any other provision of this Section 01320, if Contractor does not submit a TIE within the required fourteen (14) Days for any issue, Contractor hereby agrees that Contractor does not require a time extension for that issue.

1.10  Project Status Reporting

1.10.1  In addition to submittal requirements for scheduling identified in this Section 01320, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each Schedule as specified herein. Status reporting shall be in form specified in this paragraph 1.10 below.

1.10.2  Contractor shall prepare monthly written narrative reports of status of Project for submission to Owner. Written status reports shall include:

(1)  Status of major Project components (percent complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.

(2)  Progress made on critical activities indicated on each Schedule, including inspections.

(3)  Explanations for any lack of work on critical path activities planned to be performed during last month.

(4)  Explanations for any schedule changes, including changes to logic or to activity durations.

(5)  List of critical activities scheduled to be performed during the next month.

(6)  Status of major material and equipment procurement.
Any delays or other problems encountered during reporting period and recommendations for action to prevent such delays or problems from re-occurring.

Printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.

a. Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor’s daily reports. These reports will be basis for information provided in monthly and weekly printed reports.

b. Contractor shall explain all variances and mitigation measures.

Contractor may include any other information pertinent to status of Project. Include additional status information requested by Owner at no additional cost.

Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

At the close of each workday provide Owner with report of Contractor and its Subcontractors’ work activities for that day, including trades, equipment, work activities worked on, staff levels, and equipment deliveries. Use Owner supplied “Contractor Daily Project Report (attached), completing all portions applicable to that work day or other, as furnished by Owner.

Submit all reports and schedule files on CD, in addition to written copies.

Submit all DSA-required reports in the time, format and detail required by DSA.

END OF SECTION
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01330

SUBMITTAL PROCEDURES

1 PART 1 GENERAL

1.1 Summary

1.1.1 Section Includes:

(1) Description of general requirements for Submittals for the Work:
   a. Procedures
   b. Schedule of Shop Drawing and Sample Submittals
   c. Safety Program
   d. Progress Schedule
   e. Product Data
   f. Shop Drawings
   g. Samples
   h. Coordination Drawings
   i. Quality Assurance Control Submittals
      (i) Design Data
      (ii) Test Reports
      (iii) Certificates
      (iv) Manufacturers’ Instructions
      (v) Material Safety Data Sheets
   j. Installation, Operations, and Maintenance Manuals
   k. Computer Programs
   l. Project Record Documents

(2) Delay of Submittals

(3) Optional Review Meeting

1.2 Procedures

1.2.1 Submit at Contractor’s expense, seven (7) sets, the following items (“Submittals”) required by Contract Documents:

(1) Schedule of Shop Drawing and Sample Submittals
(2) Safety Plans
(3) Progress Schedule
(4) Product Data; Shop Drawings
(5) Samples
(6) Coordination Drawings
(7) Quality Assurance Control Data
(8) Machine Inventory Sheets
(9) Installation, Operation, and Maintenance Manuals
(10) Computer Programs
(11) Project Record Documents

1.2.2 Contractor shall submit these Submittals to Owner for review and approval in accordance with accepted Schedule of Shop Drawings and Samples Submittals. If no such schedule is agreed upon, then all Shop Drawing, Samples, and product data Submittals shall be submitted within twenty-one (21) Days after receipt of Notice of Award from Owner.

1.2.3 Contractor shall transmit each item with the appropriate Submittal transmittal form (form is located within the Prolog System). Contractor shall also identify Project, Contractor, Subcontractor, major supplier, pertinent Drawing sheet and detail number, and Specification Section number as appropriate. Where manufacturer’s standard drawings or data sheets are used, they shall be marked clearly to show those portions of the data that are applicable to this Project. Inapplicable portions shall be marked out. Submittals shall be submitted based on each Specification Section. Submittals containing information about more than one Specification Section will be returned for re-submittal. Submittals shall include all...
1.2.4 The data shown on the Submittals shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show Owner the materials and equipment Contractor proposes to provide and to enable Owner to review the information for the limited purposes specified in this Section 01330. Submittals shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which it is intended and otherwise as Owner may require to enable Owner to review the Submittal. The quantity of each Submittal to be submitted will be as required by individual Specification Sections or this Section 01330.

1.2.5 At the time of each submission, Contractor shall give Owner specific written notice of all variations, if any, that the transmitted Submittal may have from the requirements of the Contract Documents, and the reasons therefore. This written notice shall be in a written communication attached to the Submittal transmittal form. In addition, Contractor shall cause a specific notation to be made on each Submittal submitted to Owner for review and approval of each such variation. If Owner accepts deviation, Owner will note its acceptance on the returned Submittal transmittal form and, if necessary, issue appropriate Contract Modification.

1.2.6 Submittal coordination and verification is Contractor’s responsibility; this responsibility shall not be delegated in whole or in part to Subcontractors or suppliers. Before submitting each Submittal, review and coordinate each Submittal with other Submittals and with the requirements of the Work and the Contract Documents, and determine and verify:

1.2.7 Contractor’s submission to Owner of a Submittal shall constitute Contractor’s representation that it has satisfied its obligations under the Contract Documents, and as set forth immediately above in this paragraph 1.2 of Section 01330, with respect to Contractor’s review and approval of that Submittal.

1.2.8 Designation of work “by others,” if shown in Submittals, shall mean that work will be responsibility of Contractor rather than Subcontractor or supplier who has prepared Submittals.

1.2.9 After review by Owner of each of Contractor’s Submittals, one set of material will be returned to Contractor with actions defined as follows:

1.2.10 Contractor shall make a complete and acceptable Submittal at least by second submission. Owner reserves the right to deduct monies from payments due Contractor to cover additional costs of review beyond the second submission. Illegible Submittals will be rejected and returned to Contractor for resubmission. Contractor shall be in breach of the Contract if Contractor’s first re-submittal, following a Submittal which Owner determines falls within categories (3) or (4) above, does not fall within categories (1) or (2) above.

1.2.11 Favorable review will not constitute acceptance by Owner of any responsibility for the accuracy, coordination and completeness of the Submittals. Accuracy, coordination, and completeness of Submittals shall be sole responsibility of Contractor, including responsibility to back-check comments, corrections, and modifications from Owner review before fabrication. Contractor, Subcontractors, or suppliers may prepare Submittals, but Contractor shall ascertain that Submittals meet requirements of Contract Documents, while conforming to structural space and access conditions at point of installation. Owner review will be only to assess if the items covered by the Submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as indicated by the Contract Documents. Favorable review of
Submittal, method of work, or information regarding materials and equipment Contractor proposes to furnish shall not relieve Contractor of responsibility for errors therein and shall not be regarded as assumption of risks or liability by Owner, or any officer or employee thereof, and Contractor shall have no claim under Contract Documents on account of failure or partial failure or inefficiency or insufficiency of any plan or method of work or material and equipment so accepted. Favorable review shall be considered to mean merely that Owner has no objection to Contractor using, upon Contractor’s own full responsibility, plan or method of work proposed, or furnishing materials and equipment proposed.

1.2.12 Owner review will not extend to the means, methods, techniques, sequences or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.2.13 Contractor shall submit complete initial Submittal for those items where required by individual Specification Sections. Complete Submittal shall contain sufficient data to demonstrate that items comply with Specifications, shall meet minimum requirements for submissions cited in Specification Sections, shall include motor data and seismic anchorage certifications, where required, and shall include necessary revisions required for equipment other than first named. If Contractor submits incomplete initial Submittal when complete Submittal is required, Submittal may be returned to Contractor without review.

1.2.14 Reproduce and distribute copies of shop drawings and copies of product data which carry the Architect’s review stamp to:

1. Jobsite file
2. Record Documents file
3. Other affected contractors, if any
4. Subcontractors
5. Supplier or fabricator

Distribute samples which carry the Architect’s stamp as directed.

1.2.15 After Owner review of Submittal, Contractor shall revise as noted and resubmit as required. Contractor shall also identify changes made since previous Submittal, and:

1. Begin no fabrication or work that requires Submittals until return of Submittals not requiring re-submittal. Do not extrapolate from Submittals covering similar work.
2. Normally, Submittals will be processed and returned to Contractor within twenty-one (21) Days of receipt.

1.2.16 Contractor shall distribute copies of reviewed Submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.2.17 All Submittals shall be number-identified by Contractor, prior to submission to Owner, in accordance with the following:

1. Sequentially number each Submittal (i.e., “1”, “2”, “3”, etc.) as the basis for number identification of Submittals.
2. Affix the Submittal number under which each Submittal is made on every copy of each Shop Drawing, product data, sample, certification, etc.
3. Number Installation, Operation, and Maintenance Manuals with original root number of the approved Submittal for the item.
4. If the Submittal is a re-submittal (including without limitation after an initial Submittal is rejected, returned without review or marked ‘Revise as Noted and Resubmit’), add the suffix designation “A” (i.e., a re-submittal of Submittal 1 would be numbered 1A). Subsequent re-submittals would be identified by the Submittal number and sequential letters (i.e., “B”, “C”, “D”, etc.).
5. All Submittals shall include all information requested by each Specification Section. No partial Submittals will be accepted unless previously authorized by Owner. In the event a partial Submittal is authorized, each subsequent different Submittal (as opposed to re-submittal) is given a new number.
6. Submittals shall contain:
   a. The submittal number
   b. The date of submission and the dates of any previous submissions
   c. The project title and number
   d. Contract identification
   e. The names of:
      (i) Contractor
      (ii) Supplier
(iii) Manufacturer
f. Identification of product, with the Specification Section number
g. Field dimensions, clearly identified as such
h. Relation to adjacent or critical features of the Work or materials
i. Applicable standards, such as ASTM or Federal Specification numbers
j. Identification of deviations from Drawings and Specifications
k. Identification of revision on re-submittals
l. An 8-inch x 3-inch blank space for Architect’s and/or consultants’ stamps
m. Contractor’s stamp, initialed or signed, to clarify review of submittal, verification of products, field dimensions and field construction criteria, and coordination of the information within the submittal with requirements of the work and of the Drawings and Specifications

1.2.18 Submission Requirements:
   (1) Deliver Submittals to Owner at least thirty (30) Days before dates reviewed Submittals will be needed.
   (2) Initial Submittal of Installation, Operation, and Maintenance Manuals shall be forty-five (45) Days after the date Submittals that pertain to the applicable portion of the Installation, Operation, and Maintenance Manual is satisfactorily reviewed.
   (3) The following table lists the number of initial Submittals required from Contractor for each type of submission, to whom Contractor shall distribute the information, and Owner distribution of reviewed submissions. If Contractor needs more copies of reviewed Submittals returned to it, then either submit additional copies or make copies from the returned transparency Submittal. Submittals requiring resubmission will require the same quantity and distribution as an initial Submittal.

<table>
<thead>
<tr>
<th>Submittal</th>
<th>Contractor Initial Submittal</th>
<th>Owner Submittal Review Return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of Original Transparencies</td>
<td># of Copies/Prints/Samples</td>
</tr>
<tr>
<td></td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td>Shop Drawings</td>
<td>Owner</td>
<td>Contractor</td>
</tr>
<tr>
<td>Product Data Samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation, Operation, and Maintenance Manuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Documents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4) Accompany Submittals with Submittal transmittal form, in duplicate, containing:
a. Date, revision date, and Submittal log number.
b. Project name and Owner Contract number.
c. Contractor’s name, address, and job number.
d. Specification Section number clearly identified.
e. The quantity of Shop Drawings, Product Data, or Samples submitted.
h. Other pertinent data.

1.2.19 Resubmission requirements:
   (1) Shop Drawings:
a. Revise initial Shop Drawings as required and resubmit as specified for initial Submittals.
b. Indicate on Shop Drawings any changes that have been made other than those requested by Owner.
   (2) Product Data and Samples:
a. Submit new Product Data and Samples as required for initial Submittals.
(3) Installation, Operation, and Maintenance Manuals:
   a. Revise initial Installation, Operation, and Maintenance Manual(s) as required and resubmit as specified for initial Submittals.

1.2.20 Number of resubmissions:
(1) One (1) re-examination of Contractor’s Submittals that have been returned for correction or replacement will be included in Owner budget. Any additional re-examination of Contractor’s Submittals will be considered additional scope services to be paid by Contractor through Owner. Contractor shall pay Owner (or Owner may deduct from any progress or final payment), for engineering personnel, on an hourly basis at 2.5 times direct payroll expenses, and for consultant personnel time at 1.25 times the amount billed Owner.

1.3 Schedule of Shop Drawing and Sample Submittals

1.3.1 Contractor shall submit preliminary Schedule of Shop Drawing and Sample Submittals as required by Document 00700 (General Conditions). Contractor shall submit two copies of final and accepted Schedule of Shop Drawings and Sample Submittals as required by paragraph 1.2.1(1) of this Section 01330.

1.3.2 Schedule of Shop Drawing and Sample Submittals will be used by Owner to schedule its activities relating to review of Submittals. Schedule of Submittals shall indicate a spreading out of Submittals and early Submittals of long-lead-time items and of items that require extensive review.

1.3.3 Schedule of Shop Drawing and Sample Submittals will be reviewed by Owner and shall be revised and resubmitted until accepted by Owner.

1.3.4 Unless otherwise specified, Contractor shall make Submittals in groups containing all associated items to assure that information is available for checking each item when it is received. Contractor shall identify on the Submittal which Submittals should be reviewed together.

1.3.5 Contractor shall prepare the Submittal Schedule and coordinate it with the Contract Schedule. No submittals will be processed before the Submittal Schedule has been submitted to and accepted by the Architect, except in such cases where the processing of submittals is required before the acceptance of the Submittal Schedule.

1.3.6 In preparing the Submittal Schedule, Contractor must first determine from the Contract Schedule the date the particular item is needed for the Work. Working backwards, Contractor will add the required number of days for shipment, time for fabrication, and similar items to determine the date of the first submittal.

1.3.7 The Submittal Schedule shall be adjusted to meet the needs of the construction process and Contract Schedule. Submit two (2) copies of the Submittal Schedule after it is completed and each time it is updated by Contractor.

1.4 Safety Program

1.4.1 Submit three (3) copies of Safety Program specific to these Contract Documents to Owner within the time set forth in Section 01540 (Site Security and Safety), paragraph 1.5.

1.5 Progress Schedule

1.5.1 See Section 01320 (Progress Schedules and Reports) for schedule and report requirements. Section 01320 shall control in any conflict with Section 01330.

1.5.2 Submit one (1) reproducible and three (3) print copies of schedule at each of the following times:
   (1) Initial Progress Schedule at the Preconstruction Conference.
   (2) Original Schedule within twenty (20) Days of the Notice to Proceed date.
   (3) Adjustments to the Schedule as required.
   (4) Schedule updates monthly, seven (7) Days prior to monthly progress meeting.

1.5.3 Submit four (4) copies of the reports listed in Section 01320 (Progress Schedules and Reports) with:
   (1) Initial Schedule
   (2) Original Schedule
   (3) Each monthly Schedule update

1.5.4 Progress Schedules and Reports shall be submitted via email and on CD or thumb drives, using software described in paragraph 1.4.5 of Section 01320, in addition to hard copies specified in this paragraph 1.5. Electronic files shall be complete copies, including all programs and electronic coding.

1.6 Product Data

1.6.1 Within ten (10) Days after Start Date of the Contract Time, Contractor shall submit two (2) copies of complete list of major products proposed for use, with name of manufacturer, telephone number, trade
name, and model number of each product. Tabulate product data by Specification Section.

1.6.2 For products specified only by reference standards, Contractor shall give manufacturer, trade name, model or catalog designation, and reference standards.

1.6.3 Product or Catalog Data:
(1) Manufacturer’s standard drawings shall be modified to delete non-applicable data or include applicable data.
(2) For manufacturer’s catalog sheets, brochures, diagrams, schedules, charts, illustrations and other standard descriptive data, Contractor shall:
   a. Mark each copy to identify pertinent materials, products, or models.
   b. Show dimensions and clearances required, performance characteristics and capacities, wiring diagrams and controls.
   c. Include applicable MSDS.

1.6.4 Supplemental Data. Contractor shall:
(1) Submit number of copies that Contractor requires, plus four (4) copies that will be retained by Owner.
(2) Mark each copy to identify applicable products, models, options, and other data, and supplement manufacturer’s standard data to provide information unique to Project.

1.6.5 Contractor shall provide copies for Project Record Documents described in Section 01770 (Contract Closeout).

1.7 Shop Drawings

1.7.1 Minimum Sheet Size: 8½ inches by 11 inches. All others: Multiples of 8½ inches by 11 inches, 34 inches by 44 inches maximum.

1.7.2 Original sheet or reproducible transparency will be marked with Owner review comments and returned to Contractor.

1.7.3 Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers’ standard data to provide information unique to Work.

1.7.4 Include manufacturers’ installation instructions when required by Specification Section.

1.7.5 If Contractor submits Shop Drawings for items that Shop Drawings are not specified, Owner will not be obliged to review them.

1.7.6 Contractor is responsible for procuring copies of Shop Drawings for its own use as it may require for the progress of the Work.

1.7.7 Shop Drawings shall be drawn to scale and completely dimensioned, giving plan view together with such sectional views as are necessary to clearly show construction detail and methods.

1.8 Samples

1.8.1 Contractor shall submit full range of manufacturers’ standard colors, textures, and patterns for Owner selection.

1.8.2 Contractor shall submit samples to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Contractor shall coordinate Submittal of different categories for interfacing work.

1.8.3 Contractor shall include identification on each sample, giving full information.

1.8.4 Sizes: Unless otherwise specified, Contractor shall provide the following:
(1) Paint Chips: Manufacturers’ standard
(2) Flat or Sheet Products: Minimum 6 inches square, maximum 12 inches square
(3) Linear Products: Minimum 6 inches, maximum 12 inches long
(4) Bulk Products: Minimum 1 pint, maximum 1 gallon

1.8.5 Full size samples may be used in Work upon approval by Owner.

1.8.6 Field Samples and Mock-ups (if applicable):
(1) Contractor shall erect field samples and mock-ups at Site in accordance with requirements of Specification Sections. If testing is conducted, record and certify results and full Contract compliance.
(2) Contractor shall modify or make additional field samples and mock-ups as required to provide appearance and finishes approved by Owner.
(3) Approved field samples and mock-ups may be used in Work upon approval by Owner.
(4) Contractor shall construct or prepare as many additional Samples as may be required, as directed by Owner, until desired textures, finishes, and/or colors are obtained.
(5) Accepted Samples and mock-up shall serve as the standard of quality for the various units of work.

1.8.7 No review of a Sample shall be taken in itself to change or modify the requirements in the Contract Documents.

1.8.8 Finishes, materials, and workmanship in the completed Work shall match accepted Samples.

1.8.9 Remove mock-ups at conclusion of Work.

1.9 Coordination Drawings

1.9.1 For all areas of the Work, obtain shop drawings from each discipline and produce a coordinated, composite drawing that indicates the relationship of the mechanical pipes, ductwork and equipment with all automatic sprinkler pipes, electrical conduits, electrical equipment, structural members and existing utilities. Indicate clearances between Work of the mechanical, structural, electrical existing utilities and the Work of other trades.

(1) Prepare and submit Coordination drawings sufficiently in advance (i.e., 90 days or more) of scheduled date for affected area.

(2) Use minimum scales of one-quarter inch per foot for floor plans and one-half inch per foot for sections.

1.10 Quality Assurance Control Submittals

1.10.1 Test Reports:

(1) Contractor shall submit three (3) copies; one (1) copy will be marked with Owner review comments and returned to Contractor.

(2) Contractor shall indicate that material or product conforms to or exceeds specified requirements.

(3) Reports may be from recent or previous tests on material or product, but shall be acceptable to Owner. Comply with requirements of each individual Specification Section.

1.10.2 Certificates:

(1) Contractor shall submit five (5) copies; one (1) copy will be marked with Owner review comments and returned to Contractor.

(2) Contractor shall indicate that material or product conforms to or exceeds specified requirements.

(3) Contractor shall submit supporting reference data, affidavits, and certifications as appropriate.

(4) Certificates may be recent or from previous test results on material or product, but shall be acceptable to Owner.

1.10.3 Manufacturers’ Instructions. Contractor shall:

(1) Submit three (3) copies; one (1) copy will be marked with Owner review comments and returned to Contractor.

(2) Include manufacturers’ printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.

(3) Identify conflicts between manufacturers’ instructions and Contract Documents.

1.10.4 Material Safety Data Sheets:

(1) In addition to Material Safety Data Sheets (MSDS) otherwise required by the Contract Documents, Contractor shall submit five (5) copies for any paints, solvents, thinners, varnish, lacquer, glues and adhesives, mastics, or other materials needed for the Project as required by the individual Specification Sections or as otherwise specified in the Contract Documents.

(2) MSDS required for a Submittal shall be submitted with product data in order for the Submittal to be reviewed.

1.11 Installation, Operations, and Maintenance Manuals

1.11.1 Sheet Size: 8½ x 11 inch

1.11.2 Drawing Size: Contractor shall reduce drawings or diagrams to an 8½ x 11 inch or 11 x 17 inch size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes bound into the binder. Identify vinyl envelopes with drawing numbers.

1.11.3 Binding: Contractor shall bind in stiff, metal-hinged, three-ring binder(s) with standard three-hole punching.

1.11.4 Multiple Items: Multiple items may be combined into one binder; tab each section with plastic-coated dividers.

1.11.5 Page Protectors: Contractor shall provide plastic sheet lifters prior to first page and following last page.
1.11.6 Binder title: Contractor shall include the following title on front and spine of binder:

THE PERALTA COMMUNITY COLLEGE DISTRICT,
Merritt College, CHW Infrastructure Project
INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, 20____

1.11.7 Contents:
(1) Introductory Information shall include:
   a. Title page providing the same information as paragraph 1.11.6 above
   b. Contractor’s name, address, and telephone number
   c. Table of Contents

(2) Include, at a minimum, the following detailed information for each item as applicable and as required by individual Specification Sections:
   a. Equipment function, normal operating characteristics, limiting operations.
   b. Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
   c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
   d. Lubrication and maintenance instructions including specific type and amount of lubricant and recommended lubrication interval.
   e. Guide to "troubleshooting."
   f. Parts list and predicted life of parts subject to wear.
   g. Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, labeled wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
   h. Test data and performance curves.
   i. A list of recommended spare parts with a price list and a list of spare parts provided under this Contract.
   j. Copies of parts lists or other documents packed with equipment when delivered.
   k. Instrumentation or tag numbers relating the equipment back to the Contract Documents.

(3) Index

1.11.8 Final Submittal: Upon favorable review of Installation, Operation, and Maintenance Manual(s) by Owner, Contractor shall deliver nine (9) additional hard copies and one (1) electronic media format copy of the final approved Installation, Operation, and Maintenance Manual(s). Electronic media format copy shall include all tables, charts, drawings, codes and all other matters reflected in hard copies. Contractor shall complete the Equipment and Tasks lists in digital format for each piece of equipment supplied.

1.11.9 Electronic Media Format: Compatible with Microsoft® Word 2000 for Windows, AutoCAD 2000 Land Development Desktop for Windows in drawing format (.DWG), or Adobe (.PDF) unless directed otherwise by Owner. All files shall be delivered on a unique CD-ROM.

1.11.10 Draft Submittal: The Draft Submittal of Installation, Operation, and Maintenance Manuals shall be submitted to Owner prior to equipment startup.

1.12 Computer Programs

1.12.1 When any equipment requires operation by computer programs, Contractor shall submit copy of program on appropriate diskette, plus a hard-copy and an electronic copy (Adobe .PDF format) of all user manuals and guides for operating the programs and making changes in the programs for upgrading and expanding the databases. All programs shall be Windows 2000 compatible. Contractor shall provide required licenses to Owner at no additional cost.

1.13 Project Record Documents

1.13.1 Contractor shall submit one (1) copy of each of the Project Record Documents listed in Section 01770 (Contract Closeout).

1.14 Delay of Submittals

1.14.1 Delay of Submittals by Contractor is considered avoidable delay. Liquidated damages incurred because of late Submittals will be assessed to Contractor.
1.15 **Optional review meeting**

1.15.1 At the Contractor’s request, in order to facilitate the timeliness of the review process, Owner may schedule a meeting to review the materials submitted. If this option is exercised, the following requirements apply:

1. Contractor shall request a meeting date with Owner at least ten (10) Business Days in advance.
2. Contractor shall provide the complete package of Submittal information at least five (5) Business Days in advance of the meeting.
3. The meeting shall take place at Owner office. Owner will provide the authorized staff to review and respond on the Submittal information during the meeting.
4. Contractor shall make available for this meeting the job superintendent and/or foreman, Contractor’s safety officer, and someone knowledgeable of all the items submitted and authorized to make substitutions or changes.

2 **PART 2 PRODUCTS – NOT USED**

3 **PART 3 EXECUTION – NOT USED**

END OF SECTION
## EXHIBIT A

**SUBMITTAL TRANSMITTAL NO.**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>[Enter Name of Owner] [ENTER PROJECT TITLE]</th>
<th>Date Received:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ENTER NAME OF OWNER]</td>
<td></td>
<td>Checked By:</td>
</tr>
<tr>
<td>[ENTER OWNER’S ADDRESS]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contractor:</th>
<th>Log Page:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Attention:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification Section Number:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Submittal</td>
<td></td>
</tr>
<tr>
<td>Resubmittal</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date Transmitted:</th>
<th>Previous Transmittal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. Copies</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Dwg. or Data No.</th>
<th>Action Taken*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

* The action designated above is in accordance with the following legend:

- **A** – No Exceptions Taken
- **B** – Make Corrections Noted (No Resubmission Required)
- **C** – Make Corrections Noted and Resubmit
- **D** – Not Approved
  1. Not enough information for review
  2. No reproducibles submitted
  3. Copies illegible
  4. Not enough copies submitted
  5. Wrong sequence number
  6. Wrong resubmittal number
  7. Wrong Specification section number
  8. Wrong form used
  9. See comments
  10. See comments

- **E** – Owner review not required
  1. Submittal not required
  2. Supplemental information. Submittal retained for informational purposes only
  3. Information reviewed and approved on prior Submittal
  4. See comments

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
</table>

By | Date |
---|------|

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐
## EXHIBIT B

### INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

#### TRANSMITTAL NO.

<table>
<thead>
<tr>
<th>Project Name: [Enter Name of Owner] [ENTER PROJECT TITLE]</th>
<th>Date Received:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>[ENTER NAME OF OWNER]</th>
<th>Checked By:</th>
</tr>
</thead>
</table>

| [ENTER OWNER’S ADDRESS] | |
|--------------------------|-----------------

<table>
<thead>
<tr>
<th>Contractor:</th>
<th>Log Page:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Address:</th>
<th>Address:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Attention:</th>
<th>Attention:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Date Transmitted:</th>
<th>Previous Transmittal Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>No. Copies</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Dwg. or Data No.</th>
<th>Action Taken*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Remarks:</th>
</tr>
</thead>
</table>

### Specification Section Number:

<table>
<thead>
<tr>
<th>1st Submittal</th>
<th>Resubmittal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The action designated above is in accordance with the following legend:

- **A** – No exceptions taken
- **B** – Make Corrections Noted (No Resubmission Required)
- **C.** – Make Corrections Noted and Resubmit
- **D** – Not Approved—this manual Submittal is deficient in the following area:
  1. Equipment record sheets
  2. Functional description
  3. Assembly, disassembly, installation, alignment, adjustment, and checkout instructions
  4. Operating instructions
  5. Lubrication and maintenance instructions
  6. Troubleshooting guide
  7. Parts list and ordering instructions
  8. Organization (indexing and tabbing)
  9. Wiring diagrams and schematics specific to installation
  10. Outline, cross section, and assembly diagrams
  11. Test data and performance curves
  12. Tag or equipment identification numbers
  13. See comments

**Comments**

---

### Distribution:

- Contractor [ ]
- File [ ]
- Field [ ]
- Owner [ ]
- Other [ ]

---

Error! Unknown document property name.
PART 1 GENERAL

1.1 SCOPE

Contractor shall prepare and submit written safety Plans and Programs as specified herein prior to start of the Work. All written safety Plans and Programs required to be submitted herein must be favorably reviewed by Owner prior to the Contractor starting Work.

1.2 OWNER’S REVIEW OF SUBMITTALS

Neither Owner review of, nor comments on, any of the submittals shall constitute a representation of warranty as to compliance with any legal requirements. Owner reserves the right to reject all or portions of a submittal as inadequate to protect health, or safety. If conditions change, Contractor shall promptly update the Plans and Programs, as appropriate, and submit the revised Plans and Programs to Owner at no additional charge to Owner.

1.3 PLANS AND PROGRAMS

A. Submit the following site-specific, checked items within the time period established in Document 00510 Notice of Award and, in any event, prior to starting Work: [CHECK ITEMS THAT APPLY]

☐ 1. Health and Safety Plan:
   - For Non-Hazardous Waste Operations:
     Describe the health and safety hazards anticipated in performing the work, measures to be taken to reduce those hazards and to protect employees and the public. Include procedures for identifying and reporting unforeseen hazards.
   - For Potential Hazardous Waste Operations:
     Describe the health and safety hazards anticipated in performing the work, measures to be taken to reduce those hazards and to protect employees and the public. Include procedures for identifying and reporting unforeseen hazards.
   - For Identified Hazardous Waste Operations:
     All aspects of the Health and Safety Plan shall comply with CCR Title 8, Section 5192 (Cal/OSHA), Hazardous Waste Operations and Emergency Response (HAZWOPER), and who is qualified to identify potentially hazardous wastes or contaminated soils which might be encountered on the jobsite. Describe methods of identifying these materials and communicating the findings to Owner. The Plan does not need to comply with CCR Title 8, Section 5192 (Cal/OSHA).

☐ c. For Identified Hazardous Waste Operations:

   All aspects of the Health and Safety Plan shall comply with CCR, Title 8, Section 5192 (Cal/OSHA), Hazardous Waste Operations and Emergency Response. The Plan shall be signed by an individual Certified in the Comprehensive Practice of Industrial Hygiene (CIH) by the American Board of Industrial Hygiene and trained in hazardous waste site operations as required by Section 5192. If hazard conditions change, promptly update the Plan and resubmit to Owner, at no additional charge to Owner.

Include the following items:

1) Training, medical, and respirator approval documentation for all employees who will work at the site.
2) The names and addresses of the waste hauler and the landfill for hazardous waste.
2. Asbestos Abatement Program in accordance with CCR Title 8, Section 1529 (Cal/OSHA):
   Include the following items:
   a. Registration with Cal/OSHA as an Asbestos Abatement Contractor, (required for removing more than 100 square feet of materials containing greater than 0.1 percent asbestos).
   b. Notifications for asbestos work, including Cal/OSHA, the Air Quality Management District, and, where appropriate, EPA Region.
   c. Training, medical, and respirator approval documentation for all employees who will work at the site.
   d. The identity of the Competent Person, as defined by Cal/OSHA.
      A work plan to prevent asbestos fibers and debris being dispersed from the work area into the building or the environment, including diagrams showing:
      1) Staging of the project.
      2) Placement and number of negative air machines and exhausts.
      3) Staging of waste containers.
   e. Weekly progress reports as the project progresses.
   f. At project completion, documentation, including daily reports or logs, air monitoring results, waste manifests, and other similar pertinent information.
   g. Material Safety Data Sheets for hazardous materials brought onto the site.
   h. Procedures for identifying and reporting unforeseen hazards.
   i. The names and addresses of the waste hauler and the landfill for asbestos waste.

3. Lead Compliance Program in accordance with CCR Title 8, Section 1532.1 (Cal/OSHA):
   Include the following checked items:
   a. Training, medical, and respirator approval documentation for all employees who will work at the site.
   b. The identity of the Competent Person, as defined by Cal/OSHA.
   c. Material Safety Data Sheets for hazardous materials brought onto the site.
   d. The Contractor's procedures for identifying and reporting unforeseen hazards.
   e. The names and addresses of the waste hauler and the landfill for hazardous and non-hazardous wastes.

4. Storm Water Pollution Prevention Plan (SWPPP) including:
   a. A site map identifying storm drain inlets.
   b. Identification of potential sources of pollution.
   c. A plan to eliminate non-storm water discharges such as wastewater, spills, and others.
   d. Best Management Practices (BMP) to minimize discharges of pollutants in storm water runoff.
   e. How agencies and Owner will be notified in case of spills.

5. Compliance with State General Construction Activity Storm Water NPDES Permit, including:
   a. Development of a Storm Water Pollution Prevention Plan that complies with all requirements of the General Construction Activity Storm Water Permit.
   b. Development of a color coded site map showing:
      1) Areas of soil disturbance that have been stabilized.
      2) Areas to be graded, in addition to a time schedule.
      3) Areas of potential soil erosion where control practices will be implemented (Indicate the control practices and time schedule for implementation).
      4) Locations of post-construction projects (i.e., ponds, grassy swales, detention basins).
   c. Development of a Site Inspection Checklist.
   d. Submittal of the Site Inspection Checklist on a weekly basis.

6. Disposal of Fluorescent Lights and/or Ballasts Plan, as applicable.

7. Soil and Groundwater Management Plan:
   Describe how any disturbed soil or collected water will be handled, including temporary storage, testing and/or treatment, and disposal. Identify all activity where potential exists for
waste to be generated, including materials associated with the destruction of monitoring wells.
Where feasible, excavated soil from utility trenching may be placed back within the utility corridor near the original excavation.
Soil that cannot be placed back in the utility trench, and waste generated from other activities shall be tested by the Contractor as per General Conditions, Article 14.1, Alterations, Modifications and Force Account Work. The Contractor shall provide the name of an analytical laboratory and contact name for coordinating environmental testing.

☑️ 8. Debris Containment Program:
Describe the control of debris generated by the performance of the work and how the work area will be maintained unencumbered by the debris confined inside the work area.

☑️ 9. Soil and Air Pollution Management Plan:
Describe measures to be taken to control dust and prevent pollution of soil, and air resulting from the performance of the work. Describe in detail how dust, air emissions, and/or soil pollutants generated during the performance of the work will be minimized, controlled, contained, treated, and/or disposed. The Plan shall include development of a Site Inspection Checklist to be completed and submitted on a weekly basis. The Plan must also incorporate air pollution controls described in these specifications.

B. If checked, the following Plans and Programs must be made available within ten (10) calendar days only after being requested by Owner. Do not submit unless and until requested:

☑️ 1. Injury and Illness Prevention Program, in accordance with CCR Title 8, Section 3203 (Cal/OSHA).
☐ 2. Hazard Communication Program, in accordance with CCR Title 8, Section 5194 (Cal/OSHA)
☐ 3. Respiratory Protection Program, in accordance with CCR Title 8, Section 5144 (Cal/OSHA).
☑️ 4. Confined Space Entry Program, in accordance with CCR Title 8, Article 108. (Cal/OSHA).
☑️ 5. Lockout/Tagout Program, in accordance with CCR Title 8, Sections 3314 and 2320 (Cal/OSHA).
☑️ 6. Name of individual(s) having current Red Cross-equivalent first aid and CPR training.
☑️ 7. Trenching and Shoring Plan, in accordance with CCR Title 8, Article 6 (Cal/OSHA).

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION
SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

1.01 OCCUPANCY

A. The District intends to occupy all buildings and to run a normal campus schedule and environment over the entire duration of the Work. All activities, all classes and all operations associated with the entire population of students, staff and administrators will be in full operation. Therefore, access to and through the Campus and to and through each and every building must be available and clearly marked at all times.

B. The Contract, the Work, the Work Sequences and the Work Schedules shall be developed and deployed so as to accommodate this fully operational Campus environment. For this reason, a formal Work Plan shall be developed and updated weekly. Within the Work Plan process, the Contractor shall be responsible to notify the District a minimum of three weeks in advance of work which will directly affect a specific area.

C. This Work is of critical importance to the long range viability of the campus. For this reason, it is the intent of the District to develop a high functioning, supportive and fully cooperative relationship between the Contractor and the District. Critical components relating to this relationship include that:
   1. The Contractor shall cooperate with the District to minimize conflict and to facilitate District operations.
   2. The Contractor shall ensure that all work is scheduled (and, as necessary, rescheduled) to accommodate anticipated and unanticipated interference to Campus learning activities, operations and social activities.
   3. The Contractor shall implement all possible procedures to protect property adjacent to the construction project from damage resulting from work specified and performed within this Contract.
   4. The Contractor shall provide safe, clearly marked, unobstructed access to and throughout the Campus and to and throughout each building over the entire duration of the project. Furthermore, the Contractor shall maintain fire lanes and related access at all times.
   5. The Contractor shall take special considerations for pedestrian safety and convenience when any work area encroaches upon a sidewalk, walkway or crosswalk area.
   6. The District will make every possible effort to ensure that the Contractor is paid on a timely basis.
   7. The District will make every possible effort to ensure that Contractors submittals, requests, and Work Plans are reviewed, modified and approved in a timely and realistic manner.

1.02 INTERFACE WITH EXISTING FACILITIES

A. Contractor is required to protect and maintain in service all existing plumbing, mechanical, electrical, communications, security, fire protection, and control systems and components. In the event that existing systems are being replaced, the existing system shall be maintained fully operational until the new system is fully tested and accepted by the District's Representative. To permit this to occur without adversely impacting continuity, specific procedures must be developed as a part of the Work Plan process. This procedure shall be approved in advance by the District and shall identify and incorporate necessary accommodations to the systems and equipment which will ensure the desired continuity.

B. Where new products are to be installed in existing systems, the existing elements are shown on the Contract Drawings as schematic and are not necessarily shown to scale. As a result, in preparing proposed new equipment and piping layouts (and related schedules and Work Plan), the Contractor must base each plan and procedure upon the actual as-built existing conditions in the affected mechanical/electrical room and/or mechanical/electrical/telecommunications/domestic/water/sewer/storm/or-other system or component; and must locate new or relocated equipment in a manner which does not conflict with existing equipment and which complies with all manufacturer's recommended installation requirements, such as clearances, anchorage, accessibility, and applicable code requirements.
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01410

REGULATORY REQUIREMENTS

1 PART 1 GENERAL

1.1 Summary

1.1.1 Section includes: regulatory requirements applicable to Contract Documents.

1.1.2 Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of bids, except as may be otherwise specifically stated in the Contract Documents.

1.1.3 Should any conditions develop not covered by the Contract Documents wherein the finished Work will not comply with current codes, a change order detailing and specifying the required Work shall be submitted to and approved by Owner before proceeding with the Work.

1.2 References to Regulatory Requirements

1.2.1 Codes, laws, ordinances, rules, regulations and ordinances referred to shall have full force and effect as though printed in full in these Specifications. Code, laws, ordinances, rules, regulations and ordinances are not furnished to Contractor, because Contractor is assumed to be familiar with these requirements. The listing of applicable codes, laws, regulations and ordinances for hazardous waste abatement Work in the Contract Documents is supplied to Contractor as a courtesy and shall not limit Contractor’s responsibility for complying with all applicable laws, regulations or ordinances having application to the Work. Where conflict among the requirements or with these Specifications occurs, the most stringent requirements shall be used.

1.2.2 Conform to all applicable codes, laws, ordinances, rules and regulations.

1.2.3 Precedence:

(1) Where specified requirements differ from the requirements of applicable codes, ordinances and standards, the more stringent requirements shall take precedence.

(2) Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Drawings and Specifications shall take precedence so long as such increase is legal.

(3) Where no requirements are identified on Drawings or in Specifications, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.

1.3 Codes

1.3.1 Codes that apply to Contract Documents include all Codes applicable to hospital construction (see generally http://www.oshpd.state.ca.us/oshpdKEY/Const.htm), including, but not limited to, the following:

(1) CBC (Part 2, Title 24, CCR, including, without means of limitation, Sections 16A, 102A.23, 308, 420A, 504-506, 904.2.6, 1019 and 1604)

(2) CEC (Part 3, Title 24, CCR)

(3) CMC (Part 4, Title 24, CCR)

(4) CPC (Part 5, Title 24, CCR),

(5) State Elevator Safety Regulations (Part 7, Title 24, CCR)

(6) UBC

(7) UPC

(8) UMC

(9) NEC

(10) Part 1 of CBC – Administrative Regulations

(11) Part 8 – California Fire Code

1.4 Laws, Statutes, Ordinances, Rules and Regulations

1.4.1 During prosecution of Work to be done under Contract Documents, Contractor shall comply with...
applicable laws, ordinances, rules and regulations, including, but not limited to, the following:

(1) **Federal**
   a. Americans With Disabilities Act of 1990
   b. 29 CFR, Section 1910.1001, Asbestos
   c. 40 CFR, Subpart M, National Emission Standards for Asbestos
   d. Executive Order 11246
   e. Federal Endangered Species Act
   f. Clean Water Act

(2) **State of California**
   a. California Code of Regulations, Titles 5, 8, 17, 19, 21, 22, 24 and 25
   b. California Public Contract Code
   c. California Health and Safety Code
   d. California Government Code
   e. California Labor Code
   f. California Civil Code
   g. California Code of Civil Procedure
   h. CPUC General Order 95, Rules for Overhead Electric Line Construction
   i. CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications Systems
   j. Cal/OSHA
   k. OSHA: Hazard Communications Standards
   l. California Endangered Species Act
   m. Water Code
   n. Fish and Game Code

(3) **State of California Agencies**
   a. State and Consumer Services Agency
   b. Office of the State Fire Marshall
   c. Office of Statewide Health Planning and Development
   d. Department of Fish and Game
   e. Bay Area Air Quality Management Owner
   f. San Francisco Bay Regional Water Quality Control Board
   g. Division of the State Architect

(4) **Local Agencies:**
   a. Oakland Fire Department

(5) **Other Requirements:**
   b. References on Drawings or in Specifications to “code” or “building code” not otherwise identified shall mean the codes specified in this Section 01410, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction.

1.4.2 Contractor shall have access to all of the foregoing within 24 hours.
1.4.3 Other Applicable Laws, Ordinances and Regulations:
   (1) Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, state, and local governmental agencies and jurisdictions having authority over the Project.
   (2) Work shall be accomplished in conformance with all rules and regulations of public utilities and utility Owners.
   (3) Where such laws, ordinances rules, and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to the time of opening of the bids.

1.4.4 Change Orders and Claims:
1.5 Conflicts

1.5.1 If conflict is between referenced regulatory requirements, Contractor shall comply with the one establishing the more stringent requirement.

1.5.2 If conflict is between referenced regulatory requirements and Contract Documents, Contractor shall comply with the one establishing the more stringent requirement.

1.6 Required Provisions on Contract Claim Resolution

1.6.1 The California Public Contract Code specifies required provisions on resolving contract claims less than $375,000, which are set forth below, and constitute a part of this Contract.

(1) For the purposes of this section, “Claim” means a separate demand by Contractor of $375,000 or less for (1) a time extension, (2) payment or money or damages arising from Work done by or on behalf of Contractor arising under the Contract Documents and payment of which is not otherwise expressly provided for or the Claimant is not otherwise entitled to, or (3) an amount the payment of which is disputed by Owner. In order to qualify as a Claim, the written demand must state that it is a Claim submitted under paragraph 12 of Document 00700 (General Conditions) and be submitted in compliance with all requirements of Document 00700 (General Conditions), paragraph 12. Separate Claims which total more than $375,000 do not qualify as a “separate demand of $375,000 or less,” as referenced above, and are not subject to this section.

(2) A voucher, invoice, payment application, or other routine or authorized form of request for payment is not a Claim for purposes of this section. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a Claim under this section by submitting a separate claim in compliance with Contract Documents claim submission requirements.

(3) Caution. This section does not apply to tort claims and nothing in this section is intended nor shall be construed to change the time periods for filing tort claims or actions specified by Chapter 1 and Chapter 2 of Part 3 of Division 3.6 of Title 1 of the California Government Code.

1.6.2 Procedure:

(1) The Claim must be in writing, submitted in compliance with all requirements of Document 00700 (General Conditions), paragraph 12, including, but not limited to, the time prescribed by and including the documents necessary to substantiate the Claim, pursuant to Document 00700 (General Conditions), paragraph 12.3. Claims must be filed on or before the day of final payment. Nothing in this section is intended to extend the time limit or supersede notice requirements for the filing of claims as set forth in Document 00700 (General Conditions), paragraph 12 or elsewhere in the Contract Documents.

(2) For Claims of fifty thousand dollars ($50,000) or less

a. Owner shall respond in writing within forty-five (45) days of receipt of the Claim, or

b. Owner may request in writing within thirty (30) days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.

(i) If additional information is thereafter required, it shall be requested and provided in accordance with this section upon mutual agreement of Owner and Claimant.

(ii) Owner’s written response to the Claim, as further documented, shall be submitted to Claimant within fifteen (15) days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.

(3) For Claims over Fifty Thousand Dollars ($50,000) and less than or equal to $375,000:
a. Owner shall respond in writing within sixty (60) days of receipt of the Claim, or
b. Owner may request in writing within thirty (30) days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.
   (i) If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of Owner and Claimant;
   (ii) Owner’s written response to the Claim, as further documented, shall be submitted to Claimant within thirty (30) days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.

(4) Meet and Confer:
   a. If Claimant disputes Owner’s written response, or Owner fails to respond within the time prescribed above, Claimant shall notify Owner, in writing, either within fifteen (15) days of receipt of Owner’s response or within fifteen (15) days of Owner’s failure to timely respond, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon demand Owner will schedule a meet and confer conference within thirty (30) days for settlement of the dispute.
   b. Following the meet and confer conference, if the Claim or any portion remains in dispute, Claimant may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the California Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Claimant submits its written claim as set forth herein, until the time that Claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

1.7 Compliance with Americans With Disabilities Act
   1.7.1 Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services and other activities provided by a public entity to the public, whether directly or through a Contractor, must be accessible to the disabled public. Contractor shall provide the services specified in the Contract Documents in a manner that complies with the ADA and any and all other applicable federal, state and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits or activities provided under the Contract Documents and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents or assigns shall constitute a material breach of the Contract Documents.

2 PART 2 PRODUCTS – NOT USED

3 PART 3 EXECUTION – NOT USED

END OF SECTION
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01455

TESTING AND INSPECTION

1 PART 1 GENERAL

1.1 Section Includes

1.1.1 Contractor’s Quality Control
1.1.2 Quality of the Work
1.1.3 Inspections and Tests by Division of State Architect
1.1.4 Inspections and Tests by Serving Utilities
1.1.5 Inspections and Tests by Manufacturer’s Representatives
1.1.6 Inspections by Independent Testing and Inspection Agency
1.1.7 Additional Testing and Inspection

1.2 Contractor’s Quality Control

1.2.1 Contractor’s Quality Control: Ensure that products, services, workmanship and Site conditions comply with requirements of Drawings and Specifications by coordinating, supervising, testing, and inspecting the Work and by utilizing only suitably qualified and appropriately audited, licensed or trained, personnel.

1.2.2 Quality Requirements: Work shall be accomplished in accordance with quality requirements of Drawings and Specifications, including, by reference, all codes, laws, rules, regulations, and standards. When no quality basis is prescribed, the quality and testing procedures shall be in accordance with the best-accepted practices of the construction industry for the locale of the Project, for projects of this type, or standards set by engineering or technical societies (e.g., ASTM or ASHRAE), whichever is more stringent.

1.2.3 Quality Control Personnel: Employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.

1.3 Quality of the Work

1.3.1 Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects, and fit for the intended use.

1.3.2 Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements, as shown on or required by Contract Documents.

1.3.3 Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling, and staining, until acceptance by Owner.

1.3.4 Standards and Code Compliance and Manufacturer’s Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer’s instructions and recommendations, reference standards and building code research report requirements in preparing, fabricating, erecting, installing, applying, connecting, and finishing Work.

1.3.5 Deviations from Standards and Code Compliance and Manufacturer’s Instructions and Recommendations: Secure Owner’s advanced written consent. Document and explain all deviations from reference standards and building code research report requirements and manufacturer’s product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.

1.3.6 Verification of Quality: Work shall be subject to verification of quality by Owner in accordance with provisions of the Contract Documents.

(1) Cooperate by making Work available for inspection by Division of State Architect Inspector and independent testing and inspection agencies.

(2) Such verification may include mill, plant, shop, or field inspection as required.
(3) Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.

(4) Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by Owner.

(5) Applicable provisions of the Contract Documents shall govern Contract Modifications, if any, resulting from such verification activities.

1.3.7 Observations by Owner’s Consultants: Periodic and occasional observations of Work in progress will be made by Owner and Owner’s consultants as deemed necessary to review progress of Work and general conformance with design intent.

1.3.8 Limitations on Inspection, Testing and Observation: Neither employment of independent testing and inspection agency nor observations or tests by Owner and Owner’s consultants shall in any manner relieve Contractor of obligation to perform Work in full conformance to all requirements of Contract Documents.

1.3.9 Owner’s Acceptance and Rejection of Work: Owner reserves the right to reject all Work not in conformance to the requirements of the Drawings and Specifications, or otherwise defective.

1.3.10 Correction of Defective Work: Defective Work shall be modified, replaced, repaired or redone by the Contractor at no change in Contract Sum or Contract Time.

1.3.11 Acceptance of Defective Work: Acceptance of defective Work, without specific written acknowledgement and approval of Owner, shall not relieve the Contractor of the obligation to correct such Work.

1.3.12 Contract Adjustment for Defective Work: Should Owner determine that it is not feasible or in Owner’s interest to require defective Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between Owner and Contractor. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of Document 00700 (General Conditions).

1.3.13 Non-Responsibility for Defective Work: Owner and Owner’s consultants disclaim any and all responsibility for Work produced not in conformance with the Drawings and Specifications.

1.3.14 Responsibility for Defective Work: Contractor shall have full responsibility for all consequences resulting from defective work, including without limitation all delays, disruptions, extra inspection and correction costs by Contractor and Owner and re-Work, and extra time and costs of all types. Contractor waives excuses for defective work relating to Owner’s prior review of Submittals and/or prior failure to notice defective work in place on inspection.

1.4 Inspections by Division of the State Architect Inspector of Record

1.4.1 Owner will select and pay for a Division of the State Architect (DSA) certified inspector(s) for this project. The Contractor will coordinate their work with required inspections.

1.4.2 Regulatory Requirements for Testing and Inspection: Contractor shall comply with Part 1, Title 24, Section 4-335, California Code of Regulations and shall cooperate with the Inspector and Owner in all testing required by the Office of Regulation Services, Division of State Architect. Contractor shall comply with Part 2, Title 24, California Code of Regulations and shall cooperate with Inspector in all inspections, testing and approvals required by the Office of Regulation Services, Division of State Architect. Contractor shall also comply with Uniform Building Code (UBC) requirements and all other requirements of governing authorities having jurisdiction.

1.4.3 Inspections and Tests by Governing Authorities: Contractor shall cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.

(1) Such authorities may include, but are not limited to, the Division of State Architect, Office of Statewide Health Planning Department (OSHPD), Public Works Department, Fire Department, and similar agencies.

(2) Except as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor’s responsibility.

1.5 Inspections and Tests by Serving Utilities
1.5.1 Cause all tests and inspections required by serving utilities to be made for Work under this Contract. Scheduling conducting and paying for such inspections shall be solely the Contractor’s responsibility.

1.6 Inspections and Tests by Manufacturer’s Representatives

1.6.1 Cause all tests and inspections specified to be conducted by materials or systems manufacturers to be made. Additionally, all tests and inspections required by materials or systems manufacturers as conditions of warranty or certification of Work shall be made, the cost of which shall be included in the Contract Sum.

1.7 Inspections by Independent Testing and Inspection Agency

1.7.1 Owner will select an independent testing and inspection agency or agencies approved by the Division of State Architect to conduct tests and inspections in accordance with Part 1, Title 24, Section 4-335, California Code of Regulations and as indicated on Drawings, in Specifications and as required by governing authorities having jurisdiction.

1.7.2 Responsibility for time and costs shall be as indicated in schedule below. All time and costs for Contractor’s service related to such tests and inspections shall be included in Contract Time and Contract Sum.

1.7.3 Notify Owner and Inspector in writing (and, if provided, on inspection request form provided by Owner) and, if directed by Owner, testing and inspection agency, when Work is ready for specified tests and inspections. Deliver this written notification at least 48 hours before the requested inspection date.

1.7.4 The Contractor will pay or reimburse Owner for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:

(1) Contractor’s failure to properly schedule or notify testing and inspection agency or authorities having jurisdiction.

(2) Changes in sources, lots, or suppliers of products after original tests or inspections.

(3) Changes in means, methods, techniques, sequences, and procedures of construction that necessitate additional testing, inspection, and related services.

(4) Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design.

(5) Contractor submitted requests to change materials or products, which are accepted, but require testing and/or reinspection beyond original design.

1.7.5 Tests and special inspections to be paid by Owner may, where required, include the following:

<table>
<thead>
<tr>
<th>SECTION</th>
<th>MATERIAL TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBD</td>
<td>Reinforcing steel for concrete and concrete masonry</td>
</tr>
<tr>
<td>TBD</td>
<td>Concrete slump and strength</td>
</tr>
<tr>
<td>TBD</td>
<td>Masonry block strength, shrinkage and moisture content</td>
</tr>
<tr>
<td>TBD</td>
<td>Masonry grout strength</td>
</tr>
<tr>
<td>TBD</td>
<td>High strength grout strength</td>
</tr>
<tr>
<td>TBD</td>
<td>Masonry mortar strength</td>
</tr>
<tr>
<td>TBD</td>
<td>Structural steel bolting and welding</td>
</tr>
<tr>
<td>TBD</td>
<td>Pile concrete and reinforcing</td>
</tr>
<tr>
<td>TBD</td>
<td>Trench backfill</td>
</tr>
<tr>
<td>TBD</td>
<td>Building pad sub-grade and imported fill</td>
</tr>
<tr>
<td>TBD</td>
<td>Load test pile dowels</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION</th>
<th>SPECIAL INSPECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBD</td>
<td>Placement of reinforcing steel for concrete and concrete masonry</td>
</tr>
<tr>
<td>TBD</td>
<td>Placement of cast-in-place concrete</td>
</tr>
<tr>
<td>TBD</td>
<td>Placement of concrete block and grout</td>
</tr>
<tr>
<td>TBD</td>
<td>Structural steel fabrication, erection, bolting and welding</td>
</tr>
<tr>
<td>TBD</td>
<td>Installation of roof membrane</td>
</tr>
<tr>
<td>TBD</td>
<td>Installation of anchor bolts, dowels embedded in concrete and masonry</td>
</tr>
<tr>
<td>TBD</td>
<td>Installation of adhesive (epoxy) connections</td>
</tr>
<tr>
<td>TBD</td>
<td>Placement of pile concrete and reinforcement</td>
</tr>
<tr>
<td>TBD</td>
<td>Pile driving</td>
</tr>
<tr>
<td>TBD</td>
<td>Site grading, road and parking phase</td>
</tr>
<tr>
<td>TBD</td>
<td>Trench backfill</td>
</tr>
</tbody>
</table>

**SECTION ENVIRONMENTAL TESTS**

| TBD | Construction noise monitoring |
| TBD | Storm water runoff sampling |

1.7.6 Test and Inspection Reports: After each inspection and test, one copy of report shall be promptly submitted to Division of State Architect, Owner’s Representative, the Contractor and/or any other consultant Owner designates and any agency having jurisdiction (if required by Code).

(1) Reports shall clearly identify the following:
   a. Date issued.
   b. Project name and number.
   c. Identification of product and Specifications Section in which Work is specified.
   d. Name of inspector.
   e. Date and time of sampling or inspection.
   f. Location in Project where sampling or inspection was conducted.
   g. Type of inspection or test.
   h. Date of test.
   i. Results of tests.
   j. Comments concerning conformance with Contract Documents and other requirements.

(2) Test reports shall indicate specified or required values and shall include statement whether test results indicate satisfactory performance of products.

(3) Samples taken but not tested shall be reported.

(4) Test reports shall confirm that methods used for sampling and testing conform to specified test procedures.

(5) When requested, testing and inspection agency shall provide interpretations of test results.

1.7.7 Contractor Responsibilities in Inspections and Tests:

(1) Unless specified otherwise, notify Inspector, Owner’s Representative, or any other consultant Owner designates and independent testing and inspection agencies 48 hours in advance of expected time of each test and inspection, and for all other operations requiring inspection and testing services, by submitting Contractor’s inspection request in writing (or, if Owner provides a specific form, on that form).
   a. When tests or inspections cannot be performed after such notice, reimburse Owner for testing and inspection agency personnel and travel expenses incurred due to Contractor’s negligence.

(2) Deliver to laboratory or designated location, adequate samples of materials proposed to be used that require advance testing, together with proposed mix designs.

(3) Cooperate with Inspector, Owner’s Representative, or any other consultant Owner designates, and Owner’s consultants. Provide access to Work areas and off-Site fabrication and assembly locations, including during weekends and after normal Work hours.

(4) Provide incidental labor and facilities to provide safe access to Work to be tested and inspected, to obtain and handle samples at the Site or at source of products to be tested, and to store and cure test samples.
(5) Provide, at least 15 Days in advance of first test or inspection of each type, a schedule of tests or inspections indicating types of tests or inspections and their projected scheduled dates.

1.8 Additional Testing and Inspection

1.8.1 If initial tests or inspections made by the Inspector or Owner’s Representative, or any other consultant Owner designates reveal that materials do not comply with Title 24, California Code of Regulations or with the Contract Documents, or if Owner has reasonable doubt that materials do not comply with Title 24, California Code of Regulations or with Contract Documents, additional tests and inspections shall be made as directed.

(1) If additional tests and inspections establish that materials comply with Contract Documents, Owner shall pay all costs for such tests and inspections.

(2) If additional tests and inspections establish that materials do not comply with Contract Documents, all costs of such tests and inspections shall be deducted from Contract Sum.

(3) If Work requiring inspection is covered by follow-on or follow-up Work before it is inspected, uncover Work so proper inspections can be performed. All costs of such tests and inspections shall be deducted from Contract Sum.

END OF SECTION
### SOILS

**1. GENERAL:**
- a. Verify that:
  - site has been prepared properly prior to placement of controlled fill and/or excavations for foundations.
  - foundation excavations are extended to proper depth and have reached proper material, and
  - materials below footings are adequate to achieve the design bearing capacity.

<table>
<thead>
<tr>
<th>REQUIRED</th>
<th>TEST OR SPECIAL INSPECTION</th>
<th>TYPE</th>
<th>PERFORMED BY</th>
<th>CODE REFERENCE AND NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>Periodic</td>
<td>GE*</td>
<td>By geotechnical engineer or his/her qualified representative.</td>
</tr>
</tbody>
</table>

**2. COMPACTED FILLS:**
- a. Perform qualification testing of fill materials.
- b. Verify use of proper materials and inspect lift thicknesses, placement, and compaction during placement of fill.
- c. Test compaction of fill.

| X        |                            | Test | Lab*        | Under the supervision of the geotechnical engineer. |

**4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):**
- a. Inspect drilling operations and maintain complete and accurate records for each pier.
- b. Verify locations of piers.
- c. Confirm pier diameters, plumbness, bell diameters (if applicable), lengths, and embedment into bedrock (if applicable). Record concrete or grout volumes.
- a. Concrete piers.

| X        |                            | Continuous | GE*          | By geotechnical engineer or his/her qualified representative. |

**5. RETAINING WALLS:**
- a. Placement of soil reinforcement, drainage devices, and backfill.

| X        |                            | Continuous | GE*          | Placement, compaction and inspection of backfill per Section 1704A.7.1 for fills supporting foundations (see Section 2 above). |
### CONCRETE

#### 7. CAST IN PLACE CONCRETE

<table>
<thead>
<tr>
<th>Material Verification and Testing:</th>
<th>SI &amp; PI*</th>
<th>Periodic</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Verify use of required design mix.</td>
<td>SI &amp; PI*</td>
<td></td>
<td>* To be performed by batch-plant special inspector and project inspector.</td>
<td></td>
</tr>
<tr>
<td>b. Test reinforcing steel.</td>
<td>Test</td>
<td>Lab</td>
<td>1916A.2</td>
<td>(1916.1.6*). ASTM A370. See IR 17-10</td>
</tr>
<tr>
<td>c. Perform slump, temperature, and (where required) air content tests.</td>
<td>Test</td>
<td>Lab</td>
<td>ASTM C172, ASTM C31.</td>
<td></td>
</tr>
</tbody>
</table>

#### Inspection:

| a. Inspect batching of concrete.          | SI & PI*| Periodic | 1704A.4.2 | (see 1704A.4.3, option 2 for waiver on design parameters). |
| b. Inspect placement of formwork, reinforcing steel, embedded items and concrete. Inspect curing and form removal. | SI & PI*| Periodic | 1704A.4.2 | (see 1704A.4.3, option 2 for waiver on design parameters). |

### SHOTCRETE (in addition to Cast in Place Concrete tests and inspections):

| a. Inspect shotcrete placement.           | SI      | Periodic | 1704A.17 | See ACI 506. |
| b. Test shotcrete (compression).          | Lab     |          | 1913A.5, 1913A.10 and 1916A.5 (1913.5*, 1913.10* and 1916.1.9*). ASTM C42, ASTM C1140 |

### POST-INSTALLED ANCHORS:

| a. Inspect installation of post-installed anchors | SI      | Periodic | Table 1704A.4 |
| b. Test post-installed anchors.                | Lab     |          | 1916A.7    (1916.1.11*). |

### MASONRY

| STEEL | Table 1704A.3 |
| 17. STRUCTURAL STEEL AND COLD-FORMED STEEL USED FOR STRUCTURAL PURPOSES |

| Material Verification: | SI & PI* | Periodic | * By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication. |
| a. Verify that all materials are appropriately marked and that: | SI & PI* | Periodic | * By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication. |
| - Mill certificates indicate material properties that comply with requirements. | SI & PI* | Periodic | * By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication. |
| - Material sizes, types and grades comply with requirements. | SI & PI* | Periodic | * By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication. |
| X b. Test unidentified materials.               | Test    | Lab      | 2203A.1    | (2203.1*). ASTM A370. |
| X c. Examine seam welds of structural tubes and pipes | SI      | Periodic | * See DSA IR 17-3. |

#### Inspection:

| a. Verify member locations, bracing and all details constructed in the field. | SI      | Periodic | |
| b. Verify stiffener locations, connection tab locations and all construction details fabricated in the shop. | SI      | Periodic | |

### WELDING:

| Verification of Materials, Equipment, Welders, etc.: | SI      | Periodic | |
| a. Verify weld filler material identification markings per AWS designation listed on the DSA approved documents and the WPS. | SI      | Periodic | |

* In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.
## Statement of Structural Tests and Special Inspections

### 2010 CBC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>c. Verify WPS, welder qualifications and equipment.</td>
<td>Periodic</td>
<td>SI</td>
<td></td>
</tr>
</tbody>
</table>

### 19.1 SHOP WELDING:

<table>
<thead>
<tr>
<th></th>
<th>a. Inspect groove, multi-pass, and fillet welds &gt; 5/16&quot;</th>
<th>Continuous</th>
<th>SI</th>
<th>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b. Inspect single-pass fillet welds ≤ 5/16&quot;</td>
<td>Periodic</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td></td>
<td>c. Inspect welding of stairs and railing systems.</td>
<td>Periodic</td>
<td>SI</td>
<td>1704A.3.1 Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
</tbody>
</table>

### 19.2 FIELD WELDING:

<table>
<thead>
<tr>
<th></th>
<th>a. Inspect groove, multi-pass, and fillet welds &gt; 5/16&quot;</th>
<th>Continuous</th>
<th>SI</th>
<th>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b. Inspect single-pass fillet welds ≤ 5/16&quot;</td>
<td>Periodic</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td></td>
<td>f. Inspect welding of stairs and railing systems.</td>
<td>Periodic</td>
<td>SI</td>
<td>* May be performed by the project inspector when approved by DSA. See DSA IR 17-3.</td>
</tr>
</tbody>
</table>

### WOOD

### OTHER

Section 1704A.15
<table>
<thead>
<tr>
<th>KEY to Columns</th>
<th>2 Performed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Type -</td>
<td></td>
</tr>
<tr>
<td>Continuous – Indicates that a continuous special inspection is required</td>
<td>GE – Indicates that the special inspection is to be performed by a registered geotechnical engineer or his or her authorized representative</td>
</tr>
<tr>
<td>Periodic – Indicates that a periodic special inspection is required</td>
<td>Lab – Indicates that the test is to be performed by a testing laboratory accepted in the DSA laboratory Evaluation and Acceptance (LEA) Program</td>
</tr>
<tr>
<td>Test – Indicates that a test is required</td>
<td>PI – Indicates that the special inspection is to be performed by the project inspector</td>
</tr>
<tr>
<td>SI – Indicates that the special inspection is to be performed by a special inspector</td>
<td></td>
</tr>
</tbody>
</table>

(Note: The difference between “tests” and “special inspections” is addressed in IR 17-4)

NAME: Stephen R. Ward
Name of Structural Engineer (When structural design has been delegated)

Signature: [Signature]
date: 6/23/12

ARCHITECT/STRUCTURAL ENGINEER STAMP

IDENTIFICATION STAMP
DIV OF THE STATE ARCHITECT
APP.# 01-112534

AC N/A  F/LS N/A  SS [Signature]
DATE 6/23/12

1 Soils testing and inspection: Geotechnical Verified Report - Form DSA-293
2 All Structural Testing: Laboratory Verified Report - Form DSA-291
3 Concrete Batch Plant Inspection: Special Inspection Verified Report - Form DSA-292
4 Shotcrete Inspection: Special Inspection Verified Report - Form DSA-292
5 Shop Welding Inspection: Special Inspection Verified Report - Form DSA-292
6 Field Welding Inspection: Special Inspection Verified Report - Form DSA-292
### Project Information

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Item</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-5 (Project/Site)</td>
<td>For Project/Site Inspector(s)</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-5 (In-Plant)</td>
<td>For Relocatable Buildings Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form DSA-162</td>
<td>Contract Information</td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6/AE)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Report (Form DSA-6/AE)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Architect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Structural Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mechanical Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Engineer</td>
<td></td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Report (Form DSA-6)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Project/Site Inspector(s)</td>
<td>From Each Contractor</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In-Plant Inspector</td>
<td>For Relocatable Building Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Special Inspector(s)</td>
<td></td>
</tr>
</tbody>
</table>

### Other Final Verified Reports/Affidavits

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports/Affidavits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Laboratory (Form DSA-291)</td>
<td>Signed by LEA Lab Professional Engineer</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Shop Welding &amp; Fabrication (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Field Welding (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High Strength Bolt Installation (Form DSA-262)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Glulam Fabrication (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manufactured Trusses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Masonry Inspection (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Engineered Fill (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Drilled Pier Soil Inspection (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beacher Fabrication</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Other: RETAINING WALLS</td>
<td>SIGNED BY GEO TECH ENGINEER</td>
</tr>
</tbody>
</table>

### Other Documents

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Items</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Further Fees</td>
<td>See Attached Invoice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Notice of Completion</td>
<td>Signed by School District/Owner</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Automatic Sprinkler System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fire Suppression System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skylights D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beachers D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change Orders:</td>
<td>For all fees and/or reimbursable charges paid to the Construction Managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form DSA-102</td>
<td>For all fees and/or reimbursable charges paid to the Construction Managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Reports:</td>
<td>Expansion Anchors, Grouted Anchors, Adhesive Anchors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Grounding Test Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Checklist for Site Inspector of Relocatable Bldgs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Record Set of Drawings and Specifications approved by DSA during plan check but were not copied to DSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Signature of A/E: [Signature]
Date: 6/29/12

For 90 Day Letter Preparation By: [Signature]
Date: 6/29/12

(Rev. 5/07)
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01540

SITE SECURITY AND SAFETY

1 PART 1 GENERAL

1.1 Submittals

1.1.1 See Section 01330 (Submittal Procedures).
1.1.2 Site Security
1.1.3 Safety Program.
1.1.4 Fire Protection Plan

1.2 Protection

1.2.1 Contractor shall:

(1) Continuously maintain protection as necessary to protect the Work, as a whole and in part, and adjacent property and improvements from accidents, injuries or damage.

(2) Properly protect the Work:
   a. With lights, guard rails, temporary covers and barricades.
   b. Enclose excavations with proper barricades.
   c. Brace and secure all parts of the Work against storm and accident.
   d. Provide such additional forms of protection that may be necessary under existing circumstances.

(3) Provide and maintain in good condition all protective measures required to adequately protect the public from hazards resulting from the Work and to exclude unauthorized persons from the Work. When regulated by Building Code, Cal OSHA, or other authority, such legal requirements for protection shall be considered as minimum requirements. Be responsible for the protection in excess of such minimum requirements as required.

1.3 Control of Site

1.3.1 Contractor shall ensure that no alcohol, firearms, weapons, or controlled substance enters or is used at the Site. Immediately remove from the Site and terminate the employment of any employee found in violation of this provision.

1.4 Site Security

1.4.1 As part of the Work included within the Contract Price, Contractor shall take and be fully responsible for all reasonably required measures to protect and maintain the security of persons, existing facilities and property at the Site, including without limitation preventing theft, loss, vandalism and improper concealment of personal property of Owner and all persons lawfully present on the Site, and including times where workers are not present on the Site. Contractor’s measures shall include, at a minimum, maintaining a log of all persons entering and leaving the Site and who they represent, what they are delivering and to whom.

1.4.2 No claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall repair all damage to Owner property resulting from Contractor’s failure to provide adequate security measures.

1.4.3 Contractor shall maintain a lock on the Construction access gate at all times. Contractor shall appoint one (1) person to let people through the gate and maintain the sign-in/out list, with person’s name, company, reason for entering, what they are delivering, time and date. Alternatively, Contractor shall provide a full-time guard at the gate at all times to control access and maintain the sign-in/out list. The sign in/out list shall be available to Owner at anytime upon request. If Owner determines that the gate has been left unlocked, Contractor shall, if requested by Owner, provide a full time guard at no additional expense to Owner.

1.4.4 Contractor shall supply additional security fencing, barricades, lighting, and other security measures as required to protect and control the Site.
1.5 **Safety Program**

1.5.1 Within fifteen (15) days after Notice to Proceed, Contractor shall submit a Safety Program that has been reviewed and approved by an Industrial Hygienist certified by the American Board of Industrial Hygiene or a Certified Safety Professional. The Safety Program shall include the name, certification number, and certification seal of the Industrial Hygienist or Certified Safety Professional. Contractor shall comply with the Safety Program and all applicable federal, state, and local regulation codes, rules, law and ordinances.

1.5.2 Receipt and/or review of the Safety Program by Owner, Project Manager or Owner representative shall not relieve Contractor of any responsibility for complying with all applicable safety regulations.

1.5.3 It is essential that Contractor and each Subcontractor implement an effective and vigorous Safety and Health Program to cover their respective portions of the Work. Subject to Contractor’s overall responsibility for Project safety, it shall be understood that the full responsibility for providing a safe place to work with respect to their respective portions of the Work rests with each individual Contractor and Subcontractor.

1.5.4 Safety Program components:

1. **Injury and Illness Prevention Program (IIPP):** Conforming to the General Industrial Safety Orders (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 3203), and the California Labor Code (Section 6401.7).

2. **Site-Specific Safety and Health Plan (SSHP):** Describing health and safety procedures that shall be implemented during the Work in order to ensure safety of the public and those performing the Work. Follow the guidelines for a SSHP listed in CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5192, Item (b)(4) f.

3. **Confined Space Program:** The Site contains permit- and non-permit-confined spaces, including shored trenches. Owner will provide Contractor with any available information regarding existing permit space hazards, entry operations, and safety information relating to Work in the existing permit spaces as set forth in the General Industrial Safety Orders (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5157). Permit space entry is allowed only through compliance with a permit space program meeting the requirements of Section 5157 of the General Industrial Safety Orders. During entry operations, or at the conclusion of entry operations, verbally notify Owner of the permit space program followed and of any hazards confronted or created in permit spaces during entry operations.

1.5.5 The wearing of hard hats shall be mandatory at all times for personnel on Site. Contractor shall supply sufficient hard hats to equip properly all employees and visitors.

1.5.6 Whenever an exposure exists, appropriate personal protective equipment (PPE) shall be used by all affected personnel. Contractor shall supply PPE to all personnel under Contractor’s direction.

1.6 **SAFETY REQUIREMENTS**

1.6.1 Standards: Contractor shall maintain the Project in accordance with state and local safety and insurance standards.

1.6.2 Hazards Control. Contractor shall:

1. Store volatile wastes in covered metal containers and remove from premises daily.

2. Prevent accumulation of wastes that create hazardous conditions.

3. Provide adequate ventilation during use of volatile or noxious substances.

1.6.3 Contractor shall conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws, and:

1. Not burn or bury rubbish or waste material on the Site.

2. Not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Not dispose of wastes into streams or waterways.

1.6.4 Contractor shall provide accident information on the forms provided by Contractor. This information shall be provided on the same day as the occurrence of said incident.
1.7 Site Safety Officer

1.7.1 Contractor shall designate one of Contractor’s staff as “Site Safety Officer” whose duties shall include the responsibility for enforcing the environmental protection provisions of the Contract Documents including safety and health, the requirements of the Occupational Safety and Health Act, and other applicable federal, state and local standards. Contractor shall submit for review by Owner, Contractor’s intended traffic flow plan, security plan, program for temporary structures, housecleaning plan, demolition program, and environmental safety and health plan. After review by Owner, the implementation and enforcement of these plans shall become the responsibility of the Site Safety Officer. Any changes in the plans shall be requested by Contractor through the Site Safety Officer for written concurrence by Owner.

1.7.2 Owner risk management representative(s) shall be allowed access to accident/injury and illness reports, inspection reports, scheduling and construction meetings, and safety meetings.

2 PART 2 PRODUCTS - NOT USED

3 PART 3 EXECUTION - NOT USED

END OF SECTION
DIVISION 1 GENERAL REQUIREMENTS

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

1 PART 1 GENERAL

1.1 Summary
1.1.1 Section Includes:
  (1) Project identification sign.
  (2) Project informational signs.
  (3) Maintenance.
  (4) Removal.
1.1.2 Related Sections
  (1) Section 01100: Summary of Work

1.2 Quality Assurance
1.2.1 Design sign and structure to withstand fifty (50) miles/hr wind.
1.2.2 Sign Painter: Experienced as a professional sign painter for a minimum of five (5) years.
1.2.3 Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.3 Submittals
1.3.1 Section 01330 Submittals, shop drawings and product data.
1.3.2 Show content, layout, lettering, color, structure, sizes, and proposed locations for signs.

2 PART 2 – PRODUCTS

2.1 Sign Materials
2.1.1 Structure and Framing: New, wood, structurally adequate.
2.1.2 Sign Surfaces: Exterior grade plywood with medium density overlay, minimum ¾ - inch thick, standard large sizes to minimize joints.
2.1.3 Rough Hardware: Galvanized.
2.1.4 Paint and Primers: Exterior quality, two coats; sign background of color as selected.
2.1.5 Lettering: Exterior quality paint, contrasting colors as selected.

2.2 Project Identification Sign
2.2.1 One (1) Two (2) painted sign, 4 feet by 6 feet, bottom six (6) feet above ground.
2.2.2 Content:
  (1) Project title and name of County.
  (2) Names and titles of authorities.
  (3) Names and titles of Architect/Engineer and Consultants.
  (4) Name of Prime Contractor.
2.2.3 Graphic Design, Colors, Style of Lettering: Designated by Architect/Engineer.
2.2.4 Layout:

THE PERALTA COMMUNITY COLLEGE DISTRICT,
MERRITT COLLEGE
CHW INFRASTRUCTURE PROJECT

ARCHITECT: __________________________
CIVIL ENGINEER: ______________________
LANDSCAPE ARCHITECT: ___________________
3 PART 3 – EXECUTION

3.1 Installation

3.1.1 Install project identification sign within thirty (30) days after date of Notice to Proceed.
3.1.2 Erect one Project sign at a location near to the Central Plant, with final location to be reviewed with Owner before installation.
3.1.3 Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
3.1.4 Paint exposed surfaces of sign supports and framing.

3.2 Maintenance

3.2.1 Maintain sign and supports, keep clean repair deterioration and damage.

3.3 Removal

3.3.1 Remove sign, framing, supports and foundations at completion of Project and restore area.

END OF SECTION
SECTION 01 21 12
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES:
A. Product/Installation Allowances
B. Contract Sum Allowances
C. Allowances for Specific Campus Situations

PART 2 PRODUCTS

2.01 PRODUCT/INSTALLATION ALLOWANCES
A. This Section of the Specification sets forth the extent of Allowances described hereafter. Work performed under allowances shall conform fully to all applicable parts of these specifications and drawings.
1. As shown on the bid form, Contractor shall include in the total amount, the base bid and all allowances stated in the Contract Documents.
2. The Contractor shall cause the work/materials and critical path time covered by these allowances to be performed for such amounts and by such persons as the District may direct, but Contractor will not be required to employ persons against whom Contractor makes a reasonable objection. If the actual cost, when determined, is more than or less than the allowance, the contract sum shall be adjusted accordingly by Change Order.
3. Cash allowances shall include complete work in place with all costs fully accounted for.
4. Payment to the contractor shall be made as per normal payment procedures discussed in other portions of the Contract Documents.
5. Payment to a District-designated third party shall be made by the Contractor as approved by the District. Contractor shall pay designated third party within 15 days of receipt of payment from the District.
6. Funds unused in any allowance item will be credited to the contract by credit change order, and shall carry no contractor markup.

2.02 CONTRACT SUM ALLOWANCES
A. The Allowances below correspond to the total allowance amounts defined on the Bid Form. In addition, each allowance item has applied to it a critical path duration that shall be included within the critical path schedule in anticipation of the Allowance activity (i.e. in order to accomplish the completion time as provided for in the Contract Documents, the critical path duration, below, shall be accommodated within the progress schedules defined elsewhere in these contract documents):
1. Unforeseen Site Conditions:
   a. Cash Allowance:
      1) A cash allowance of $100,000 shall be available for the purpose of accommodating unforeseen site conditions.
   b. Critical Path Duration:
      1) Add 10 calendar days of critical path time.
2. Unforeseen Hazardous Material Abatement:
   a. Cash Allowance:
      1) A cash allowance of $10,000 shall be available for proper handling of asbestos, lead, PCB or other hazardous materials which are not defined as part of the bid documents. This allowance is for work over and above that already defined in the Contract Documents.
   b. Critical Path Duration:
      1) Add 5 calendar days of critical path time.
3. Facilities Services:
   a. Cash Allowance:
1) A cash allowance of $5,000 shall be available for time applied by the District's trades (i.e., in the Facilities Department) in support of the Contractor or Contractors construction activities.

b. Critical Path Duration:
   1) Add 0 calendar days of critical path time.

2.03 ALLOWANCES FOR SPECIFIC FACILITY SITUATIONS

A. Excavation work interference with irrigation piping:
   1. The Contractor shall assume in the base bid, that during the course of excavation, irrigation piping will be accidentally cut or in some way broken. This base bid allowance shall include all material and labor to repair the irrigation piping in 1 break per 10 feet of trench separate locations including:
      a. capping, cutting and replacement of damaged irrigation pipe
      b. repair of control wiring
      c. repair and replacement of control valves
      d. pumping of excess water or any pooled water into the nearest storm drain
      e. immediate notification to the District of the irrigation piping incident
   2. Active irrigation piping must be capped immediately upon line breakage and the District must be notified immediately.
   3. Inactive irrigation piping must be capped immediately and the District shall be notified immediately.
   4. In the event that water is allowed to flow unchecked from a broken or ruptured line for greater than 15 minutes, the District shall have the right to have the line repaired and the Contractor shall be billed for the repair work (i.e., against the base bid contract amount).
   5. This allowance item has been identified in order to accommodate the inevitable breakage of irrigation piping and related wiring, valves and controls. It is believed that the 1 break per 10 feet of trench incidents are realistic for a facility of this size and type. If Contractor anticipates a request for payment for breakage associated with more than the number of incidents listed above, Contractor shall keep continuous count, on a formal log, and document on a pre-approved form, all of the incidents which have occurred and been repaired by the Contractor.

PART 3 EXECUTION

3.01 UNDERGROUND PIPING - UNIT PRICING

A. Existing soil is unusually rocky, that is a known condition of the site. The quantities listed on the Bid Form assume that large rocks/boulders up to three feet (3') in approximate diameter will be encountered for every ten feet (10') of lineal trench. Base bid shall include the unit cost for boulder removal, off hauling and removal from site, as well as subsequent backfilling with suitable clean fill. Contractor shall maintain a cumulative log of rock removal satisfying these requirements to perform unit price adjustments. Final payment shall be made in accordance with this Allowance and the Unit Prices and procedures as set forth in Section 01 22 00, and in accordance with the General Conditions.

END OF SECTION
SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. List of unit prices, for use in preparing Bids.
B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED
A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit. This includes both excavation and backfill associated with removed rock as defined as unforeseen conditions in Section 01 21 12, Allowances.

1.03 UNIT QUANTITIES SPECIFIED
A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES
A. Take all measurements and compute quantities. Measurements and quantities will be verified by District.
B. Assist by providing necessary equipment, workers, and survey personnel as required.
C. Measurement Devices:
1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.
D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
E. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
F. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes. Maintain current, cumulative record of quantities removed, reviewed by Owner's Representative. Final payment for rock removal will be adjusted by additive or deductive change order based on the actual quantities of rock removed as described in Section 01 21 12 Allowances.

1.05 PAYMENT
A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Engineer, multiplied by the unit price. Contract price will be modified by deductive or additive change order to account for actual Work versus Bid Form quantities.
B. Payment will not be made for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products remaining on hand after completion of the Work.
4. Loading, hauling, and disposing of rejected Products.
1.06 SCHEDULE OF UNIT PRICES

A. Item: Rock; Provide units pricing by volume in $/CY (Cubic Yards). Provide Unit Price (and extension) on Bid Form.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Description of alternates.

1.02 DESCRIPTION OF ADDITIVE ALTERNATES
A. Additive Alternates shall be quoted as provided on the Bid Form. Additive Alternates listed hereafter refer to all materials installed and completely in place in accordance with all applicable portions of the Plans, Specifications and Contract Documents and include all costs connected with such items including, but not necessarily limited to, material, labor, overhead and profit for Contractor and/or Subcontractor.
B. Section 1.03, below provides a listing of the specific Additive Alternates and of drawings (or specs) where the Additive Alternates are identified. Drawing and Specification sections identified below are for the convenience of the Contractor and do not necessarily indicate each and every location in the Contract Drawings and specifications which would fully describe the particular additive alternate.
C. Drawings were not marked to identify and/or summarize Additive Alternates. Contractor shall study all of the drawings and Contract Documents and ensure that the overall scope, and Contractor's subsequent bid for each Additive Alternative, shall comply with all requirements of all of the Contract Documents.

1.03 LISTING OF ADDITIVE ALTERNATES
A. The overall project will have a total of 2 additive alternates as indicated below:
1. Install Shotcrete concrete Cooling Tower enclosure in lieu of chainlink fence enclosure.
2. Provide, install, pipe, power, control and make operational chiller CH-3 as shown on drawings.
B. Contractor shall study all of the drawings and Contract Documents and ensure that the overall scope, and Contractor's subsequent bid for each Additive Alternative, shall comply with all requirements of all of the Contract Documents.

1.04 SELECTION OF ADDITIVE ALTERNATES
A. Additive Alternates will be taken in the order listed until all funds are exhausted. Bids will be evaluated based on the Base Bid, and increased by additive alternatives until either all alternatives are taken, or the highest number of additive alternatives may be selected with the available funding.

1.05 ACCEPTANCE OF ALTERNATES
A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at District's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.
B. Site mobilization meeting.
C. Progress meetings.
D. Construction progress schedule.
E. Submittals for review, information, and project closeout.
F. Number of copies of submittals.
G. Submittal procedures.

1.02 PROJECT COORDINATION

A. Project Coordinator: Construction Manager.
B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for vehicular access, traffic, and parking facilities.
C. During construction, coordinate use of site and facilities through the Project Coordinator.
D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
G. Make the following types of submittals to Engineer through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. District will schedule a meeting after Notice of Award.
B. Attendance Required:
   1. District.
   2. Engineer.
   3. Contractor.
C. Agenda:
   1. Execution of District-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Engineer, District, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. District will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. District.
   3. Engineer.
   4. Contractor's Superintendent.
   5. Major Subcontractors.

C. Agenda:
   1. Use of premises by District and Contractor.
   2. District's requirements and occupancy prior to completion.
   3. Construction facilities and controls provided by District.
   4. Temporary utilities provided by District.
   5. Survey and utility layout.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, District, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.
3.04 CONSTRUCTION PROGRESS SCHEDULE
A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
C. Samples will be reviewed only for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - CLOSEOUT SUBMITTALS.

3.06 SUBMITTALS FOR INFORMATION
A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer’s instructions.
   6. Manufacturer’s field reports.
   7. Other types indicated.
B. Submit for Engineer’s knowledge as contract administrator or for District. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT
A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. As-Built Drawings.
   6. Other types as indicated.
B. Submit for District’s benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS
A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Engineer.
   2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Engineer.
B. Documents for Information: Submit two copies.

C. Extra Copies at Project Closeout: See Section 01 78 00.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Sequentially number the transmittal form. Revised submittals shall be indicated with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Contractor shall verify both the field dimensions and the drawing layouts prior to submitting products for review to verify that installation is properly coordinated. It is the contractor's responsibility to submit products that are appropriate for the actual field conditions.

F. Deliver submittals to Engineer at business address.

G. Schedule submittals to expedite the Project, and coordinate submission of related items.

H. For each submittal for review, allow 15 calendar days excluding delivery time to and from the Contractor.

I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

J. Provide space for Contractor and Engineer review stamps.

K. When revised for resubmission, identify all changes made since previous submission.

L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

N. Engineer's review will result in the return of the submittal with one of the following marks:
   1. "No Exceptions - materials may be provided as described in the submittal.
   2. "Exceptions Noted, Resubmittal Not Required" - materials may be provided as described in the submittal, in accordance with comments or notes or additional requirements noted by the reviewer.
   3. "Not Acceptable" - Materials are unacceptable and shall not be provided.
   4. "Exceptions Noted, Resubmit" - Requires that the submittal be modified, according to requirements noted, and resubmitted.

O. Materials or equipment shall not be delivered to the jobsite without first obtaining a submittal which has the "No Exceptions" or "Exceptions Noted, Resubmittal Not Required" stamp mark.

END OF SECTION
SECTION 01 30 55
SAMPLE FORMS

PART 1 GENERAL
1.01 SECTION INCLUDES:
A. This section includes sample forms to be used during execution of this Contract.

1.02 FORMS INCLUDED:
A. Substitution Request
B. Access Request

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.
B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct an appropriate remedy or adjust payment.

END OF SECTION
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Project identification sign.

1.02 TEMPORARY UTILITIES

A. District will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.
B. New permanent facilities may be used.
C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Email: Account/address reserved for project use.
   3. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
E. Gates in barriers shall be maintained in the closed position when not in use. Provide signs on all gates stating: "NOTICE - GATES MUST BE CLOSED AFTER ENTRY OR EXIT."
F. Shield all welding operations from public view with solid barrier.
G. Protective barricades, fencing, handrails and bridges, together with warning and guidance devices and signs, must be utilized so that passageway for pedestrians, especially blind and other physically disabled persons, is safe and well defined.
H. Walkways in construction areas shall be maintained at least 4 feet in width or equal to sidewalk/entry way width, whichever is greater, unless expressly permitted otherwise by the district in writing; and shall be free of abrupt changes in the grade. These walkways shall be clearly marked and shall provide safe passage for pedestrians (i.e. free from potential danger from construction activities). Obstructions within the walkways shall be illuminated during hours of darkness. Minimum vertical clearance to any obstruction within the walkway shall be seven feet.

I. Where walks, pathways or accessways are closed by the Work, an ADA compliant, alternate walkway shall be provided, preferably within the immediate location of the pathway or access to be closed. Where it is necessary to divert pedestrians into a major detour and/or into a parking lane or traffic area, at no time shall pedestrians be diverted into a portion of a street used for vehicular traffic. Any deviation from the above must have prior approval of the District.

J. At locations where adjacent alternate walkways cannot be provided (i.e. where no pathway or access is available within the immediate location of the interruption) ADA compliant detours shall be clearly planned, marked and constructed. Appropriate signs and barricades must be installed at the limits of construction and in advance of the closure (or detour) in order to divert pedestrians to the appropriate walkway or detour.

K. Wherever it is necessary that trenches and excavation be bridged, bridges shall be constructed in an ADA compliant manner. These bridges shall permit unobstructed flow of traffic or pedestrians and shall meet the following criteria:
   1. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts or other devices.
   2. Bridging shall be installed to operate with minimum noise.
   3. The trench shall be adequately shored to support the bridging and traffic.
   4. Only steel plates shall be used for bridging. Steel plates used for bridging shall extend one foot (minimum) beyond the edges of the trench. The steel plates shall be beveled in order to provide smooth and uninterrupted wheelchair and other access. Temporary paving materials may be used in conjunction with the beveled steel plates. Provide handrails.

L. Remove barriers and enclosures only after acceptance of that portion of the Work.

1.06 FENCING
   A. Construction: Commercial grade chain link fence.
   B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES
   A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY
   A. Provide security and facilities to protect Work, existing facilities, and District's operations from unauthorized entry, vandalism, or theft.
   B. Security of Construction areas, including, but not limited to, work in place, work in storage, Contractor's equipment and tools shall be the sole responsibility of the Contractor.
   C. Coordinate with District's security program.

1.09 VEHICULAR ACCESS AND PARKING
   A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
   B. Coordinate access and haul routes with governing authorities and District.
   C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Existing on-site roads may be used for construction traffic.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL
A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION
A. Provide project identification sign of design, construction, and location approved by District.
B. No other signs are allowed without District permission except those required by law.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
10200 - Merritt College CHW Infrastructure

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations and procedures.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS
A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS
A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.
D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS
A. Provide new products unless specifically required or permitted by the Contract Documents.
B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
C. Provide interchangeable components of the same manufacture for components being replaced.
D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

2.03 PRODUCT OPTIONS
A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. A Substitution is a change from one product or material to another of equal or like value, quality, features, appearance or durability. The burden of proof is on the submitter and the determination of equality rests solely with the District's Representative and District. In general, substitutions will be considered and indicated in the "Conditions" or when the cost differential and benefit is favorable to the District without affecting the final results of the Project. All "Requests for Substitutions" must be accompanied by a completed request form.

B. Within a period of fifteen (15) calendar days after award of Contract, the District's Representative will consider formal requests from the Contractor for substitution of products in place of those specified.

C. After the end of that period, requests will be considered only in case of product unavailability or other conditions beyond the control of Contractor.

D. Product unavailability shall be verified in writing by manufacturer.

E. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it is equal or better than the specified product in all aspects.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the District.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse District's Representative for review or redesign services associated with approval and re-approval by authorities.

F. Submit separate Requests for each substitution with requirements stated in Contract Documents:
   1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
      a. Product identification, including manufacturer's name and address.
      b. Manufacturer's literature identifying:
         1) Product's description.
         2) Reference Standards.
         3) Performance and test data.
         4) Samples: as applicable.
         5) Name and address of similar projects on which product has been used, and date of each installation.
   2. Itemized comparison of the proposed substitution with product specified; list significant variations. Provide tabbed and marked manufacturer's data for specified product and the substitution for documentation.
   3. Data relating to changes in Construction Schedule.
   4. Any effect of substitution on separate Contracts.
   5. List of changes required in other work or products.
   6. Detailed cost data comparing proposed substitution with product specified.
7. Designation of availability of required license fees or royalties.

G. Substitutions will not be considered for acceptance when:
   1. They are indicated or implied on Shop Drawings or product data submittals without a
      formal request from Contractor.
   2. They are requested directly by a Subcontractor.
   3. Acceptance will require substantial revision of Contract Documents.
   4. Insufficient information is available.

H. Products and materials described on the Drawings and in these Specifications are known to be
   available at the time of bidding. Failure on the part of the Contractor to procure, receive and
   store such products and materials will not be considered as a basis for substitution or an
   increase in the Contract Price.

I. Should the Contractor fail to furnish specified products or materials in a timely manner and such
   products or materials are no longer available, the Contractor shall furnish such substitution as
   determined by the District’s Representative to be equal to the original Specification at no
   additional cost to the District.

J. The District shall assume no responsibility for failure on the part of the Contractor to provide the
   specified products or materials.

K. Substitute products shall not be ordered or installed without prior written review by the District’s
   Representative.

L. District’s Representative shall determine acceptability of proposed substitutions and reserves
   the right to reject proposals due to insufficient information or to reject proposals, if, in the
   District’s Representative’s judgment, the proposed substitution does not meet the aesthetic
   criteria of the specified materials.

M. Compensation: Contractor shall reimburse District for compensation paid to the District’s
   Representative for evaluation of substitution proposals made during construction, whether or
   not substitution is accepted by District.

3.02 TRANSPORTATION AND HANDLING
   
A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site
   storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer’s instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of
   surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are
   correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling,
   disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION
   
A. Designate receiving/storage areas for incoming products so that they are delivered according to
   installation schedule and placed convenient to work area in order to minimize waste due to
   excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers’ instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment
   favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to
   prevent condensation and degradation of products.

DSA Re-submittal 6/21/2012

PRODUCT REQUIREMENTS

01 60 00 - 3
G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
H. Prevent contact with material that may cause corrosion, discoloration, or staining.
I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
Specifications

For

Merritt College -
CHW Infrastructure

SOBE No. 10200

6/21/2012
SPECIFICATIONS

Merritt Community College – CHW Infrastructure
Project #10200

Merritt Community College
12500 Campus Drive
Oakland, CA 94619

PERALTA COMMUNITY COLLEGE DISTRICT
OAKLAND, CA. 94619

Approval Stamps

ARCHITECT
Joseph Gonzalez
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

ELECTRICAL ENGINEER
Jeffry Gosal
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

MECHANICAL ENGINEER
John Salas
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

STRUCTURAL ENGINEER
Stephen Ward
AKH Structural Engineers
1505 Meridian Ave., Ste. B
San Jose, Ca. 95125

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
APPL'D. 112534
AC 029665
DATE 6/29/12
### Statement of Structural Tests and Special Inspections

#### 2010 CBC

**School Name:** Merritt College  
**District:** Peralta Community College

**Important:** This form is only a summary list of structural tests and special inspections required for the project. The actual tests and inspections must be performed as detailed on the DSA approved documents. The project inspector is responsible for providing inspection of all facets of construction, including但不限于, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A.

**Note:** This form is also available for projects submitted for review under the 2007 CBC.

**Instructions:** Click a plus sign (+) before any category or subcategory to reveal additional tests and special inspections. An "X" before a listed test or inspection indicates it is a mandatory requirement. A shaded box indicates a test or special inspection that may be required, depending on the scope of the construction and other issues. A shaded box can be clicked indicating your selection of that test. **Note:** A minus (-) on a category or subcategory heading indicates that it can be collapsed. However, any selections you may have made will be cleared. Click on the "Compile" button to show only the tests finally selected. For more information on use of this form, see DSA-103.INSTR.

---

**SOILS**

**1. General:**
- **Verify that:**
  - Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations.
  - Foundation excavations are extended to proper depth and have reached proper material, and
  - Materials below footings are adequate to achieve the design bearing capacity.

**2. Compacted Fills:**
- **Perform qualification testing of fill materials.**
- **Verify use of proper materials and inspect lift thicknesses, placement, and compaction during placement of fill.**
- **Test compaction of fill.**

**3. Cast-In-Place Deep Foundations (Piers):**
- **Inspect drilling operations and maintain complete and accurate records for each pier.**
- **Verify locations of piers.**
- **Confirm pier diameters, plumbness, and embedment into bedrock.**
  - Record concrete or grout volumes.
- **Concrete piers.**

**5. Retaining Walls:**
- **Placement of soil reinforcement, drainage devices, and backfill.**

---

*In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.*
### CONCRETE

#### 7. CAST IN PLACE CONCRETE

**Material Verification and Testing:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Verify use of required design mix.</td>
<td>Periodic</td>
<td>SI &amp; PI*</td>
<td>&quot;To be performed by batch-plant special inspector and project inspector.&quot;</td>
</tr>
<tr>
<td>X</td>
<td>Test reinforcing steel.</td>
<td>Test</td>
<td>Lab 1916A.2 (1916.1(^\circ)) , ASTM A370. See IR 17-10</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Perform slump, temperature, and (where required) air content tests.</td>
<td>Test</td>
<td>Lab ASTM C172, ASTM C31.</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Test concrete (compression)</td>
<td>Test</td>
<td>Lab 1905A.6 (1905.8(^\circ)), ASTM C39.</td>
<td></td>
</tr>
</tbody>
</table>

**Inspection:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Inspect batching of concrete.</td>
<td>Continuous</td>
<td>SI</td>
<td>1704A.4.2: (see 1704A.4.3, option 2 for waiver based on design parameters).</td>
</tr>
<tr>
<td>X</td>
<td>Inspect placement of formwork, reinforcing steel, embedded items and concrete. Inspect curing and form removal.</td>
<td>Continuous</td>
<td>PI*</td>
<td>&quot;May be performed by a special inspector when specifically approved by DSA.&quot;</td>
</tr>
</tbody>
</table>

#### 10. SHOTCRETE (in addition to Cast in Place Concrete tests and inspections):

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Test shotcrete (compression).</td>
<td>Test</td>
<td>Lab 1913A.5, 1913A.10 and 1916A.5 (1913.5(^\circ), 1913.10(^\circ) and 1916.1(^\circ)). ASTM C42, ASTM C1140</td>
</tr>
</tbody>
</table>

#### 11. POST-INSTALLED ANCHORS:

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Inspect installation of post-installed anchors</td>
<td>Continuous</td>
<td>PI Table 1704A.4</td>
</tr>
<tr>
<td>X</td>
<td>Test post-installed anchors.</td>
<td>Test</td>
<td>Lab 1916A.7 (1916.1(^\circ)).</td>
</tr>
</tbody>
</table>

### MASONRY

#### STEEL

#### 17. STRUCTURAL STEEL AND COLD-FORMED STEEL USED FOR STRUCTURAL PURPOSES

**Material Verification:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
</table>
| X    | Verify that all materials are appropriately marked and that:  
- Mill certificates indicate material properties that comply with requirements.  
- Material sizes, types and grades comply with requirements. | Periodic  |          | "By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication." |
| X    | Test unidentified materials. | Test      | Lab 2203A.1 (2203.1\(^\circ\)), ASTM A370. |
| X    | Examine seam welds of structural tubes and pipes. | Periodic  | SI*     | "See DSA IR 17-3." |

**Inspection:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Verify member locations, bracing and all details constructed in the field.</td>
<td>Continuous</td>
<td>PI</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Verify stiffener locations, connection tab locations and all construction details fabricated in the shop.</td>
<td>Periodic</td>
<td>SI</td>
<td></td>
</tr>
</tbody>
</table>

#### 19. WELDING:

**Verification of Materials, Equipment, Welders, etc.:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Frequency</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Verify weld filler material identification markings per AWS designation listed on the DSA approved documents and the WPS.</td>
<td>Periodic</td>
<td>SI</td>
</tr>
</tbody>
</table>

* In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.
### Statement of Structural Tests and Special Inspections

**2010 CBC**

|---|---|---|---|---|

**19.1 SHOP WELDING:**

| X | a. Inspect groove, multi-pass, and fillet welds > 5/16" | Continuous | SI | Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3. |
| X | b. Inspect single-pass fillet welds ≤ 5/16" | Periodic | SI | Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3. |
| X | c. Inspect welding of stairs and railing systems. | Periodic | SI | 1704A.3.1 Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3. |

**19.2 FIELD WELDING:**

| X | a. Inspect groove, multi-pass, and fillet welds > 5/16" | Continuous | SI | Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3. |
| X | b. Inspect single-pass fillet welds ≤ 5/16" | Periodic | SI | Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3. |
| X | f. Inspect welding of stairs and railing systems | Periodic | SI | * May be performed by the project inspector when approved by DSA. See DSA IR 17-3. |

**WOOD**

**OTHER**

Section 1704A.15

---

*In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.*
<table>
<thead>
<tr>
<th>Key to Columns</th>
<th>2 Performed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous – Indicates that a continuous special inspection is required</td>
<td>GE – Indicates that the special inspection is to be performed by a registered geotechnical engineer or his or her authorized representative</td>
</tr>
<tr>
<td>Periodic – Indicates that a periodic special inspection is required</td>
<td>Lab – Indicates that the test is to be performed by a testing laboratory accepted in the DSA laboratory Evaluation and Acceptance (LEA) Program</td>
</tr>
<tr>
<td>Test – Indicates that a test is required</td>
<td>PI – Indicates that the special inspection is to be performed by the project inspector</td>
</tr>
<tr>
<td>SI – Indicates that the special inspection is to be performed by a special inspector</td>
<td></td>
</tr>
</tbody>
</table>

(Note: The difference between "tests" and "special inspections" is addressed in IR 17-4)

**Compile**

Name of Architect or Engineer (general responsible charge)

**Stephen R. Ward**

Name of Structural Engineer (When structural design has been delegated)

**Signature of Architect or Structural Engineer**

**Identification Stamp**

DIV OF THE STATE ARCHITECT
APP. # 01-112534

AC N/A F/LS N/A SS 01-112534

DATE 01/12/12

Architect or Structural Engineer Stamp

+ In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.
**DOCUMENTS REQUIRED FOR PROJECT CERTIFICATION- ORS-6**

**Project Name:** MERRIT COLLEGE

**File No.: 1-CL**  **Application No.: 01-112537**  **Name of A/E:** SALASOBRIEN

### Project Information

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Item</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-5 (Project/Site)</td>
<td>For Project/Site Inspector(s)</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-6 (In-Plant)</td>
<td>For Relocatable Buildings Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form DSA-102</td>
<td>Contract Information</td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6/A/E)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports (Form DSA-6/A/E)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Architect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Structural Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mechanical Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Engineer</td>
<td></td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports (Form DSA-6)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Project/Site Inspector(s)</td>
<td>From Each Contractor</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Contractor</td>
<td>For Relocatable Building Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In-Plant Inspector</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Special Inspector(s)</td>
<td></td>
</tr>
</tbody>
</table>

### Other Final Verified Reports/Affidavits

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports/Affidavits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Laboratory (Form DSA-291)</td>
<td>Signed by LEA Lab Professional Engineer</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Shop Welding &amp; Fabrication (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Field Welding (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High Strength Bolt Installation (Form DSA-262)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Glulam Fabrication (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manufactured Trusses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Masonry Inspection (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Engineered Fill (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Drilled Pier Soil Inspection (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beacher Fabrication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td></td>
<td>Other: RETAINING WALLS</td>
<td>SIGNED BY GEOTECH ENGINEER</td>
</tr>
</tbody>
</table>

### Other Documents

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Items</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Further Fees</td>
<td>See Attached Invoice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Notice of Completion</td>
<td>Signed by School District/Owner</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Automatic Sprinkler System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fire Suppression System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skylights D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beachers D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change Orders:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form DSA-102</td>
<td>For all fees and/or reimbursable charges paid to the Construction Managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Reports:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expansion Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grouted Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Adhesive Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Grounding Test Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Checklist for Site Inspector of Relocatable Bldgs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Record Set of Drawings and Specifications approved by DSA during plan check but were not copied to DSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

**Signature of A/E:** [Signature]  **Date:** 6/29/12

**For 90 Day Letter Preparation By:** [Signature]  **Date:** 6/29/12

(Rev. 5/07)
# TABLE OF CONTENTS

## DIVISION 01 - GENERAL REQUIREMENTS

- 01 10 00  SUMMARY
- 01 13 00  PROJECT COORDINATION
- 01 14 00  WORK RESTRICTIONS
- 01 21 12  ALLOWANCES
- 01 22 00  UNIT PRICES
- 01 23 00  ALTERNATES
- 01 30 00  ADMINISTRATIVE REQUIREMENTS
- 01 30 55  SAMPLE FORMS
- 01 40 00  QUALITY REQUIREMENTS
- 01 50 00  TEMPORARY FACILITIES AND CONTROLS
- 01 60 00  PRODUCT REQUIREMENTS
- 01 70 00  EXECUTION AND CLOSEOUT REQUIREMENTS
- 01 78 00  CLOSEOUT SUBMITTALS
- 01 79 00  DEMONSTRATION AND TRAINING

## DIVISION 05 - METALS

- 05 51 00  METAL STAIRS
- 05 52 13  PIPE AND TUBE RAILINGS

## DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 07 46 46  FIBER CEMENT SIDING
- 07 90 05  JOINT SEALERS

## DIVISION 08 - OPENINGS

- 08 11 13  HOLLOW METAL DOORS AND FRAMES
- 08 33 23  OVERHEAD COILING DOORS
- 08 71 00  DOOR HARDWARE
- 08 91 00  LOUVERS

## DIVISION 09 - FINISHES

- 09 21 16  GYPSUM BOARD ASSEMBLIES
- 09 90 00  PAINTING AND COATING

## DIVISION 10 - SPECIALTIES

- 10 14 00  SIGNAGE
- 10 44 00  FIRE PROTECTION SPECIALTIES

## DIVISION 22 - PLUMBING

- 22 10 05  PLUMBING PIPING
- 22 10 06  PLUMBING PIPING SPECIALTIES

## DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
23 05 19 METERS AND GAGES FOR HVAC PIPING
23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 19 HVAC PIPING INSULATION
23 08 00 COMMISSIONING OF HVAC
23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
23 09 30 ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS
23 21 13 HYDRONIC PIPING
23 21 14 HYDRONIC SPECIALTIES
23 21 23 HYDRONIC PUMPS
23 25 00 HVAC WATER TREATMENT
23 31 00 HVAC DUCTS AND CASINGS
23 34 23 HVAC POWER VENTILATORS
23 64 16 CENTRIFUGAL WATER CHILLERS
23 65 13 INDUCED DRAFT COOLING TOWERS

DIVISION 26 - ELECTRICAL

26 05 01 MINOR ELECTRICAL DEMOLITION
26 05 10 ELECTRICAL GENERAL PROVISIONS
26 05 12 BASIC MATERIAL AND METHODS
26 05 13 MEDIUM-VOLTAGE CABLE
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 73 POWER SYSTEM STUDY
26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 02 ELECTRICAL ACCEPTANCE TESTING
26 11 16 SECONDARY UNIT SUBSTATIONS
26 13 21 AIR INTERRUPTER SWITCHES
26 24 13 SWITCHBOARDS
26 24 16 PANELBOARDS
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 00 FIRE ALARM SYSTEM
28 35 00 REFRIGERANT MONITORING SYSTEM

DIVISION 31 - EARTHWORK

31 23 16.13 TRENCHING
31 23 16.25 ROCK REMOVAL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING
32 13 13 CONCRETE PAVING
32 31 13 CHAIN LINK FENCES AND GATES

DIVISION 33 - UTILITIES

33 05 13 MANHOLES
33 61 13 UNDERGROUND HYDRONIC ENERGY DISTRIBUTION
33 71 19 ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

DSA Re-submittal 6/21/2012
PART 1 GENERAL

1.01 PROJECT
A. Project Name: Chilled Water Infrastructure.
B. District's Name: Peralta Community College District
C. Engineer's Name: Salas O'Brien Engineers, Inc.
D. The Project consists of the alteration of Building F, and underground chilled water infrastructure with connections to Building L, and Building Q. Work includes the installation of a chilled water plant in Building F, with cooling tower yard, including new electrical service. Also included is stubout service to future Science Building. Building F alterations include converting the existing entrance into a chiller room, installing second floor stair exiting and lower room addition with accoustical louvers, a cooling tower yard with site screen chain link fences & gates, pumps and new electrical substation to serve the new central chilled water plant equipment. Exposed pipes to have outdoor box enclosures on exterior walls and low roofs. See 01 23 00 Alternates for Concrete Cooling Tower Yard Enclosure and third chiller.

1.02 CONTRACT DESCRIPTION
A. Contract Type: A single prime contract based on a Stipulated Price as described in the Invitation to Bid.

1.03 DESCRIPTION OF ALTERATIONS WORK
A. Scope of demolition and removal work is shown on drawings.
B. Scope of alterations work is shown on drawings.
C. HVAC: Alter existing system and add new construction, keeping existing in operation.
D. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
E. Relocation of storage container currently located in future cooling tower area at Bldg F to an on site area designated by the District.
F. District will remove the following items before start of work:
   2. Contents of storage container for the installation of the cooling tower pad and piping near Building F.
   3. All stored/loose items currently inside the future chiller room in Building F.

1.04 FUTURE WORK
A. Project is designed for future chilled water connection to future Science Building. Proposed building outline is shown on Contract Drawings.

1.05 OWNER OCCUPANCY
A. District intends to continue to occupy portions of the existing buildings during the entire construction period.
B. District intends to occupy the Project upon Substantial Completion.
C. Cooperate with District to minimize conflict and to facilitate District's operations.
D. Schedule the Work to accommodate District occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES
A. Construction Operations: Limited to areas noted on Drawings.
B. Arrange use of site and premises to allow:
   1. District occupancy.
   2. Work by Others.
   3. Work by District.
4. Use of site and premises by the public.
5. Use of site by Students, Staff and Employees.

C. Provide access to and from site as required by law and by District:

D. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

E. Existing building spaces may not be used for storage.

F. Limit shutdown of utility services to 4 hours at a time, arranged at least two weeks in advance with District.
   1. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

A. Coordinate construction schedule and operations with District.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 13 00
PROJECT COORDINATION

PART 1 GENERAL

1.01 GENERAL COORDINATION

A. The requirements of this Section relate to various requirements of the Agreement, General and Special Conditions, specifications, drawings, and all modifying documents which are part of the construction contract. Responsibility for coordination of all such applicable requirements shall be that of the Contractor.

B. The Contractor shall coordinate and cooperate with the District and other Contractors, and shall execute the work of this contract in a timely manner so as to cause no delay in the work of other contracts.

C. The Contractor shall be responsible for the coordination of all Work, including but not limited to, all trades including specialized trades to accomplish all aspects of the Work.

D. The Contractor shall coordinate scheduling, submittals, and work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items to be installed later.

E. The Contractor shall verify that utility requirement characteristics of operating equipment are compatible with building utilities. Contractor shall coordinate work of various Sections having interdependent functions and be responsible for installing, connecting to, and placing in service, related equipment.

F. Contractor shall coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. This shall include, but not be limited to: following routing shown for pipes, ducts, and conduit, as closely as practicable; placing runs parallel with line of building, and utilizing spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

G. In finished areas except as otherwise indicated, Contractor shall ensure that pipes, ducts, and wiring are concealed within the construction.

H. Contractor shall coordinate locations of fixtures and outlets with finish elements.

I. Contractor shall coordinate daily clean up of Work in each area of work and at the end of each work shift.

J. Contractor shall coordinate completion and clean up of Work of separate Sections in preparation for substantial completion and for portions of Work designated for District's occupancy.

K. Contractor shall coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of District activities.

L. In addition to the above requirements and requirements of the General Conditions, Contractor shall be responsible for the coordination of the following:
   1. Provisions for future installation of work not included in the contract as shown or specified.
   2. Primary, major and accessory materials, and items necessary to complete the installation.
   3. Labor operations and material items reasonably incidental for finishing.
   4. Performing of Work and delivery of materials in accordance with established construction schedules.
   5. Development of procedures for implementation of all utility shutdowns, pathway closures; wayfinding signage and directives; development and construction of alternative pathways, barricading and related signage.
   6. Coordination of and obtaining approval for all schedules, schedule modifications, Work Plans, utility shutdowns, pathway closures, wayfinding and alternative pathways, barricading, and all signage with District.
   7. Submittal of Access Request Forms and development, coordination and submittal of other forms as appropriate for communicating work efforts, changes or clarifications to the District and impacted personnel.
8. Coordination with Campus Facilities and Trades personnel as regards on-going support of peripheral equipment and systems (e.g. electric panels, manhole access, central plant shutdown, fire water and fire alarm system shutdown or relocation, security/alarm system shutdown or relocation, etc.).

M. Contractor shall coordinate all aspects of his construction operations, generally, and specifically as required under various Articles of this Section and other parts of the Contract Documents, to provide the District with a complete and operable facility. Other Contractors working at the project site, including those delivering materials or equipment, shall coordinate their operations with each other to provide the District with a complete and operable facility.

1. Any dispute over coordination, or failure to coordinate, shall be brought to the District for resolution.

2. If any part of the work depends on proper execution or on proper results of the work or systems or equipment of any other provider or of the District, Contractor shall inspect and promptly report to the District, any defects in the work that render it unsuitable for such proper execution and necessary results. Failure to so inspect the providers' or District's work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the provided work, system or equipment. This requirement is waived only to the extent that defects develop in the other providers' or District's work or systems or equipment after the execution of subsequent work.

3. Contractor shall cooperate with other Contractors on the project site and with the District so that completion of all work may proceed with all possible speed. Contractor shall attend a monthly Campus project coordination meeting and shall furnish other Contractors, whose work is fitted to this work, details and erection drawings giving full information regarding the scheduling, fabrication and assembly of this Work. So far as possible, drawings shall indicate checked field measurements. Contractor shall cooperate in timing this work to join with the work of other Contractors or the District.

4. Contractor shall check the drawings of other Contractors for interferences with this work and promptly report, in writing, any such interferences to the District. In addition, Contractor shall submit complete information, including drawings, descriptions, sketches, marked prints, etc., as required for District coordination of drawings by others which are not a part of this work.

5. To ensure the proper evaluation of subsequent work of this contract, Contractor shall measure work already in place and report to the District any discrepancy between the executed work and the contract documents. Failure to so measure work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the available space(s).

6. Contractor shall do all cutting and fitting of this work and of other work that may be required to properly fit this work to receive, or be received by, the work of other Contractors as shown on or reasonably implied by, the contract documents. Contractor shall properly finish and complete this work after other Contractors have finished. Any costs for additional cutting and fitting caused by defective work shall be borne by the party responsible thereof. Contractor shall not endanger any work by cutting, fitting or otherwise, and shall not cut or alter the work of other Contractor without the consent of the District.

1.02 INCIDENTAL COSTS

A. Contractor shall furnish at his own cost and expense all tools, consumable supplies, appliances, equipment, etc. necessary for the execution of his work, and shall be responsible for care and guarding thereof.

B. Contractor shall be entirely responsible for professional trade, business, or other licenses required by State statute or local government.

1.03 CORRESPONDENCE AND NOTICES

A. Contractor shall clearly identify correspondence, notices, requests for information (RFI's) and submittals with project name, subject, and detailed references to drawings and specifications.
In order to properly track and document all correspondences and notices, a unique sequential numbering system shall be applied for each type of correspondence or notice.

B. Contractor shall notify the District's representatives in writing 6 working days, unless otherwise specified, in advance of all required inspections.

1.04 MISCELLANEOUS PROVISIONS

A. Contractor shall immediately refer to the District, any requirement shown or specified which Contractor finds or believes:
   1. Is not equal to industry standards for achieving the intended results.
   2. Is excessive in cost or effort to effect the intended results.
   3. Is below standard for proper enforcement of the guaranties required.
   4. Is at variance with governing laws, regulations, codes or standards.

B. Failure to so inform the District, in advance of Work, shall constitute acceptance by the Contractor for resolution of the requirements at Contractor's expense.

C. Contractor shall shop fabricate and preassemble interrelated parts where possible.

D. Closing up of walls, partitions or furred spaces, backfilling, or other "covering up" operations shall not proceed until all required tests and inspections have been completed.

E. Prior to starting a particular type or kind of work, Contractor shall:
   1. Examine for relevant information all contract documents and subsequent data issued to the project.
   2. Check accepted submittals and verify dimensions at job site.
   3. Consult manufacturers for instructions applicable to conditions under which work is to be installed.
   4. Inspect areas, surfaces, or any construction location receiving the work. Start of work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory condition to achieve proper installations and first quality workmanship as intended under these specifications.

1.05 WORK ON OCCUPIED FACILITIES

A. This section shall apply to all modifications or additions to work on all occupied facilities. In this case, all buildings and all grounds are considered fully occupied.

B. Contractor shall cooperate with the District to sequence his work so as not to unnecessarily interfere with operation of occupied facilities. Prior to demolition or construction work, Contractor shall consult with the District as a part of the Work Plan process and Contractor shall develop a construction schedule and Work Plan which will permit the existing users (staff, students, administrators) to function without interruption; while remaining in compliance with the schedules and limitations as delineated in other portions of the Contract Documents. This includes power outages, noise levels greater than 65dB, dislocation, or other interruptions as would cause intrusion to users or disruption of the user environment.

C. Campus operations cannot be impacted by the Contractor without prior written approval from the District's representatives. Requests to perform activities which potentially impact campus operation, or occur in occupied buildings, shall be made by utilizing the Access Request Form. The Contractor shall sequentially number each access request and maintain a log of the requests issued. After receiving approval for Contractor's 3 week Work Plan, Contractor will submit properly completed Access Requests to the District's representative. Each Access Request shall occur a minimum of two weeks prior to the proposed date of the work. Submittal of the Access Request Form shall provide the District a minimum of 4 days during which the District may coordinate with campus personnel and ongoing campus activities; and subsequently suggest changes to the requested Access. Such changes to the requested access time shall not form a basis for Contract time extensions regardless of the critical nature of the proposed activity. For this reason, Contractor shall always have one or more "spare" locations or operations planned for construction as a part of the Work Plan process.

D. In planning and performing the work, every effort shall be made to control the noise, dirt and fugitive dust levels as required by these contract specifications.

DSA Re-submittal 6/21/2012

PROJECT COORDINATION
E. Ingress and egress to and from existing buildings shall be continuously maintained for purposes of normal personnel access (i.e. to classes, offices, administrative events and social events), fire and emergency entrances and escape, loading and delivery, and building maintenance, to the satisfaction of the District, and the local fire and building departments. Contractor shall determine and install all necessary wayfinding signage as indicated on the Work Plan and approved in advance by the District. Said signage shall be installed prior to any shutout or interruption of access to a room, pathway, system, building, doorway or hallway.

F. All utilities shall be protected against interruption, damage, or contamination during construction. Temporary utilities shall be installed, if necessary, to maintain services continuously. Such utilities shall include but shall not be limited to electricity, water, gas, sewerage, chilled water, steam, telephone and data.

G. Contractor shall limit equipment and vehicles in ingress and egress and use of service areas to the minimum essential to Contractor's operations. Other vehicles and equipment shall be kept out of such areas. In the event of unavoidable conflict with Contractor's equipment in such areas, upon request of the District, Contractor shall remove such equipment immediately.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Because of the sensitive nature of campus operations, to the extent that unplanned outages create unreplaceable loss of time, and operation deficiencies, the planning and execution of work procedures to reduce outages to an absolute minimum is of prime importance in this project. Such planning and execution is the full responsibility of the Contractor performing the work under these contract documents.

3.02 POWER OUTAGES

A. Interruption of the power to any electrical system for performing the construction work shall be scheduled in advance by use of an Access Request and approval will be at the convenience of the District.

B. Time of outages in individual buildings shall be scheduled for the times that the classrooms are not in session. Contractor to mobilize required work force and equipment to be able to accomplish individual tasks within permitted Work sequences.

C. Scheduling of any power outages shall be performed and approved as a part of the Work Plan and Scheduling process. In all cases, approval of power outages and procedures shall be obtained in writing by use of an Access Request at least two weeks prior to the Work. Request to be filed on Access Request Forms. This includes shut down of any equipment, system or system(s).

D. The work to any area with power outages shall be performed and proceed on a continuous, non-stopping basis until power is restored to all areas.

E. Contractor to consider all costs associated with difficulty of performing the work under restricted conditions in its bid price. Contractor shall also be responsible for any damages to District properties resulting from lack of performance in accordance with the requirements of this section and these contract documents.

3.03 FIELD INVESTIGATION OF INFORMATION

A. The information regarding each feeder and feeding each individual building as appear on the existing single line diagrams, is based on the best information available. However, it was considered impractical to verify the data by test outages prior to the actual need. The Contractor shall thus verify all buildings power sources, feeders data and initiate the work accordingly.
3.04 SPECIAL REQUIREMENTS FOR TRENCHING/EXCAVATING

A. To minimize access interference and facility disruption, open trench headings shall be limited to a maximum of 300 feet of trench. District may, upon written request allow additional headings to be open concurrently, if acceptable access and wayfinding means are provided by contractor.

B. Existing utilities shall be located by contractor through the contractor provided utility locating service subcontractor. USA will not locate utilities that are not within the public right of way (i.e., no locating on campuses or private property). Utilities shall be clearly marked with non-permanent paint with depth estimates provided by the locating subcontractor.

C. Contractor shall pothole a minimum of 10' in advance of any powered trenching or excavating operations. Potholing shall locate and expose any and all utilities in the path of trenching or excavating activities. Potholing shall be by vacuum excavating equipment or hand digging. All utilities encountered shall be clearly marked, and hand excavated to prevent damage. (Exception: irrigation utilities are usually not readily located with underground survey equipment, and breakage is expected to occur - see Section 01 21 12 Allowances, for special allowances).

D. All utilities located, whether or not shown on contract drawings are to be marked on the project record drawings, as to size and service, with either a reference to station number or reference to permanent surface features, and elevations noted (referenced to sea level). At completion of the project, all such located utilities shall be incorporated in the electronic As-Built drawings required to be provided by this contract. Regardless of other requirements (or lack thereof) for As-Built Drawings, contractor shall provide As-Built, electronic documentation of ALL utilities crossed or exposed, indicating location, size, service and elevation, whether shown on contract documents or not.

3.05 SAFETY - (REGARDING POWER OUTAGES)

A. Contractor shall coordinate through the District, and implement a procedure to prevent accidental shut-down or injury. The procedure shall include a systematic method of tagging and locking the circuit breakers and switches. All circuit breakers and switches which can energize a circuit wherein work needs to be performed must be opened, tagged with warning signs and locked. Temporary grounding of the circuit and locking the circuit breaker(s)/switch(es) is required for all long circuits and for all circuits with operating voltage above 480 volts. Proper isolation of circuits on which work is to be performed shall be required for safety of the workers. The Contractor shall be fully responsible for implementing all required safety procedures to protect personnel.

B. The Contractor shall never assume, no matter how obvious the circumstances, that any conductor or piece of equipment is de-energized before it is handled by the workman, without actually testing for de energization. Primary conductors shall be tested with hot stick or similar means.

END OF SECTION
PART 1 GENERAL

1.01 OCCUPANCY

A. The District intends to occupy all buildings and to run a normal campus schedule and environment over the entire duration of the Work. All activities, all classes and all operations associated with the entire population of students, staff and administrators will be in full operation. Therefore, access to and through the Campus and to and through each and every building must be available and clearly marked at all times.

B. The Contract, the Work, the Work Sequences and the Work Schedules shall be developed and deployed so as to accommodate this fully operational Campus environment. For this reason, a formal Work Plan shall be developed and updated weekly. Within the Work Plan process, the Contractor shall be responsible to notify the District a minimum of three weeks in advance of work which will directly affect a specific area.

C. This Work is of critical importance to the long range viability of the campus. For this reason, it is the intent of the District to develop a high functioning, supportive and fully cooperative relationship between the Contractor and the District. Critical components relating to this relationship include that:
   1. The Contractor shall cooperate with the District to minimize conflict and to facilitate District operations.
   2. The Contractor shall ensure that all work is scheduled (and, as necessary, rescheduled) to accommodate anticipated and unanticipated interference to Campus learning activities, operations and social activities.
   3. The Contractor shall implement all possible procedures to protect property adjacent to the construction project from damage resulting from work specified and performed within this Contract.
   4. The Contractor shall provide safe, clearly marked, unobstructed access to and throughout the Campus and to and throughout each building over the entire duration of the project. Furthermore, the Contractor shall maintain fire lanes and related access at all times.
   5. The Contractor shall take special considerations for pedestrian safety and convenience when any work area encroaches upon a sidewalk, walkway or crosswalk area.
   6. The District will make every possible effort to ensure that the Contractor is paid on a timely basis.
   7. The District will make every possible effort to ensure that Contractors submittals, requests, and Work Plans are reviewed, modified and approved in a timely and realistic manner.

1.02 INTERFACE WITH EXISTING FACILITIES

A. Contractor is required to protect and maintain in service all existing plumbing, mechanical, electrical, communications, security, fire protection, and control systems and components. In the event that existing systems are being replaced, the existing system shall be maintained fully operational until the new system is fully tested and accepted by the District's Representative. To permit this to occur without adversely impacting continuity, specific procedures must be developed as a part of the Work Plan process. This procedure shall be approved in advance by the District and shall identify and incorporate necessary accommodations to the systems and equipment which will ensure the desired continuity.

B. Where new products are to be installed in existing systems, the existing elements are shown on the Contract Drawings as schematic and are not necessarily shown to scale. As a result, in preparing proposed new equipment and piping layouts (and related schedules and Work Plan), the Contractor must base each plan and procedure upon the actual as-built existing conditions in the affected mechanical/electrical room and/or mechanical/electrical/telecommunications/domestic/water/sewer/storm/or-other system or component; and must locate new or relocated equipment in a manner which does not conflict with existing equipment and which complies with all manufacturer's recommended installation requirements, such as clearances, anchorage, accessibility, and applicable code requirements.
C. Access to or modification of any existing system for any purpose must be coordinated with Campus Facilities through the District's Representative. Access requests must be submitted in writing, using the Access Request Form and each must be consecutively and uniquely numbered. Access requests must be submitted a minimum of fourteen (14) calendar days prior to the date required. Delays which occur due to the failure of the Contractor to follow the access request procedure will be the responsibility of the Contractor.

1.03 CONTRACTOR GENERAL CONSIDERATIONS

A. Superintendent
1. In addition to the requirement of the General Conditions:
   a. Failure to maintain a Superintendent on the Project site at all times work is in progress shall be considered a material breach of this Contract entitling the District to terminate the Contract or, alternatively, issue a Stop Work order until the Superintendent is on the Project site. If, by virtue of issuance of said stop order notice, Contractor fails to complete the Contract on time, it will be assessed liquidated damages in accordance with this. No extension of this to the Contract will be allowed as a result of the stoppage of work as a result of the absence of a Superintendent.
   b. Superintendent approved for this Project shall be able to read, write and verbally communicate fluently in English.

B. Storage of Materials and Equipment:
1. All materials and equipment to be incorporated in the work shall be placed so as not to cause any damage to any part of the Work or to any existing facilities and so that free and safe access can be had at all times to all parts of the Campus and environs and to all public utility installations in the vicinity of the Work.
2. Material and equipment storage shall be only as provided for in the Contract Documents and/or only as approved in writing (by the District) and in advance of placement. Material or equipment stored at other than pre approved and pre-designated areas may be removed by the District and at no liability to the District if the Contractor is notified of an improper storage situation or improper placement (and if no action has been taken by the Contractor within 2 days after notification). Fees incurred by the District for removal of the equipment or material shall be back-billed to the Contractor.

C. Safety:
1. The Contractor shall take all necessary precautions and provide all necessary safeguards to prevent personal injury and to prevent property damage.
2. The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This responsible safety officer shall have the authority to take immediate action to correct unsafe or hazardous conditions and to enforce safety precautions and programs. This responsible person shall have a cellular telephone on his or her person at all times.

D. Owner Access to Contractor and Crews:
1. In order to facilitate open and rapid communications between the District and the Contractor (and subsequent response to issues regarding safety, interference, unexpected field conditions, field changes and field clarification) Contractor's key and responsible personnel (supervisors, foremen and managers) shall have a cellular phone and/or an active and available 2-way radio on their person at all times. This requirement applies to:
   a. The Contractor's superintendent - cellular phone
   b. Each foreman on each active crew - cellular phone or active 2-way radio in constant communication with the superintendent's trailer and the superintendent.

E. Utilities Services: Each and every existing utility service must be maintained on the Campus at all times. No interruption of any utility or service is allowed without advance written approval as discussed in other sections of this document and as a part of the Work Plan process.

1.04 NO SMOKING
A. The District has adopted a no-smoking provision in all Campus buildings. The Contractor, his forces and his employees will observe this requirement while performing work in and around...
District buildings. Smoking shall not be permitted except in Contractor designated smoking areas, away from Campus personnel, and as approved in advance by the District.

1.05 WORK BY OTHERS

A. Coordinate the work for this Contract with other construction operations as directed by the District. This includes the scheduling of traffic and use of roadways.

B. The District has awarded (or will award) other contracts which will be under construction in full or in part during construction of this project. The Contractor shall coordinate his/her work with the District in order to identify any and all interface or interference issues. These "other" contracts include, but are not limited to, the following:
   1. Library (Building L) Renovation
   2. Library Utilities Extension - Phase I (Note Phase I project is scheduled to be complete prior to start of this project. Further note, Phase I project will provide underground electrical survey for use and reference on this project - area near future science, and cooling tower area near Building F).
   3. New Science Building

C. Contractor's Superintendent shall attend a monthly coordination meeting. This meeting is separate from the normal project/progress meetings, and is for the express purpose of assisting the Contractor in meeting his responsibilities with respect to coordination of his Work with the other independent, concurrent construction contracts which will be underway on campus including, but not limited to, the projects listed herein. The Contractor is required to bring a current Work Plan and CPM schedule to the meeting to aid the discussion.

1.06 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed (temporary or permanent) and from demolition of equipment, systems, buildings or structures, or parts thereof, shall be disposed of as follows:
   1. Reserved items or items to be reused and/or relocated and/or which are to remain the property of the District are noted in the contract documents or will be identified by Facilities or the Engineer and shall be clearly marked, by the Contractor, as items to be reused and/or retained.
   2. Items which remain the property of the District shall be removed or dislodged from present locations in such a manner as to prevent damage and shall be stored in a local area as designated by the District.
   3. In the event that damage to the equipment or property occurs during the Work, Contractor shall notify the District immediately and shall upon approval of the repair procedure by the District, shall commence repair at his/her own cost so as not to affect the Work schedule.
   4. Items or materials not retained by the District shall become the property of the Contractor and shall be removed by the Contractor from the Campus and shall be disposed of by the Contractor at Contractors expense (or recycled as appropriate). Disposal or recycling shall be in compliance with local, State and Federal laws. Once the item or material is removed from its existing location it becomes the sole property (and liability) of the Contractor.

1.07 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the Work or work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall remove trees which are absolutely an obstruction for installation of the new work, only with prior, written authorization by the District (unless specifically shown to be removed on the Contract Drawings).

B. Avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a
tree-painting compound as approved by the District. In the event that trees or foliage are damaged beyond repair due to careless operation or improper activity, the Contractor shall be responsible to replace the lost item(s) with equivalent trees or foliage as approved by the District.

C. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work.

D. If the Contractor fails or refuses to repair the damage promptly, the District may have the necessary repair or replacement work performed and charge the cost to the Contractor.

1.08 STOP WORK

A. The District shall have the right, at any time, to stop any or all of the Contractor's work by written notification to the Contractor by the District's Construction Manager or by the District's Project Manager. Such notification does not relieve the Contractor of other contract requirements, such as maintenance of the site, and does not modify specified milestones if not a critical path activity. Upon receipt of a notice to Stop Work, the Contractor shall immediately and in a safe manner halt the associated work and, as directed by the District, clean up and stabilize the work by fencing, backfilling, or other action deemed appropriate by the District.

1.09 USE OF ELEVATORS

A. Unless otherwise approved in writing, only freight elevators shall be used for material moving. Use of elevators which are not specifically defined or designated as freight elevators must be approved in advance and in writing by the District. Contractor shall assume that there is at least one elevator in each building (containing three floors or more), but that this elevator is not necessarily a freight elevator.

B. It shall be the sole responsibility of the Contractor to prepare the elevator to accommodate any and all material moving so as to protect elevator(s) from damage. By use of the elevator, Contractor accepts full responsibility for repair of any and all damage or breakage that occurs during the time of material transfer. If the Contractor fails or refuses to repair the damage promptly, the District may have the necessary work performed and charge the cost to the Contractor.

C. Contractor shall make every effort to accommodate and allow access to handicapped persons for use of elevator when needed. To this end, at least one (1) elevator in the building must be operable at all times during construction to provide access for disabled persons.

D. Whenever the contractor uses an elevator which requires that student(s) or member(s) of the general public share the elevator (i.e. in the event that the contractor's means and methods require joint use of the elevator with the general public), Contractor shall name the general public as additionally insured.

1.10 SYSTEMS STARTUP, INTERRUPTION OR SHUTDOWN

A. Systems critical to building safety or security (such as fire protection system(s), and building security systems) which are required to be interrupted, altered, relocated or temporarily shut down as a result of any of this Work shall only be shut down upon advance notification to the District and upon implementation of a procedure approved by the District and which is in compliance to prevailing codes and standards (including but not limited to providing an NFPA Fire Watch when a Fire Protection System is interrupted or shut down, and providing fire sprinkler piping relocation in compliance with NFPA 13). Development of these procedures is the responsibility of the Contractor and these procedures shall be approved as part of the Work Plan process.
PART 2 PRODUCTS
2.01 NOT USED
PART 3 EXECUTION
3.01 NOT USED

END OF SECTION
SECTION 01 21 12
ALLOWANCES

PART 1 GENERAL
1.01 SECTION INCLUDES:
A. Product/Installation Allowances
B. Contract Sum Allowances
C. Allowances for Specific Campus Situations

PART 2 PRODUCTS
2.01 PRODUCT/INSTALLATION ALLOWANCES
A. This Section of the Specification sets forth the extent of Allowances described hereafter. Work performed under allowances shall conform fully to all applicable parts of these specifications and drawings.
1. As shown on the bid form, Contractor shall include in the total amount, the base bid and all allowances stated in the Contract Documents.
2. The Contractor shall cause the work/materials and critical path time covered by these allowances to be performed for such amounts and by such persons as the District may direct, but Contractor will not be required to employ persons against whom Contractor makes a reasonable objection. If the actual cost, when determined, is more than or less than the allowance, the contract sum shall be adjusted accordingly by Change Order.
3. Cash allowances shall include complete work in place with all costs fully accounted for.
4. Payment to the contractor shall be made as per normal payment procedures discussed in other portions of the Contract Documents.
5. Payment to a District-designated third party shall be made by the Contractor as approved by the District. Contractor shall pay designated third party within 15 days of receipt of payment from the District.
6. Funds unused in any allowance item will be credited to the contract by credit change order, and shall carry no contractor markup.

2.02 CONTRACT SUM ALLOWANCES
A. The Allowances below correspond to the total allowance amounts defined on the Bid Form. In addition, each allowance item has applied to it a critical path duration that shall be included within the critical path schedule in anticipation of the Allowance activity (i.e. in order to accomplish the completion time as provided for in the Contract Documents, the critical path duration, below, shall be accommodated within the progress schedules defined elsewhere in these contract documents):
1. Unforeseen Site Conditions:
   a. Cash Allowance:
      1) A cash allowance of $100,000 shall be available for the purpose of accommodating unforeseen site conditions.
   b. Critical Path Duration:
      1) Add 10 calendar days of critical path time.
2. Unforeseen Hazardous Material Abatement:
   a. Cash Allowance:
      1) A cash allowance of $10,000 shall be available for proper handling of asbestos, lead, PCB or other hazardous materials which are not defined as part of the bid documents. This allowance is for work over and above that already defined in the Contract Documents.
   b. Critical Path Duration:
      1) Add 5 calendar days of critical path time.
3. Facilities Services:
   a. Cash Allowance:
1) A cash allowance of $5,000 shall be available for time applied by the District's trades (i.e., in the Facilities Department) in support of the Contractor or Contractors construction activities.

2. Critical Path Duration:
   1) Add 0 calendar days of critical path time.

2.03 ALLOWANCES FOR SPECIFIC FACILITY SITUATIONS

A. Excavation work interference with irrigation piping:
   1. The Contractor shall assume in the base bid, that during the course of excavation, irrigation piping will be accidentally cut or in some way broken. This base bid allowance shall include all material and labor to repair the irrigation piping in 1 break per 10 feet of trench separate locations including:
      a. capping, cutting and replacement of damaged irrigation pipe
      b. repair of control wiring
      c. repair and replacement of control valves
      d. pumping of excess water or any pooled water into the nearest storm drain
      e. immediate notification to the District of the irrigation piping incident

   2. Active irrigation piping must be capped immediately upon line breakage and the District must be notified immediately.

   3. Inactive irrigation piping must be capped immediately and the District shall be notified immediately.

   4. In the event that water is allowed to flow unchecked from a broken or ruptured line for greater than 15 minutes, the District shall have the right to have the line repaired and the Contractor shall be billed for the repair work (i.e., against the base bid contract amount).

   5. This allowance item has been identified in order to accommodate the inevitable breakage of irrigation piping and related wiring, valves and controls. It is believed that the 1 break per 10 feet of trench incidents are realistic for a facility of this size and type. If Contractor anticipates a request for payment for breakage associated with more than the number of incidents listed above, Contractor shall keep continuous count, on a formal log, and document on a pre-approved form, all of the incidents which have occurred and been repaired by the Contractor.

PART 3 EXECUTION

3.01 UNDERGROUND PIPING - UNIT PRICING

A. Existing soil is unusually rocky, that is a known condition of the site. The quantities listed on the Bid Form assume that large rocks/boulders up to three feet (3') in approximate diameter will be encountered for every ten feet (10') of lineal trench. Base bid shall include the unit cost for boulder removal, off hauling and removal from site, as well as subsequent backfilling with suitable clean fill. Contractor shall maintain a cumulative log of rock removal satisfying these requirements to perform unit price adjustments. Final payment shall be made in accordance with this Allowance and the Unit Prices and procedures as set forth in Section 01 22 00, and in accordance with the General Conditions.

END OF SECTION
SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. List of unit prices, for use in preparing Bids.
B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED
A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidental; erection, application or installation of an item of the Work; overhead and profit. This includes both excavation and backfill associated with removed rock as defined as unforeseen conditions in Section 01 21 12, Allowances.

1.03 UNIT QUANTITIES SPECIFIED
A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES
A. Take all measurements and compute quantities. Measurements and quantities will be verified by District.
B. Assist by providing necessary equipment, workers, and survey personnel as required.
C. Measurement Devices:
   1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
   3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.
D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
E. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
F. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes. Maintain current, cumulative record of quantities removed, reviewed by Owner's Representative. Final payment for rock removal will be adjusted by additive or deductive change order based on the actual quantities of rock removed as described in Section 01 21 12 Allowances.

1.05 PAYMENT
A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Engineer, multiplied by the unit price. Contract price will be modified by deductive or additive change order to account for actual Work versus Bid Form quantities.
B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products remaining on hand after completion of the Work.
   4. Loading, hauling, and disposing of rejected Products.
1.06 SCHEDULE OF UNIT PRICES

A. Item: Rock; Provide units pricing by volume in $/CY (Cubic Yards). Provide Unit Price (and extension) on Bid Form.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of alternates.

1.02 DESCRIPTION OF ADDITIVE ALTERNATES

A. Additive Alternates shall be quoted as provided on the Bid Form. Additive Alternates listed hereafter refer to all materials installed and completely in place in accordance with all applicable portions of the Plans, Specifications and Contract Documents and include all costs connected with such items including, but not necessarily limited to, material, labor, overhead and profit for Contractor and/or Subcontractor.

B. Section 1.03, below provides a listing of the specific Additive Alternates and of drawings (or specs) where the Additive Alternates are identified. Drawing and Specification sections identified below are for the convenience of the Contractor and do not necessarily indicate each and every location in the Contract Drawings and specifications which would fully describe the particular additive alternate.

C. Drawings were not marked to identify and/or summarize Additive Alternates. Contractor shall study all of the drawings and Contract Documents and ensure that the overall scope, and Contractor's subsequent bid for each Additive Alternative, shall comply with all requirements of all of the Contract Documents.

1.03 LISTING OF ADDITIVE ALTERNATES

A. The overall project will have a total of 2 additive alternates as indicated below:
   1. Install Shotcrete concrete Cooling Tower enclosure in lieu of chainlink fence enclosure.
   2. Provide, install, pipe, power, control and make operational chiller CH-3 as shown on drawings.

B. Contractor shall study all of the drawings and Contract Documents and ensure that the overall scope, and Contractor's subsequent bid for each Additive Alternative, shall comply with all requirements of all of the Contract Documents.

1.04 SELECTION OF ADDITIVE ALTERNATES

A. Additive Alternates will be taken in the order listed until all funds are exhausted. Bids will be evaluated based on the Base Bid, and increased by additive alternates until either all alternates are taken, or the highest number of additive alternates may be selected with the available funding.

1.05 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at District's option. Accepted alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Preconstruction meeting.
   B. Site mobilization meeting.
   C. Progress meetings.
   D. Construction progress schedule.
   E. Submittals for review, information, and project closeout.
   F. Number of copies of submittals.
   G. Submittal procedures.

1.02 PROJECT COORDINATION
   A. Project Coordinator: Construction Manager.
   B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for vehicular access, traffic, and parking facilities.
   C. During construction, coordinate use of site and facilities through the Project Coordinator.
   D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
   E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
   F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
   G. Make the following types of submittals to Engineer through the Project Coordinator:
      1. Requests for interpretation.
      2. Requests for substitution.
      3. Shop drawings, product data, and samples.
      4. Test and inspection reports.
      5. Manufacturer's instructions and field reports.
      6. Applications for payment and change order requests.
      7. Progress schedules.
      8. Coordination drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING
   A. District will schedule a meeting after Notice of Award.
   B. Attendance Required:
      1. District.
      2. Engineer.
      3. Contractor.
   C. Agenda:
      1. Execution of District-Contractor Agreement.
      2. Submission of executed bonds and insurance certificates.
      4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Engineer, District, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. District will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. District.
   3. Engineer.
   4. Contractor's Superintendent.
   5. Major Subcontractors.

C. Agenda:
   1. Use of premises by District and Contractor.
   2. District's requirements and occupancy prior to completion.
   3. Construction facilities and controls provided by District.
   4. Temporary utilities provided by District.
   5. Survey and utility layout.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, District, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.
3.04 CONSTRUCTION PROGRESS SCHEDULE
A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
C. Samples will be reviewed only for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - CLOSEOUT SUBMITTALS.

3.06 SUBMITTALS FOR INFORMATION
A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.
B. Submit for Engineer's knowledge as contract administrator or for District. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT
A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. As-Built Drawings.
   6. Other types as indicated.
B. Submit for District's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS
A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Engineer.
   2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Engineer.
B. Documents for Information: Submit two copies.
C. Extra Copies at Project Closeout: See Section 01 78 00.
D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES
A. Transmit each submittal with approved form.
B. Sequentially number the transmittal form. Revised submittals shall be indicated with original number and a sequential alphabetic suffix.
C. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate on each copy.
D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
E. Contractor shall verify both the field dimensions and the drawing layouts prior to submitting products for review to verify that installation is properly coordinated. It is the contractor's responsibility to submit products that are appropriate for the actual field conditions.
F. Deliver submittals to Engineer at business address.
G. Schedule submittals to expedite the Project, and coordinate submission of related items.
H. For each submittal for review, allow 15 calendar days excluding delivery time to and from the Contractor.
I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
J. Provide space for Contractor and Engineer review stamps.
K. When revised for resubmission, identify all changes made since previous submission.
L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
M. Submittals not requested will not be recognized or processed.
N. Engineer's review will result in the return of the submittal with one of the following marks:
   1. "No Exceptions - materials may be provided as described in the submittal.
   2. "Exceptions Noted, Resubmittal Not Required" - materials may be provided as described in the submittal, in accordance with comments or notes or additional requirements noted by the reviewer.
   3. "Not Acceptable" - Materials are unacceptable and shall not be provided.
   4. "Exceptions Noted, Resubmit" - Requires that the submittal be modified, according to requirements noted, and resubmitted.
O. Materials or equipment shall not be delivered to the jobsite without first obtaining a submittal which has the "No Exceptions" or "Exceptions Noted, Resubmittal Not Required" stamp mark.

END OF SECTION
SECTION 01 30 55
SAMPLE FORMS

PART 1 GENERAL
1.01 SECTION INCLUDES:
   A. This section includes sample forms to be used during execution of this Contract.

1.02 FORMS INCLUDED:
   A. Substitution Request
   B. Access Request

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS
01 10 00 SUMMARY
01 13 00 PROJECT COORDINATION
01 14 00 WORK RESTRICTIONS
01 21 12 ALLOWANCES
01 22 00 UNIT PRICES
01 23 00 ALTERNATES
01 30 00 ADMINISTRATIVE REQUIREMENTS
01 30 55 SAMPLE FORMS
01 40 00 QUALITY REQUIREMENTS
01 50 00 TEMPORARY FACILITIES AND CONTROLS
01 60 00 PRODUCT REQUIREMENTS
01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS
01 78 00 CLOSEOUT SUBMITTALS
01 79 00 DEMONSTRATION AND TRAINING

DIVISION 05 - METALS
05 51 00 METAL STAIRS
05 52 13 PIPE AND TUBE RAILINGS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 46 46 FIBER CEMENT SIDING
07 90 05 JOINT SEALERS

DIVISION 08 - OPENINGS
08 11 13 HOLLOW METAL DOORS AND FRAMES
08 33 23 OVERHEAD COILING DOORS
08 71 00 DOOR HARDWARE
08 91 00 LOUVERS

DIVISION 09 - FINISHES
09 21 16 GYPSUM BOARD ASSEMBLIES
09 90 00 PAINTING AND COATING

DIVISION 10 - SPECIALTIES
10 14 00 SIGNAGE
10 44 00 FIRE PROTECTION SPECIALTIES

DIVISION 22 - PLUMBING
22 10 05 PLUMBING PIPING
22 10 06 PLUMBING PIPING SPECIALTIES

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

DSA Re-submittal 6/21/2012
23 05 19     METERS AND GAGES FOR HVAC PIPING
23 05 53     IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93     TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 19     HVAC PIPING INSULATION
23 08 00     COMMISSIONING OF HVAC
23 09 23     DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
23 09 30     ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS
23 21 13     HYDRONIC PIPING
23 21 14     HYDRONIC SPECIALTIES
23 21 23     HYDRONIC PUMPS
23 25 00     HVAC WATER TREATMENT
23 31 00     HVAC DUCTS AND CASINGS
23 34 23     HVAC POWER VENTILATORS
23 64 16     CENTRIFUGAL WATER CHILLERS
23 65 13     INDUCED DRAFT COOLING TOWERS

DIVISION 26 - ELECTRICAL

26 05 01     MINOR ELECTRICAL DEMOLITION
26 05 10     ELECTRICAL GENERAL PROVISIONS
26 05 12     BASIC MATERIAL AND METHODS
26 05 13     MEDIUM-VOLTAGE CABLE
26 05 26     GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 32     POWER SYSTEM STUDY
26 08 00     COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 02     ELECTRICAL ACCEPTANCE TESTING
26 11 16     SECONDARY UNIT SUBSTATIONS
26 13 21     AIR INTERRUPTER SWITCHES
26 24 13     SWITCHBOARDS
26 24 16     PANELBOARDS
26 51 00     INTERIOR LIGHTING
26 56 00     EXTERIOR LIGHTING

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 35 10     REFRIGERANT MONITORING SYSTEM

DIVISION 31 - EARTHWORK

31 23 16.13   TRENCHING
31 23 16.26   ROCK REMOVAL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16     ASPHALT PAVING
32 13 13     CONCRETE PAVING
32 31 13     CHAIN LINK FENCES AND GATES

DIVISION 33 - UTILITIES

33 05 13     MANHOLES
33 61 13     UNDERGROUND HYDRONIC ENERGY DISTRIBUTION
33 71 19     ELECTRICAL UNDERGROUND DUCTS AND MANHOLES
SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. References and standards.
B. Control of installation.
C. Tolerances.
D. Testing services.
E. Manufacturers’ field services.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
B. Test Reports: After each test/inspection, promptly submit two copies of report to Engineer and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Engineer, provide interpretation of results.
   2. Test report submittals are for Engineer's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for District's information.
C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Engineer, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.
D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the District's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
E. Manufacturer's Field Reports: Submit reports for Engineer's benefit as contract administrator or for District.

DSA Re-submittal 6/21/2012
01 40 00 - 1
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 REFERENCES AND STANDARDS
A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
C. Obtain copies of standards where required by product specification sections.
D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
E. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES
A. District will employ and pay for services of an independent testing agency to perform other specified testing.
B. As indicated in individual specification sections, District or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
D. Contractor Employed Agency:
   1. Laboratory: Authorized to operate in the State in which the Project is located.
   2. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION
3.01 CONTROL OF INSTALLATION
A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
3.02 TOLERANCES
A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION
A. See individual specification sections for testing required.
B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests and inspections required by Engineer.
   7. Submit reports of all tests/inspections specified.
C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlange on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.
D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer.
F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES
A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.
B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct an appropriate remedy or adjust payment.

END OF SECTION
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Temporary utilities.
   B. Temporary telecommunications services.
   C. Temporary sanitary facilities.
   D. Temporary Controls: Barriers, enclosures, and fencing.
   E. Security requirements.
   F. Vehicular access and parking.
   G. Waste removal facilities and services.
   H. Project identification sign.

1.02 TEMPORARY UTILITIES
   A. District will provide the following:
      1. Electrical power and metering, consisting of connection to existing facilities.
      2. Water supply, consisting of connection to existing facilities.
   B. New permanent facilities may be used.
   C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES
   A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
   B. Telecommunications services shall include:
      1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
      2. Email: Account/address reserved for project use.
      3. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.04 TEMPORARY SANITARY FACILITIES
   A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
   B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS
   A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner’s use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
   B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
   C. Provide protection for plants designated to remain. Replace damaged plants.
   D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
   E. Gates in barriers shall be maintained in the closed position when not in use. Provide signs on all gates stating: "NOTICE - GATES MUST BE CLOSED AFTER ENTRY OR EXIT."
   F. Shield all welding operations from public view with solid barrier.
   G. Protective barricades, fencing, handrails and bridges, together with warning and guidance devices and signs, must be utilized so that passageway for pedestrians, especially blind and other physically disabled persons, is safe and well defined.
II. Walkways in construction areas shall be maintained at least 4 feet in width or equal to sidewalk/every way width, whichever is greater, unless expressly permitted otherwise by the district in writing; and shall be free of abrupt changes in the grade. These walkways shall be clearly marked and shall provide safe passage for pedestrians (i.e. free from potential danger from construction activities). Obstructions within the walkways shall be illuminated during hours of darkness. Minimum vertical clearance to any obstruction within the walkway shall be seven feet.

I. Where walks, pathways or accessways are closed by the Work, an ADA compliant, alternate walkway shall be provided, preferably within the immediate location of the pathway or access to be closed. Where it is necessary to divert pedestrians into a major detour and/or into a parking lane or traffic area, at no time shall pedestrians be diverted into a portion of a street used for vehicular traffic. Any deviation from the above must have prior approval of the District.

J. At locations where adjacent alternate walkways cannot be provided (i.e. where no pathway or access is available within the immediate location of the interruption) ADA compliant detours shall be clearly planned, marked and constructed. Appropriate signs and barricades must be installed at the limits of construction and in advance of the closure (or detour) in order to divert pedestrians to the appropriate walkway or detour.

K. Wherever it is necessary that trenches and excavation be bridged, bridges shall be constructed in an ADA compliant manner. These bridges shall permit unobstructed flow of traffic or pedestrians and shall meet the following criteria:
   1. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts or other devices.
   2. Bridging shall be installed to operate with minimum noise.
   3. The trench shall be adequately shored to support the bridging and traffic.
   4. Only steel plates shall be used for bridging. Steel plates used for bridging shall extend one foot (minimum) beyond the edges of the trench. The steel plates shall be beveled in order to provide smooth and uninterrupted wheelchair and other access. Temporary paving materials may be used in conjunction with the beveled steel plates. Provide handrails.

L. Remove barriers and enclosures only after acceptance of that portion of the Work.

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and District's operations from unauthorized entry, vandalism, or theft.

B. Security of Construction areas, including, but not limited to, work in place, work in storage, Contractor's equipment and tools shall be the sole responsibility of the Contractor.

C. Coordinate with District's security program.

1.09 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and District.

C. Provide and maintain access to fire hydrants, free of obstructions.

DSA Re-submittal 6/21/2012
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Existing on-site roads may be used for construction traffic.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL
A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION
A. Provide project identification sign of design, construction, and location approved by District.
B. No other signs are allowed without District permission except those required by law.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations and procedures.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS
A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
1. Submit within 15 days after date of Agreement.
2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS
A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.
D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS
A. Provide new products unless specifically required or permitted by the Contract Documents.
B. Do not use products having any of the following characteristics:
1. Made using or containing CFC's or HCFC's.
C. Provide interchangeable components of the same manufacture for components being replaced.
D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

2.03 PRODUCT OPTIONS
A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS
A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION
3.01 SUBSTITUTION PROCEDURES
A. A Substitution is a change from one product or material to another of equal or like value, quality, features, appearance or durability. The burden of proof is on the submitter and the determination of equality rests solely with the District's Representative and District. In general, substitutions will be considered and indicated in the "Conditions" or when the cost differential and benefit is favorable to the District without affecting the final results of the Project. All "Requests for Substitutions" must be accompanied by a completed request form.

B. Within a period of fifteen (15) calendar days after award of Contract, the District's Representative will consider formal requests from the Contractor for substitution of products in place of those specified.

C. After the end of that period, requests will be considered only in case of product unavailability or other conditions beyond the control of Contractor.

D. Product unavailability shall be verified in writing by manufacturer.

E. A request for substitution constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it is equal or better than the specified product in all aspects.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the District.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse District's Representative for review or redesign services associated with approval and re-approval by authorities.

F. Submit separate Requests for each substitution with requirements stated in Contract Documents:
1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature identifying:
      1) Product's description.
      2) Reference Standards.
      3) Performance and test data.
      4) Samples: as applicable.
      5) Name and address of similar projects on which product has been used, and date of each installation.
2. Itemized comparison of the proposed substitution with product specified; list significant variations. Provide tabbed and marked manufacturer's data for specified product and the substitution for documentation.
3. Data relating to changes in Construction Schedule.
4. Any effect of substitution on separate Contracts.
5. List of changes required in other work or products.
6. Detailed cost data comparing proposed substitution with product specified.

DSA Re-submittal 6/21/2012

01 60 00 - 2

PRODUCT REQUIREMENTS
7. Designation of availability of required license fees or royalties.

G. Substitutions will not be considered for acceptance when:
   1. They are indicated or implied on Shop Drawings or product data submittals without a
      formal request from Contractor.
   2. They are requested directly by a Subcontractor.
   3. Acceptance will require substantial revision of Contract Documents.
   4. Insufficient information is available.

H. Products and materials described on the Drawings and in these Specifications are known to be
   available at the time of bidding. Failure on the part of the Contractor to procure, receive and
   store such products and materials will not be considered as a basis for substitution or an
   increase in the Contract Price.

I. Should the Contractor fail to furnish specified products or materials in a timely manner and such
   products or materials are no longer available, the Contractor shall furnish such substitution as
   determined by the District's Representative to be equal to the original Specification at no
   additional cost to the District.

J. The District shall assume no responsibility for failure on the part of the Contractor to provide the
   specified products or materials.

K. Substitute products shall not be ordered or installed without prior written review by the District's
   Representative.

L. District's Representative shall determine acceptability of proposed substitutions and reserves
   the right to reject proposals due to insufficient information or to reject proposals, if, in the
   District's Representative's judgment, the proposed substitution does not meet the aesthetic
   criteria of the specified materials.

M. Compensation: Contractor shall reimburse District for compensation paid to the District's
   Representative for evaluation of substitution proposals made during construction, whether or
   not substitution is accepted by District.

3.02 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site
   storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of
   surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are
   correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling,
   disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to
   installation schedule and placed convenient to work area in order to minimize waste due to
   excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment
   favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to
   prevent condensation and degradation of products.

DSA Re-submittal 6/21/2012

01 60 00 - 3

PRODUCT REQUIREMENTS
G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Prevent contact with material that may cause corrosion, discoloration, or staining.

I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Cutting and patching.
D. Surveying for laying out the work.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Demonstration and instruction of District personnel.
H. Closeout procedures, except payment procedures.
I. General requirements for maintenance service.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Efficiency, maintenance, or safety of any operational element.
   4. Work of District or separate Contractor.
   5. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of District or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.
C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by District.

DSA Re-submittal 6/21/2012
F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
   2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

H. Pest Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work or invading the premises.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

K. Moisture Control: Provide methods, means, and facilities to prevent moisture from entering the building.

1.05 COORDINATION

A. See Section 01 10 00 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After District occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of District's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION
A. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.
B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.
C. Remove debris and abandoned items from area and from concealed spaces.
D. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.
E. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.
F. Clean substrate surfaces prior to applying next material or substance.
G. Seal cracks or openings of substrate prior to applying next material or substance.
H. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK
A. Promptly notify Engineer of any discrepancies discovered.
B. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
C. Periodically verify layouts by same means.

3.04 GENERAL INSTALLATION REQUIREMENTS
A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
B. Install products as specified in individual sections, in accordance with manufacturer’s instructions and recommendations, and so as to avoid waste due to necessity for replacement.
C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
F. Make neat transitions between different surfaces, maintaining texture and appearance.

DSA Re-submittal 6/21/2012
3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 01 10 00 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   3. Verify that abandoned services serve only abandoned facilities.
   4. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

H. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

I. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
J. Refinish existing surfaces as indicated:
K. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
L. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
M. Clean existing systems and equipment.
N. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
O. Do not begin new construction in alterations areas before demolition is complete.
P. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING
A. Whenever possible, execute the work by methods that avoid cutting or patching.
B. See Alterations article above for additional requirements.
C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove sample of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.
D. Execute cutting and patching including excavation and fill to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
F. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
H. Restore work with new products in accordance with requirements of Contract Documents.
I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
K. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
L. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to patching finish. Finish patches to produce
uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.07 PROGRESS CLEANING
A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK
A. Protect installed work from damage by construction operations.
B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
F. Prohibit traffic from landscaped areas.
G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP
A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Engineer and owner seven days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION
A. See Section 01 79 00 - Demonstration and Training.
B. Demonstrate operation and maintenance of products to District's personnel two weeks prior to date of Substantial Completion.
C. Perform instruction in a classroom environment located at at the Campus.
D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with District's personnel in detail to explain all aspects of operation and maintenance.
E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING
A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93.

3.12 FINAL CLEANING
A. Execute final cleaning after Substantial Completion but before making final application for payment.
   1. Clean areas to be occupied by District prior to final completion before District occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Replace filters of operating equipment.
F. Clean site; sweep paved areas; rake clean landscaped surfaces.
G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
H. Clean District-occupied areas of work.

3.13 CLOSEOUT PROCEDURES
A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer and District.
B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor’s Notice of Substantial Completion.
C. Notify Engineer when work is considered ready for Substantial Completion.
D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer’s review.
E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to District-occupied areas.
F. Accompany Project Coordinator on preliminary final inspection.
G. Notify Engineer when work is considered finally complete.
H. Complete items of work determined by Engineer’s final inspection.
I. The Engineer will make only two (2) inspections to determine substantial completion. If these inspections determine that the work is not substantially complete, either because of major items not completed or an excessive number of punchlist items, successive inspections requested by the Contractor shall be charged to the Contractor at a rate of $400.00 per person per half day.

3.14 MAINTENANCE
A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

DSA Re-submittal 6/21/2012  
EXECUTION AND CLOSEOUT REQUIREMENTS  
01 70 00 - 7
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the District.

END OF SECTION
SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.
D. As-Built Drawings

1.02 SUBMITTALS
A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by District, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with District's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. As-Built Drawings:
   1. Submit two compact disks with electronic as-built drawings in AutoCad 2008 or newer. Include all pen settings.
   2. Submit two opaque copies and one reproducible original of drawings to Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling future reference by District.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

DSA Re-submittal 6/21/2012
1. Manufacturer’s name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer’s recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.


D. Additional information as specified in individual product specification sections.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and trouble shooting; disassembly, repair, and reassembly instructions.

G. Include manufacturer’s printed operation and maintenance instructions.
H. Include sequence of operation by controls manufacturer.
I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide control diagrams by controls manufacturer as installed.
K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
M. Include test and balancing reports.
N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
B. Prepare data in the form of an instructional manual.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with District's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

DSA Re-submittal 6/21/2012
01 78.00 - 3
CLOSEOUT SUBMITTALS
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 AS BUILT DRAWINGS
A. Prepare as-built drawings utilizing AutoCad 2008 or later. Use nationally recognized drawing standards, including layer management and organization.
B. Engineer will provide original design drawing files for starting point of as-builts.
C. Drawings shall indicate actual installed location, elevation, orientation, size and features of all equipment and materials installed under this contract.
D. Revise all sheets from the design drawings as required to reflect actual construction. This includes but is not limited to all diagrams, panel schedules, equipment schedules, controls points lists, floor plans, elevations, profiles and sequences.
E. As Built drawings for underground utilities shall include showing and marking of all utilities crossed, whether shown on Contract Drawings or not. Information for existing utilities shall include utility type, size, depth or elevation, and station number or location to permanent, fixed above grade features.

END OF SECTION
PART 1 GENERAL

DEMONSTRATION AND TRAINING

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of District personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Contractor's Commissioning Authority.
   2. Submit one copy to the Contractor's Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Contractor’s Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Contractor's Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: District will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Contractor's Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by District.

B. Demonstrations conducted during Functional Testing need not be repeated unless District personnel training is specified.

C. Demonstration may be combined with District personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Contractor's Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. District will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the District.

E. Provide training in minimum two hour segments.

F. The District or District's Representative is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of District's personnel to be trained; re-schedule training sessions as required by District; once schedule has been approved by District failure to conduct sessions according to schedule will be cause for District to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.
J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.
B. Structural steel stair framing and supports.
C. Handrails and guards.

1.02 REFERENCE STANDARDS

F. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.
G. ASTM A600/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.

1.03 SUBMITTALS

A. See Division 1 for submittal requirements.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.
C. Welders' Certificates.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Unit Stair Towers:

2.02 METAL STAIRS - GENERAL
A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations including CBC 2010 Chapters 16A & 17A; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Dimensions: As indicated on drawings. Field verify all dimensions and floor elevations prior to shop drawing submittal and fabrication
   3. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   4. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   5. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE TREADS
A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
   5. Concrete Reinforcement: None.
   6. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Depth: Not more than 1-1/2 inch overhang.
   3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

DSA Re-submittal 6/21/2012
H. Finish: Galvanized after fabrication, except sheet components to be galvanized before fabrication.

2.04 HANDRAILS AND GUARDS
A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
   2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
      b. Material: Steel pipe or tube, round.
      c. Vertical Spacing: Maximum opening to be 4 inches.
      d. Jointing: Welded and ground smooth and flush.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.

2.05 MATERIALS
A. Steel Sections: ASTM A 36/A 36M.
B. Steel Tubing: ASTM A500 or ASTM A501 structural tubing, round and shapes as indicated.
C. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
D. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
E. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.
F. Concrete Reinforcement: Bar type as detailed, galvanized.
G. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
H. Steel Bolts, Nuts, and Washers: , galvanized to ASTM A 153/A 153M where connecting galvanized components.
I. Welding Materials: AWS D1.1; type required for materials being welded.
J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING
A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
B. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. When field welding is required, clean and strip primed steel items to bare metal.
B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION
A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

DSA Re-submittal 6/21/2012
METAL STAIRS
C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on shop drawings. Perform field welding in accordance with AWS D1.1.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION
SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wall mounted handrails.
B. Stair railings and guardrails.
C. Free-standing railings at steps.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Handrails and Railings:
   3. Substitutions: See Division 1 for requirements and procedures.

2.02 RAILINGS - GENERAL REQUIREMENTS
A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code including section 1704A.3 of CBC 2010.
B. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
C. Allow for expansion and contraction of members and building movement without damage to connections or members.
D. Dimensions: See drawings for configurations and heights.
E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to stud walls, provide backing plates, for bolting anchors.
F. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM
A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
B. Galvanizing: In accordance with requirements of ASTM A123/A123M.
2.04 FABRICATION
A. Accurately form components to suit specific project conditions and for proper connection to building structure.
B. Fit and shop assemble components in largest practical sizes for delivery to site.
C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply items required to be cast into concrete or embedded in masonry/concrete with setting templates, for installation as work of other sections.

3.03 INSTALLATION
A. Install in accordance with manufacturer’s instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Anchor railings securely to structure.
D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES
A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 07 46 46
FIBER CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wood-fiber cement siding.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Manufacturer's requirements for related materials to be installed by others.
      2. Preparation instructions and recommendations.
      3. Storage and handling requirements and recommendations.
      4. Installation methods, including nail patterns.
   B. Warranty: Submit copy of manufacturer's warranty, made out in District's name, showing that it
      has been registered with manufacturer.

PART 2 PRODUCTS

2.01 SIDING
   A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high
      pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with
      machined edges, for screw attachment.
      1. Length (Height): 96 inches, nominal.
      2. Width: 48 inches.
      3. Thickness: 5/16 inch, nominal.
      5. Color: To match existing.
      6. Warranty: 50 year limited siding warranty; transferable. 15 year limited paint warranty.
      7. Panel Siding Manufacturers:

2.02 ACCESSORIES
   A. Furring Strips: Galvanized metal channels.
   B. Trim: EZ trim.
   C. Fasteners: Double dip Galvanized or Stainless steel; length as required to penetrate minimum
      1-1/4 inch.
   D. Sealant/Primer: FiberTect Sealant/Primer.
   E. Sheet Metal Flashing: Minimum 26 gauge hot-dipped galvanized steel sheet, or coated
      aluminum.
   F. Touch Up Kit: Provide CertainTeed Color Max touch-up kit for each color provided.
   G. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by
      paint manufacturer.

PART 3 EXECUTION

3.01 PREPARATION
   A. Examine substrate and clean and repair as required to eliminate conditions that would be
      detrimental to proper installation.
   B. Do not begin until unacceptable conditions have been corrected.
   C. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory
      preparation before proceeding.
3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with all terms necessary to maintain warranty coverage.
   2. Use trim details indicated on drawings.
   3. Touch up all field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. Over Steel Studs: Minimum 20 gauge steel, 3-5/8" C-studs. Use 1-5/8" long, #6-18 x 3/8" HD self-tapping, corrosion-resistant ribbed bugle head screws, with the points of at least 3 screws penetrating each stud the panel crosses and at panel ends.

C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

D. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

E. Before installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

F. Finish Painting: Within one month after installation, paint siding and trim with one coat primer and two coats finish paint.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.

C. Joints in vertical surfaces and horizontal surfaces as indicated below:
   1. Perimeter joints between materials listed above and frames of doors and glazed assemblies.
   2. Other joints as indicated and required to make the building weathertight.
   3. Pavement and sidewalk joints.
   4. Concrete construction joints.
   5. Floor joints (interior).
   6. Wall joints (exterior).
   7. Flashing and coping joints.
   8. Interior wall/ceiling joints.

D. Precompressed foam sealers.

E. Hollow gaskets.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics.

B. Samples: Submit two samples, illustrating sealant colors for selection.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Certified Tests: With product data submit certified test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low-temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposures to ozone and ultraviolet.

1.04 QUALITY ASSURANCE

A. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent bases, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

B. Sealants must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants must meet or exceed Bay Area Air Quality Management District Reg. 8, Rule 51.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
1.06 WARRANTY
   A. Correct defective work within a five year period after Date of Substantial Completion.
   B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight
      seal, exhibit loss of adhesion or cohesion, or do not cure.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Delivery: Deliver materials in the manufacturer's unopened containers bearing the
      manufacturer's mixing directions. Containers must be clearly marked with manufacturer's
      name, brand, type, color grade, and packaging date.
   B. Storage: Store in accordance with manufacturer's instructions. Do not use sealant materials
      that have been stored for a period of time exceeding the maximum recommended shelf life of
      the materials.

1.08 JOB CONDITIONS
   A. Weather: Do not proceed with installation of sealants under adverse weather conditions, or
      when temperatures are above or below the manufacturer's recommended temperature range
      for installation. Proceed with the work only when forecasted weather conditions are favorable
      for proper cure and development of high early bond strength. Where joint width is affected by
      ambient temperature variations, install elastomeric sealants only when temperatures are in the
      lower third of the manufacturer's recommended installation temperature range so that sealant
      will not be subjected to excess elongation and bond stress at subsequent low temperatures.
      Notwithstanding any recommendations by the manufacturer to the contrary, do not install
      sealant if the ambient temperatures are below 40°F or over 80°F without written authorization
      from Architect.

PART 2 PRODUCTS

2.01 SEALANTS
   A. Sealants and Primers - General: Provide only products having lower volatile organic compound
      (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
   B. General Sealer Requirements: Provide colors indicated or, if not otherwise indicated, as
      selected by Architect from manufacturer's standard colors. Select materials for compatibility
      with joint surfaces and other indicated exposures and except as otherwise indicated select
      modulus of elasticity and hardness or grade recommended by manufacturer for each
      application indicated. Where exposed to foot traffic, select nontracking materials of sufficient
      strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer
      system.
   C. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25,
      Uses M, G, and A; single component.
      1. Color: To be selected by Engineer from manufacturer's standard range.
      2. Product: Sikaflex manufactured by Sika Corp or approved equal.
      3. Applications: Use for:
         a. Control, expansion, and soft joints in masonry.
         b. Joints between concrete and other materials.
         c. Joints between metal frames and other materials.
         d. Other exterior joints for which no other sealant is indicated.
   D. Type 2 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning,
      noncuring.
      1. Product: BR - 96 Curtain Wall Sealant manufactured by Pecora Corp or approved equal.
      2. Applications: Use for:
         a. Concealed sealant bead in sheet metal work.
   E. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP,
      Grade NF single component, paintable.
      1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
   a. Interior wall and ceiling control joints.
   b. Other interior joints for which no other type of sealant is indicated.

F. Type 4 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
   2. Product: Sikaflex - 1CSL manufactured by Sika Corp.
   3. Applications: Use for:
      a. Joints in sidewalks and vehicular paving.

G. Type 5 - Silicone Sealant: ASTM C920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: Match adjacent finished surfaces.
   2. Product: 786 manufactured by Dow Corning.
   3. Applications: Use for:
      a. Ceramic Tile.

H. Foam-Type Filler-Sealants:
   1. Fire-resistant Foam-in-place Filler (FR-Fm-F): Provide manufacturer's standard, 2-part, silicone-based, room-temperature-vulcanizing, foam elastomer, recommended by mfg for filling joints and other openings in construction work; with cured density of 15 or 20pcf, partially (50%) closed-cell structure, cohesive/tensile strength of 25 psi, 40% compression deflection of 10 psi, and flame-spread rating of 25 (ASTM E 84); tested and rated by UL for 3-hr. fire resistance for penetration seals (ASTM E 119).
   2. Preformed Compressible-Foam Sealants (CmpF-S): Provide manufacturer's standard open-cell, flexible foam strip of polyurethane or other weather-resistant foam, saturated with butylene or other nontoxic liquid sealant/adhesive, to a formulation which will form a paintable watertight joint at 50% compression, without staining, migrating, hardening, or other performance failure.

2.02 ACCESSORIES
   A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
   B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
   C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1867, closed cell PVC; oversized 30 to 50 percent larger than joint width. Shall be Approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   D. Sealant Backer Rod (S-BR): Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
   E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
   B. Verify that substrate surfaces are ready to receive work.
   C. Verify that joint backing and release tapes are compatible with sealant.
3.02 PREPARATION
A. Clean joint surfaces immediately before installation of gaskets, sealant or calking compound. Remove dirt, insecure coatings, moisture and other substances which could interfere with seal of gasket or bond of sealant or calking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.
B. Remove loose materials and foreign matter that could impair adhesion of sealant.
C. Clean and prime joints in accordance with manufacturer's instructions.
D. Vacuum clean or remove loose particles by blowing oil-free compressed air in joints. Surfaces must be sound, clean, dry and free from oil or grease.
E. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
F. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION
A. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbit to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
B. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
C. Perform installation in accordance with ASTM C1193.
D. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.
E. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.
F. Install bond breaker tape where indicated and where required by manufacturer's recommendations to ensure that liquid-applied sealants will perform as intended.
G. Install bond breaker where joint backing is not used.
H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
I. Install liquid-applied sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead; (not applicable to sealants in lapped joints):
   1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.
   2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
   3. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in range of 75% to 125% of joint width.
J. Spillage: Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
K. Do not overheat or reheat hot-applied sealants; discard (do not use).
L. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will protrude from joints.

DSA Re-submittal 6/21/2012

07 90 05 - 4

JOINT SEALERS
M. Installation of Fire-Stop Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings as indicated or as required.

N. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Install fire-resistant foamed-in-place filler in openings where indicated, and at thicknesses indicated. Dam bottom of vertical openings and one side of horizontal openings with temporary containment forms or, where required to achieve fire-resistance ratings, provide permanent mineral composition board forms. On horizontal penetrations, provide partial face containment forms where required for form placement. Allow installed fillers to cure 24 hours; remove temporary forms, trim ragged edges with sharp knife; inspect and fill voids with additional filler to form uniform thickness of filler.

P. Bond ends of gaskets together with adhesively or "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 CURING / PROTECTING

A. Cure sealants in compliance with their manufacturer's printed instructions to obtain high early bond strength, internal cohesive strength and durability.

B. Protect sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

C. If, despite such protection, damage or deterioration occurs, cut-out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

3.06 PROTECTION

A. Protect sealants until cured.

B. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Steel doors and frames.
B. Fire-rated steel doors and frames.
C. Accessories, including glazing.

1.02 REFERENCE STANDARDS
G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
L. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

1.03 SUBMITTALS
A. See Division 1 for submittal procedures,
B. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
C. Shop Drawings: Submit for fabrication and installation of steel frames. Include details of each frame type, elevations of each type, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
   1. Provide schedule of frames using same reference numbers for details and openings as those on Contract Drawings.
   2. Indicate coordination of glazing frames and stops with glass and glazing requirements.
D. Identify work that cannot be permanently factory assembled before shipment.
E. Label Construction Certification: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, submit manufacturer's certification for that each frame has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

DSA Re-submittal 6/21/2012

08 11 13 - 1 HOLLOW METAL DOORS AND FRAMES
F. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

G. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

H. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

C. Provide frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI - 100) and as herein specified.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated frames that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

E. Provide fire-rated door and frame assemblies per current California Building Code and bearing the label of a testing agency acceptable to the DSA for the fire resistance indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Store in accordance with NAAMM HMMA 840.

B. Packing: Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

C. During delivery, provide temporary steel spreaders securely fastened to the bottom of each frame.

D. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinishing items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

E. The storage spaces shall be dry and accessible, adequately ventilated and free from dust or water, and shall permit easy access for inspection and handling.

F. If doors are shipped with fiberboard wrapper and it becomes wet, remove it immediately.

G. Store frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non vented plastic or canvas shelters which could create humidity chamber.

H. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Steel Doors and Frames:

2.02 MATERIALS
A. Hot Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569, ASTM A 568, and ASTM A620.

B. Cold Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized steel sheets: Commercial quality, Class 1, zino-coated carbon steel sheets complying with ASTM A 526, with ASTM A 525, A 60 zinc coating, mill phosphatized.
D. Supports and Anchors: Fabricate of hot-dip galvanized if less than 16 gauge. Hot dip - galvanize all items in exterior walls.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop Applied Primer: Rust-inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.

2.03 FINISH MATERIALS

A. Paints:
   1. Shop primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surface for Steel Doors and Frames", and compatible with finish paint system specified in Section 09900.
   2. For touch-up of damaged galvanized surfaces: SSPC Paint No. 20, Type II (Organic), Tneme-Zinc 90-97 by Tneme Co., MZ-4 by Valspar Corp., 308 Zinc-Lok by Porter International or Amercoat 68HS by Ameron Protective Coating Division.

B. Door filler: In compliance with SDI 100, except use UL listed materials in fire-rated doors.

2.04 FINISH

A. Shop priming: After assembly, clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before painting. Grind welds and fabrication marks flush and smooth with parent metal. Fill depressions with metal filler before applying the shop primer. Apply one or more coats or epoxy mineral filler to conceal spot welds.

B. Acid-etch galvanized surfaces before pretreating.

C. Apply shop primer, within time limits recommended by pretreatment manufacturer, to provide a smooth coat of even consistency and to produce a dry film thickness of not less than 1-1/2 mil.

D. Doors & frames with visible welds before or after application of finish paint will be unacceptable.

2.05 ACCESSORY MATERIALS

A. Louvers: Roll formed steel with overlapping frame; factory-painted finish, color as selected; factory-installed.

B. Removable Stops: Formed sheet steel, None - N/A mitered or butted corners; prepared for countersink style tamper proof screws.

C. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
   8. Fabricate doors and frames at the following locations from galvanized steel; exterior walls, toilet rooms, locker rooms and shower rooms. Fabricate doors and frames at other locations from non-galvanized steel.
10200 - Merritt College CHW Infrastructure

10. Do not begin fabrication until the hardware schedule approved by the Architect and submitted by the hardware supplier has been received by the fabricator.

B. Provide sound insulation filler of fiberboard, mineral-wool board, asbestos, or other approved noncombustible material solidly packed full door height to fill the voids between inner core reinforcing members.

C. Reinforce doors with rigid tubular frame where stiles and rails are less than 8" wide. Form tubular frame with 16 gage steel, welded to outer sheets.

2.07 STEEL DOORS

A. Hollow metal doors:
   1. SDI Grade II, Model 2, seamless, (16 gage) for doors up to 3 ft. wide, and Grade III, Model 2, seamless. Close the top of outswinging exterior doors with an inverted flush channel.
   3. Texture: Smooth faces
   4. Finish: Factory primed, for field finishing.
   5. Provide exterior doors with a U factor of 0.24 BTU/hr. x sq. ft. x deg. F when tested in compliance with ASTM C 236. Core: Polystyrene foam.

B. Exterior Doors:
   1. Construct doors with smooth, flush surfaces without visible joints or seams or exposed faces or stile edges, except around glazed or louvered panel inserts. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
   2. Reinforce inside of doors with vertical galvanized sheet steel channel-shaped sections or interlocking z-shaped sections not less than 22 gage. Space vertical reinforcing 6" o.c. and extend full door heights. Spot-weld at not more than 6" o.c. to both face sheets.
   3. Continuous truss-form inner core of 28 gage galvanized sheet steel reinforcing may be provided as inner reinforcement, in lieu of above. Spot-weld at not more than 3" o.c. vertically and horizontally over entire surface of both sides.
   4. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to the outer sheets. Close top and bottom edges to provide weather seal, as integral part of door construction or by addition of inverted steel channels.

C. Interior Doors:
   1. Fabricate interior doors of 2 outer cold-rolled, stretcher-levelled steel sheets not less than 18 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.
   2. Reinforce inside of doors with vertical, hot-rolled, not less than 22 gage steel channel-shaped sections or interlocking z-shaped steel sections. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.
   3. Continuous truss-form inner core of 28 gage sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.
   4. Reinforce tops and bottoms of doors with 18 gage, horizontal steel channels, welded continuously to the outer sheets.

D. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with NFPA 252.
   1. Rate of Temperature Rise Across Door Thickness: In accordance with code
   2. Provide units listed and labeled by UL.
   3. Core: Mineral fiberboard.
   4. Attach fire rating label to each fire rated unit.

E. Vision panels in doors:
   1. Make cutouts for vision panels square and parallel with door edges.
   2. Provide integrally-formed glass stops on security side of doors and removable glass stops on opposite side.
      a. Size rabbet to fit glass thickness indicated.

DSA Re-submittal 6/21/2012
08 11 13 - 4

HOLLOW METAL DOORS AND FRAMES
b. Attach removable glass stops securely in place with countersunk oval head machine screws spaced equally at not more than 12 in. o.c. and 2 in. from corners.

### 2.08 STEEL FRAMES

**A. General:**

1. Provide metal frames for doors of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16 gauge cold-rolled furniture steel.
   a. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame, unless otherwise indicated.
   b. Knock-down type frames are not acceptable.
   c. Fabricate steel frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant.
   d. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project Site. Comply with SDI-100 requirements.
   e. Fabricate work of this Section to required profiles by roll-forming, brake-forming and welding to produce hollow metal work with straight and square edges, with surfaces free from warp, wave, buckle, oil-canning and other defects.
   f. Conform to AWS standards for welding. Frames shall be face welded with exposed welds ground flush and smooth with parent metal.
   g. Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

**B. Where shown or scheduled, provide frame assemblies which have been fabricated as sound-reducing type, tested in accordance with ASTM E 90, and classified in accordance with ASTM E 413.**

1. Finish: Factory primed, for field finishing.
2. Form frames of galvanized steel sheets for exterior, and either cold or hot-rolled sheet steel for interior.
   a. Gage: Not less than 14, for exterior openings up to and including 4'-0" wide.
   b. Gage: Not less than 16, for interior openings up to and including 4'-0" wide.
   c. For openings over 4'-0" wide, increase thickness by at least two standard gages.
3. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

**C. Exterior Door Frames:** Face welded, seamless with joints filled.

1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Finish: Factory primed, for field finishing.

**D. Mullions for Pairs of Doors:** Fixed, of profile similar to jambs.

**E. Anchors:**

1. **Jamb Anchors:**
   a. Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gage galvanized steel.
   b. Masonry Construction: Adjustable, flat or corrugate or perforated, t-shaped to suit frame size with leg not less than 2" wide by 10" long. Furnish at least 3 anchors per jamb up to 7'-6" height; 4 anchors up to 8'-0" jamb height; one additional anchor for each 24" or fraction thereof over 8'-0" height.
   c. In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8" concealed bolts into expansion shields or inserts at 6" from top and bottom and 26" o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.

2. **Floor Anchors:**
   a. Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet, as follows:
b. Monolithic Concrete Slabs: Clip type anchors, with 2 holes to receive fasteners, welded to bottom of jamb and mullions.
c. Separate Topping Concrete Slabs: Adjustable type with extension clips, allowing not less than 2" height adjustment. Terminate bottom of frames at finish floor surface.

3. Head Anchors:
   a. Provide 2 anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.

F. Frame Accessories
   1. Removable Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.
   2. Astragals for Double Doors: Specified in Section 08 71 00.
   3. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jamb of single-swing frames and 2 silencers on heads of double-swing frames.
   4. Temporary Frame Spreaders: Provide for all factory- or shop-assembled double frames.

2.09 FINISH HARDWARE PREPARATION

A. Prepare frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
   1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastenings in top rail of doors or head of frames, as applicable.

B. Reinforce frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at Project Site.

C. Reinforce doors for required finish hardware, as follows:
   1. Hinges: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than 6 spot-welds.
   2. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than 2 spot-welds.
   3. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.
   4. Cylinder Locks: 12 gage steel sheet, secured with not less than 2 spot-welds.
   5. Flush Bolts: 12 gage steel sheet, secured with not less than 2 spot-welds.
   7. Concealed Closers: Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.
   8. Push Plates and Bars: 16 gage steel sheet, (except when through bolts are shown or specified), secured with not less than 2 spot-welds.
   9. Surface Panic Devices: 14 gage sheet steel (except when through bolts are shown or specified), secured with not less than 2 spot-welds.
   10. Automatic Door Bottoms: Reinforce for mortise-type units with 12 gage steel, and 16 gage for surface-applied units.

D. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with DSA/ADA requirements and "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Inspect adjacent construction and supports.
D. Make sure that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface, and that other conditions detrimental to the proper or timely completion of this work are corrected before proceeding with installation.

3.02 INSTALLATION
A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
B. In addition, install fire rated units in accordance with NFPA 80.
C. General: Install standard steel frames and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
D. Coordinate frame anchor placement with wall construction.
E. Placing Frames: Comply provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
   1. Provide a minimum of 2 anchors for head of double door frames.
   2. Provide a minimum of 3 anchors per jamb for frame with doors under 81 in. high; provide one additional anchor for doors in frame over 81 in.
   3. Attach jamb anchors to studs with a minimum of four 3/8 in. diameter self-tapping screws or bolts (2 per side).
F. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
G. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.
H. Provide UL tested adjustable floor clips for all frames. Anchor clips to floor with powder-driven pins or bolts in expansion shields.
I. Leave frame spreader bars intact, wherever possible, until frames are set perfectly square and plumb and all anchors are securely attached and grouted where required.
J. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
K. Coordinate installation of hardware.
L. Coordinate installation of glazing.
M. Touch up damaged factory finishes.

3.03 HANGING DOORS
A. Install finish hardware in compliance with its manufacturer's templates and printed instructions.
B. Hang doors in compliance with their manufacturer's instructions, and adjust to the clearances specified in SDI publication 100, paragraph 2.2.1, except where more stringent clearances are indicated on the Drawings or required by UL listing for fire-rated doors.
C. Fit hollow metal doors accurately in their respective frames, with the following clearances:
   1. Jambs and Head: 3/32".
   2. Meeting Edges, Pairs of Doors: 1/8".
   3. Bottom: 3/8", where no threshold or carpet.
   4. Bottom at Threshold or Carpet: 1/8".
D. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
E. Do not install doors warped, bowed, dented or otherwise damaged.
F. Adjust hardware so that doors operate freely for their entire travel, but not loosely, without sticking or hinge binding, with all hardware adjusted and functioning properly.
3.04 TOLERANCES
   A. Clearances Between Door and Frame: As specified in ANSI A250.8.
   B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.
   B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel frames
      undamaged and in complete and proper operating condition.
   C. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas
      of prime coat and apply touch-up of compatible air-drying primer.
   D. Before application of primer, touchup galvanized surfaces with zinc-rich coating where zinc
      coating has been removed or damaged.

3.06 SCHEDULE
   A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION
SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Overhead coiling doors, operating hardware, non-fire-rated and exterior, manual operation.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Provide general construction, component connections and details.
C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
D. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Overhead Coiling Doors:
2. Substitutions: See Division 1 for substitutions.

2.02 COILING DOORS
A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
   2. Single thickness slats.
   3. Finish: Factory painted, from standard color chart.
   5. Hood Enclosure: Manufacturer’s standard; galvanized steel.
   7. Mounting: Surface mounted.

2.03 MATERIALS
A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Steel Slats: Minimum 18 gage ASTM A653/A653M galvanized steel sheet.

C. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

D. Steel Guides: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A 123/A 123M.

E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

DSA Re-submittal 6/21/2012 08 33 23 - 1
OVERHEAD COILING DOORS
F. Hardware:
   1. Latching: Inside mounted, adjustable keeper; spring activated latch bar with feature to keep in locked or retracted position.
   2. Latch Handle: Interior handle.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION
   A. Install units in accordance with manufacturer's instructions.
   B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
   C. Securely and rigidly brace components suspended from structure.
   D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 ADJUSTING
   A. Adjust operating assemblies for smooth and noiseless operation.

3.04 CLEANING
   A. Clean installed components.
   B. Remove labels and visible markings.

END OF SECTION
SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Hardware for doors.
B. Hardware for fire-rated doors.
C. Thresholds.
D. Weatherstripping, seals and door gaskets.
E. Gate locks.

1.02 REFERENCE STANDARDS
B. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.1).
C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.2).
D. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.3).
E. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2000 (ANSI/BHMA A156.4).
F. BHMA A156.5 - American National Standard for Auxiliary Locks & Associated Products; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.5).
G. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.6).
H. BHMA A156.7 - American National Standard for Template Hinge Dimensions; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.7).
I. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2005 (ANSI/BHMA A156.8).
J. BHMA A156.12 - American National Standard for Interconnected Locks & Latches; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.12).
M. BHMA A156.16 - American National Standard for Auxiliary Hardware; Builders Hardware Manufacturers Association; 2002 (ANSI/BHMA A156.16).
N. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).
O. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

DSA Re-submittal 6/21/2012

08 71 00 - 1

DOOR HARDWARE
B. Convey District's keying requirements to manufacturers.
C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

1.04 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Include manufacturer's complete product literature for specified items, including detailed installation diagrams and instructions.
C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.
D. Keying Schedule: Submit for approval of District.
E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
F. Maintenance Data: Include one set of adjusting tools, data on operating hardware, maintenance manuals for all hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
G. Keys: Deliver with identifying tags to District by security shipment direct from hardware supplier.
H. Keying Schedule: Submit separate detailed schedule indicating clearly how the District's final instructions on keying of locks has been fulfilled.
I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.
J. Submit hardware schedule in a timely manner so as not to delay the progress of related trades (i.e. hollow metal work) or the progress of the construction schedule.
K. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
   a. Quantities.
   b. Type, style, function, size and finish of each hardware item.
   c. Name and manufacturer of each item.
   d. Fastenings and other pertinent information.
   e. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
   f. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
   g. Mounting locations.
   h. Door and frame size.
L. Mounting locations for hardware.
M. Door and frame sizes and materials:
N. Keying information:
   1. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordination review of hardware schedule.
O. Submittal Sequence: Submit initial draft of schedule along with essential product data in order to facilitate the fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Submit final draft of schedule after samples, product data, coordination with shops drawings of other work, delivery schedules, and similar information has been completed and accepted.

P. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operations and quality as the type specified, and shall be subject to the approval of District's Representative.

Q. Construction Schedule: Inform Contractor at earliest possible date of estimated times and dates to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing Finish Hardware for purposes of including in construction progress schedule and then comply with this schedule.

1.05 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience. Must employ an experienced architectural hardware consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to District, Architect and Contractor.

B. Supplier Qualifications: Hardware supplier shall have minimum 5 years experience in supplying hardware for projects of similar size and scope and shall have in his employ a certified architectural hardware consultant (AHC) to prepare hardware submittals and coordinate proper preparation for and installation of hardware items.

C. Hardware Supplier Qualifications: Local company specializing in supplying commercial door hardware with 3 years of experience. Must employ an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to District, Architect and Contractor.

D. Performance: This section is based on use of products of manufacturers listed on schedule included at end of this Section; however, materials by other manufacturers as specifically accepted in writing may be substituted, provided they meet specified requirements in all respects. Use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer products as listed will not be acceptable, unless they are not equal in design, size, weight, finish, function, or other qualities of significance, or followed by the words "No Substitution(s)". After District acceptance of hardware supplier's completed hardware schedule, manufacturer selection shall not be changed.

E. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.
   1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

F. Design Criteria: Intent of Specification contemplates providing hardware for all doors in Project, specifically listed. It is Contractor's responsibility to examine Contract Documents and call omissions to Architect's attention prior to bid for instructions. No extras allowed. Omissions not rectified as stated herein shall be furnished at no extra cost to District.

G. Special Requirement: Comply with latest applicable publications of Builders Hardware Manufacturing Association (BHMA) "Builders Hardware Handbook".

H. Source Quality Control: Each type of kind of hardware shall be obtained from only one manufacturer, even though several may be specified as acceptable.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ship hardware items in lots coordinated with openings, as numbered in opening schedule.
B. Packaging of hardware is the responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Package shall include all fastenings and appurtenances. Two or more identical sets may be packaged in the same container.
   1. Mark each package on the outside to show the contents and specific location in the work.
   2. Mark each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
C. Inspect hardware items upon delivery to assure that specified products have been received.
D. Store in clean, dry, secure area.
E. Storage: Provide secure lock-up for hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items with are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.
F. Coordinate hardware with other Work. Furnish all hardware items of proper design for use on doors and frames of thickness, profile, swing, security, and similar requirements indicated as necessary for proper installation and function.
G. Furnish printed templates or actual hardware to the various subcontractors responsible for installation of, or preparation for installation of hardware furnished under this Section. Check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.
H. Coordinate Campus keying requirements during the course of the Work.
I. All exit doors shall be openable from the inside at all times without the use of a key or special knowledge or effort. All hardware shall be as determined by building, accessibility and fire codes in effect and current at the time of furnishing the finish hardware to the Project.

1.07 WARRANTY
A. Provide five year warranty for door closers and locksets, mortise locks and lever handles.
B. Warrant, against defective materials and workmanship, door closers for 5 years after Substantial Completion, and remaining finish hardware for 2 years after Substantial Completion.
C. Door Closers: Provide a 10 year warranty against failure or leakage in addition to warranty/ guaranty requirements of the Conditions of the Contract beginning on date Work is Accepted by District.
D. Replace defective hardware during the warranty period at no cost to the District.

PART 2 PRODUCTS

2.01 MATERIALS
A. General: Furnish hardware following receipt of review comments on detailed schedules and samples. Furnish templates or sample items to shops and trades fabricating Work which will receive hardware. Package sets individually with labels attached, identifying contents in same manner as in schedules.
B. Miscellaneous Items: Furnish hardware with incidental items such as screws, bolts, expansion shields, tampins, anchors, or other fastenings required by manufacturer to ensure heavy usage and long life.
C. Fasteners: Manufacture hardware to conform to published templates, generally prepared for wood or machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws. Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fasteners.
   1. Screws: Furnish installation screws with each hardware item; generally phillips flat-head type and finished same as or closely matching hardware item finish.
   2. Concealed Fasteners: Typically provide concealed fasteners for hardware items which are exposed when door is closed except to extent no standard units of type specified are
available with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed except where it is not feasible to adequately reinforce the Work or where required by building code.

D. Hand of Door: Drawings indicate direction of slide or swing. Determine hand of each door leaf and furnish each item of hardware for proper installation and operation of door movement.

E. Manufacturer’s Name Plate: Do not use manufacturer’s products which have manufacturer’s name or trade name displayed in visible location.

F. Keying: Provide construction keying systems for all locks.

G. Keys: Include construction keys for Campus and Architect as well as Contractor.

H. Finish: Hardware shall be commercial grade to match existing or stainless steel finish.

2.02 FASTENINGS

A. Furnish all hardware complete with all necessary screws, bolts, and other fasteners of suitable type and size to anchor the hardware in position for hard use and long life. All fastenings shall harmonize with the hardware as to material and finish. Furnish fastenings where necessary with expansion shields, sex bolts, toggle bolts, or other anchors approved by the District’s Representative, according to the material to which the hardware is to be applied, and the recommendations of the hardware manufacturer.

2.03 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer’s Product Designation: One or more manufacturers are listed for each hardware type required. An asterisk (*) after a manufacturer’s name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

B. ANSI/BHMA designations used elsewhere in this section or in schedules to describe hardware items of to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this section.

2.04 MANUFACTURERS - BASIS OF DESIGN

2.05 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.
3. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Finishes: Identified in schedule or match existing unless noted otherwise.

E. Fasteners:

1. Concrete and Masonry Substrates: Stainless steel machine screws and lead expansion shields.

2.06 HARDWARE

A. Hardware sets listed below fully show extent of finish hardware to be provided at each opening. Hardware Schedule shall be modified only as directed in writing by Architect.
B. Specified and Acceptable Manufacturers and Products: Products by the following manufacturers are acceptable for bidding provided item or product meets preamble specification of each item. If, in opinion of Architect, item or product is not of same or similar type, then scheduled item shall be furnished. Hardware items are listed below to establish standard of quality.

1. Butt Hinges: Maximum of 5 knuckles, and 4-1/2" height (unless otherwise noted) at 1-3/4" doors. Use 2 pairs of hinges for doors 7'-5" and over.

2. Specified Acceptable Products:
   a. McKinney.
   b. Hager, Stanley.

3. Cylinders: Furnish 6 pin cylinders as required where indicated; no substitutions.

4. Locksets and Latchsets: Mortise design as listed by American National Standards Institute (ANSI).

5. Specified Acceptable Products:
   a. Schlage - No substitutions.

6. Surface-Mounted Door Closers: Product of one manufacturer, reversible and nonhanded; fully hydraulic, full rack and pinion action with high strength cast iron cylinder, having either slim line or full covers. Pieces of door closer shall be painted to match adjacent hardware.

7. Specified Acceptable Products:
   a. LCN.
   b. Sargent, Norton, Dorma.

8. Exit devices shall be product of one manufacturer, where specified at fire-rated door openings, carrying listing by Underwriter’s Laboratories as fire exit hardware.

9. Specified Acceptable Products:
   a. Von Duprin - No Substitutions.

10. Automatic and semi-automatic flushbolts and coordinator’s shall bear underwriter’s listing for use on fire-rated door openings.

11. Specified Acceptable Products:
   a. Door Control.
   b. Ives, Glynn Johnson.

12. Wall Stops, Push Plates, Armor Plates, and Door Trim: Builders Brass Works (BBW) is specified. Acceptable manufacturers include Trimco, Baldwin, Glynn Johnson, Master Manufacturing, and Ives.

13. Weatherstrip, Smoke Seal, and Atragais: Pemko is specified. Acceptable manufacturers include Zero, Master Manufacturing, Reese, and National Guard.

14. Magnetic Holders: Rixson. Products by other manufacturers may be used provided that projection of armorture unit is same and they are compatible with fire alarm sytem.

15. Silencers for hollow metal frames shall be similar to BBW No. W-07. Stick-on silencers shall not be used on this Project.

16. Manufacturers used in this schedule unless otherwise noted:
   b. Locksets and Latchsets: Schlage.
   c. Closers: LCN
   d. Exit Devices: Von Duprin.
   e. Automatic Flushbolts and Coordinator s: Door Control.
   g. Thresholds & Weatherstrip: Pemko.
   h. Miscellaneous: As noted.

17. Hardware Sets: Refer to Door Schedule Drawings for assignment to specific doors.
   a. Hardware sets to be selected.

C. Hinges: Provide hinges on every swinging door.

1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.

2. Provide ball-bearing hinges at all doors.

3. Provide hinges in the quantities indicated.

DSA Re-submittal 6/21/2012

08 71 00 - 6

DOOR HARDWARE
4. Provide non-removable pins on exterior outswinging doors.

2.07 LOCKS AND LATCHES
   A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
      1. Hardware Sets indicate locking functions required for each door.
      2. If no hardware set is indicated for a swinging door provide an office lockset.
      3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
      4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.
   B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
      1. Provide cams and/or tailpieces as required for locking devices required.
   C. Keying: Grand master keyed.
      1. Include construction keying.
      2. Key to existing keying system.
   D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.08 FLUSHBOLTS
   A. Flushbolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
      1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
      2. Floor Bolts: Provide dustproof strike except at metal thresholds.
   B. Coordinators: Provide on doors having closers and self-latching or automatic flushbolts to ensure that leaves close in proper order.

2.09 STOPS AND HOLDERS
   A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
      1. Provide wall stops, unless otherwise indicated.
      2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
      3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.
   B. Kick Plate: Trimco
      1. Trimco, Triangle Brass Manufacturer Co., Inc.: www.trimcobbw.com
   C. Door Stops: IVES
      1. IVES: www.schiagelock.com/brands/iveshome.htm
   D. Thresholds: pemko
      1. pemko Manufacturing Company: www.pemko.com

2.10 PROTECTION PLATES AND ARCHITECTURAL TRIM
   A. Protection Plates:
      1. Kickplate: Provide on push side of every door with closer, except storefront and all-glass doors.
   B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.

2.11 HARDWARE SCHEDULE
   A. While the Hardware Schedule is intended to cover all doors and other moveable parts of the building and establish a type and standard of quality, it shall be the specific duty and responsibility of the finish hardware supplier to examine the Drawings and Specifications and furnish proper hardware for all openings whether listed or not.
B. If there are any omissions in the hardware groups, they shall be called to the attention of the Architect prior to bid opening for instructions. Otherwise the list shall be considered complete. No extra will be allowed for omissions, changes or corrections necessary to facilitate proper installation.

C. Hardware supplier shall meet with School District to determine keying requirements. A keying schedule will then be prepared and submitted for approval prior to ordering of factory keyed locks and cylinders.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare openings and doors in accordance with manufacturer’s installation instructions.

B. Contractor shall field verify opening size, <E> hardware locations, threshold requirements and make all necessary adjustments for an ADA approved system. See drawings for appropriate details.

C. Prior to installation of hardware at Project Site, conduct a general orientation meeting attended by hardware supplier, hardware installers, Architect, District, and Contractor. Review installation procedures related to schedules of hardware, doors, and frames. Establish final provisions related to security and key control. Examine hardware items for unusual provisions including special operational features, security devices, UL labels, and similar considerations related to installation.

3.02 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install hardware in accordance with manufacturer’s instructions, details, and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:
   1. Comply with T-24 CBC, 11338.2.5.1.
   2. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
   3. Seal thresholds to exterior pavement and walls. Use mildew resistant sealant.
   5. Exit devices: Between 30 and 40 inches above floor.

E. Floor mounted door stops shall be installed no more than 4 inches from face of walls or partitions per DSA policy 99-08, dated 12-1-99.

F. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

G. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Position: Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation. Install closers on room side of doors.
H. Position: Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation. Install closers on room side of doors.

I. Fasteners: Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Exposed fasteners Phillips head, counter sunk.

J. Check: Adjust and examine each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for application intended.

K. Seal thresholds to exterior pavement and walls. Use mildew resistant sealant and anchor securely to concrete a minimum of 3 flat head machine screws in expansion shields.

3.04 ADJUSTING
   A. Check: Adjust and examine each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for application intended.

   B. Adjust hardware for smooth operation.

   C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 PROTECTION
   A. Protect finished Work under provisions of Section 01 70 00.

   B. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULE - ATTACHED.

A. Hardware Group HW-1
   1. 3 Ea Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
   2. 1 Ea Lock ND96TD RHO US10B Schlage
   3. 1 Ea Core Only 20-740 IC Everest Primus Level 9Z Schlage
   4. 2 Ea Kickplates 10 x 34" 8400 US10B Ives
   5. 1 Ea Door Stop FS18S Black Ives
   6. 1 Ea Closer 4041EPA-TB Drk Bronze LCN
   7. 1 Ea Door Seal 162SA Drk An NPG
   8. 1 Ea Lock Guard LG12 US10B Ives
   9. 1 Ea Drip Guard 17DKB Drk. Bronze NPG
   10. 1 Set Silencer SR64 Gray Ives

B. Hardware Group HW-2
   1. 3 Ea Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
   2. 1 Ea Lock ND96TD RHO US10B Schlage
   3. 1 Ea Core Only 20-740 IC Everest Primus Level 9Z Schlage
   4. 1 Ea Panic Device 9875-EO-F-3' US10B Von Duprin
   5. 2 Ea Kickplates 10 x 34" 8400 US10B Ives
   6. 1 Ea Door Stop FS18S Black Ives
   7. 1 Ea Closer 4041EPA-TB Drk Bronze LCN
   8. 1 Ea Door Seal 162SA Drk An NPG
   9. 1 Set Silencer SR64 Gray Ives
   10. 1 Ea Threshold 272AxSS MS/A 630 Pemko

C. Hardware Group HW-3
   1. 6 Ea Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
   2. 2 Ea Manual Flush Bolt FB31P US10B Ives
   3. 1 Ea Dust Proof Strike DP-2 US10B Ives
   4. 1 Ea Lock ND96TD RHO US10B Schlage
   5. 2 Ea Panic Device 9827-EO-F-3' US10B Von Duprin
   6. 1 Ea Core Only 20-740 IC Everest Primus Level 9Z Schlage

DSA Re-submittal 6/21/2012

DOOR HARDWARE
<table>
<thead>
<tr>
<th>No.</th>
<th>Quantity</th>
<th>Item Description</th>
<th>Finish 1</th>
<th>Finish 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1 Ea.</td>
<td>Astragal 139SP or by HM Door Mfr.</td>
<td>NPG</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2 Ea.</td>
<td>Door Stop FS18S</td>
<td>Black</td>
<td>Ives</td>
</tr>
<tr>
<td>9</td>
<td>1 Ea.</td>
<td>Closer 4041EPA-TB</td>
<td>Dk.Bronze</td>
<td>LCN</td>
</tr>
<tr>
<td>10</td>
<td>4 Ea.</td>
<td>Kickplates 10x34 8400</td>
<td>US10B</td>
<td>Ives</td>
</tr>
<tr>
<td>11</td>
<td>2 Ea.</td>
<td>Door Seal 162SA</td>
<td>Drk. An</td>
<td>NPG</td>
</tr>
<tr>
<td>12</td>
<td>1 Ea.</td>
<td>Lockguard LG12</td>
<td>US10B</td>
<td>Ives</td>
</tr>
<tr>
<td>13</td>
<td>1 Ea.</td>
<td>Threshold 272AxSS MS/A</td>
<td>630</td>
<td>Pemko</td>
</tr>
<tr>
<td>14</td>
<td>2 Set</td>
<td>Silencer SR64</td>
<td>Gray</td>
<td>Ives</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Louvers.

1.02 REFERENCE STANDARDS
   A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control
   B. CBC 2010 Sections 1609A.1.2.1, 1615A.1.2.1 and 2403.5.

1.03 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Manufacturer shall submit shop drawings incorporating key plans, elevations, sections and
      details showing profiles, angles and spacing of louver blades and frames; unit dimensions
      related to wall openings and construction; and, anchorage details and locations.
   C. Submit theoretical calculations prepared by a professional engineer specializing in the
      application of welding technology demonstrating that each fillet weld joining blade and frame
      members will withstand a minimum of 526 pounds of force in shear.
   D. Provide samples of manufacturer’s finish and color charts showing the full range of colors
      available. For each type of product specified, submit free area, air performance and water
      penetration ratings determined in accordance with AMCA Standard 500-L and licensed under
      the AMCA Certified Ratings Program.

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products of the type
      specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Wall Louvers:

2.02 ACOUSTICAL LOUVERS (CHILLER ROOM)
   A. GENERAL
      1. Furnish and install where indicated on plans or described in schedules Acoustic Louver
         Type T9108 designed and manufactured by The Aiolite Company LLC, Schofield,
         Wisconsin. Louvers shall be furnished with insect screen, supports, installation hardware
         and finishes as specified and as required for a complete installation. Louver shall be
         aluminum construction with visible vertical mullions.

   B. PRODUCTS
      1. Louvers shall be acoustic type incorporating stationary, parallelogram blades in a single
         frame. Louvers shall be 8-inches deep and assembled entirely from fabricated aluminum
         components. Blades and frames shall be 0.080-inch thick aluminum, alloy 3003-H32.
         Blades shall be positioned at 45-degrees and spaced 5-inches on center. Each blade and
         top and bottom frame cavity shall be filled with fiberglass acoustic insulation to absorb the
         transmission of sound. Acoustic insulation shall be held in place by 0.032-inch thick
         perforated aluminum panels.
      2. Louvers finish shall be 3-coat fluoropolymer finish.

   C. ALL-WELDED ASSEMBLY
      1. Join stationary blade and frames and frame members with fillet welds concealed from
         view, unless the size of the louver makes bolted connections between louver sections
         necessary. Louver blades shall be joined to each jamb frame with a minimum of two fillet

DSA Re-submittal 6/21/2012
welds produced with the Pulsed Gas Metal Arc Welding (GMAW/Mig) process. Each weld shall be a minimum of 1-inch in length with a minimum 1/8-inch LEG. Frames shall be joined at each corner with a full-length GMAW fillet weld with a minimum 1/8-inch leg.

D. STRUCTURAL DESIGN CRITERIA
1. Manufacturer shall design and furnish all supports required to withstand a wind force of not less than 25 pounds per square foot. Louvers larger than 60-inches wide x 96-inches high will be fabricated and installed in multiple sections. Louver blades, frames, mullions and anchorages shall be demonstrated to withstand the specified wind design load.

2.03 EXHAUST LOUVERS (ROOFTOP)

A. GENERAL
1. Furnish and install where indicated on plans or described in schedules drainable Louver Type K6774 as designed and manufactured by The Airolite Company LLC, Schofield, Wisconsin. Louvers shall be furnished with bird screen, supports, installation hardware and finishes as specified and as required for a complete installation.

B. PRODUCTS
1. Louvers shall be drainable Louver Type K6774 with visible vertical mullions. Louvers shall be 4-inches deep and assembled entirely from extruded aluminum components. Blades and frames shall be 0.081-inch thick extruded aluminum, alloy 6063-T5. Blades shall be stationary, incorporate drainable gutters, and be spaced 4-inches on center. Jamb frames shall incorporate drainable gutters to ensure resistance to water penetration.
2. Louvers finish shall be 3-coat fluoropolymer finish.

C. ALL-WELDED ASSEMBLY
1. Join stationary blade and frames and frame members with fillet welds concealed from view, unless the size of the louver makes bolted connections between louver sections necessary. Louver blades shall be joined to each jamb frame with a minimum of two fillet welds produced with the Pulsed Gas Metal Arc Welding (GMAW/Mig) process. Each weld shall be a minimum of 1-inch in length with a minimum 1/8-inch leg. Frames shall be joined at each corner with a full-length GMAW fillet weld with a minimum 1/8-inch throat.

D. STRUCTURAL DESIGN CRITERIA
1. Manufacturer shall design and furnish all supports required to withstand a wind force of not less than 25 pounds per square foot. Louvers 72-inches wide x 144-inches high or 144-inches wide x 72-inches high will be fabricated and installed in multiple sections. Louver blades, frames, mullions and anchorages shall be demonstrated to withstand the specified wind design load.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.
B. Install louvers level and plumb.
C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
D. Secure louver frames in openings with fasteners.

3.02 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

END OF SECTION
SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Gypsum wallboard.
D. Textured finish system.

1.02 REFERENCE STANDARDS
D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2010.

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
C. Product Data: Submit manufacturer’s product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

1.04 QUALITY ASSURANCE
A. Fire-Resistance Rating: Where gypsum drywall systems with fire-resistance ratings area indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.
B. Provide fire resistance rated assembmlies identical to those indicated by reference to those indicated by reference to:
   1. GA File No'S in GA "Fire Resistance Design Manual".
2. Design designations in UL "Fire Resistance Directory".
3. Listings of other testing and agencies acceptable to authorities having jurisdiction.

1.05 DELIVERY STORAGE AND HANDLING
A. Deliver Materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect material corner beads from being bent or damaged.

PART 2 PRODUCTS
2.01 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C640 and GA-216.
B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions; 2 hour rating
   2. Fire Rated Shaft Walls; 1 hour rating
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

DIRECT SUSPENSBASE MANUFACTURERION SYSTEMS:
3.01 CHICAGO METALLIC CORPORATION: WWW.CHICAGO-METALLIC.COM.
3.02 DONN CORPORATION.
   A. National Rolling Mills Company.

3.03 METAL FRAMING MATERIALS
A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E72 using assemblies specified by ASTM C754.
   2. Studs: "C" shaped with flat or formed webs with knurled faces.
B. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754.

3.04 METAL SUPPORT MATERIALS
A. Wall/Partition Support Materials:
   1. Studs: ASTM C 645; 0.0179" min. thickness of base metal unless otherwise indicated.
      a. Depth of Section: 3-5/8", except as otherwise indicated.
      b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
   2. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.
      a. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.
   3. Z-Furring Members: Manufacturer's standard screw-type galvanized steel, zee-shaped furring members; ASTM A 525, G60, 0.0179" min. thickness of base metal; of depth indicated; designed for mechanical attachment of insulation boards or blankets to monolithic concrete and masonry walls.
3.05 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass-mat-faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch
   5. Glass-Mat-Faced Products:
      a. National Gypsum Company; Gold Bond e2XP Fire-Shield Interior Extreme.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
   1. Application: Stairs.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M: Ends square cut.

E. Gypsum Shaftwall or Coreboard: ASTM C 442; sizes to minimize joints in place; 4 inch thick; square edges, ends square cut.

3.06 ACCESSORIES

A. General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with knurled and perforated for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.
   1. Semi-Finishing Type: Manufacturer's standard trim units which are not to be finished with joint compound (nonbeaded).

B. H-Molding: Manufacturer's standard extruded aluminum H-molding of height required for board, designed for combination trim and control joint in exterior gypsum board ceiling/soffit work.

C. JOINT TREATMENT MATERIALS
   1. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
      a. Grade: A single multi-purpose grout, for entire application.
   4. Joint Compound: On interior work provide chemical-hardening-type for bedding and filling, ready-mixed vinyl-type or vinyl-type powder type for topping.


E. Screws for Attachment to Steel Members From 0.033 to 0.112 Inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

3.07 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

B. Board Screws: Comply with ASTM C 646.

C. Water-Resistant Adhesive: Type I organic adhesive for ceramic tile complying with ANSI A136.1.
D. Thermal Insulation: FS HH-I-521, Type I; semi-rigid mineral fiber blanket without membrane; Class 25 flame spread, K value of 0.25; designed for use with Z-furring members, of thickness and width to completely fill void formed by Z-furring members; density between 4.0 and 6.0 lbs. per cu. ft. depending on thickness.

E. Polyethylene Vapor Retarder: A single polyethylene film, 4.0 mils thick, with a vapor rating of 0.20 perms per ASTM E 96.

3.08 TEXTURE FINISH MATERIALS

A. Primer: Of type recommended by manufacturer of texture finish.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.
   1. Coordinate installation with work of other trades whose work connects with or is affected or concealed by gypsum wallboard. Do all the butting, and patching or work as may be required to accommodate other trades.
   2. Before applying gypsum wallboard, see that corners and framing are plumb, true, and solid. Do not apply wallboard until conduits, pipes, ducts, vents, supports, fixture frames, etc., are in place and tested as required. Solid bearing required at all edges and ends of wallboard.
   3. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
   4. Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F (13 degrees C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 degrees F (13 degrees C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
   5. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

4.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer’s installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

4.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer’s instructions.

B. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer’s instructions.
   3. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.
   4. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
   5. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
   6. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support or substrate above the ceiling.
7. Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.

C. Frame door openings to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co; www.usg.com.
1. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames.
2. Install runner track section (for jack studs) at head and secure to jamb studs.
3. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

D. Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

E. Expansion Joints:
1. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

4.04 BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
1. Locate exposed end but joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
2. Install wall/partition boards vertically to avoid end-but joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
3. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
4. Located either edge or end joints over supports, except in horizontal applications or where intermediate supports, or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs at opposite sides of partitions.
5. Attach gypsum board to supplementary framing and blocking provide for additional support at openings and cutouts.
6. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.
7. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Installation on Metal Framing: Use screws for attachment of all gypsum board.

D. Apply wallboard first to ceilings then to walls using maximum lengths to minimize end joints. Apply gypsum wallboard to framing members in horizontal application (long edges of board at right angles to framing), with all abutting ends and edges over supports. Install all panels plumb, level, and with all joints on bearing. Smooth all cut ends and edges of panels where necessary to obtain a smooth joint. Neatly fit and stagger all end joints. Boards brought into moderate contact, but not forced into place. Maximum width joint shall be 1/8". Cut and fit neatly around all devices in surface. For cut-outs in panels for pipes, fixtures, or other small openings, make holes and cut-outs by sawing or by such other method that will not fracture the core or tear the covering, and with such accuracy that plates, escutcheons, trim, etc., will cover all edges. "Score-and-knockout" methods will not be permitted.
4.05 INSTALLATION OF TRIM AND ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

B. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

C. Corner Beads: Install at external corners, using longest practical lengths.

D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

E. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

F. Install semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings or indicated to receive trim with face flanges covered with joint compound.

G. Install plastic edge trim where indicated on wall panels at juncture with ceilings.

4.06 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.

B. Texture Required: Match existing texture.

C. Surface Preparation and Primer: Prepare and prime drywall and other surfaces in strict accordance with texture finish manufacturer's instructions. Apply primer to all surfaces to achieve texture finish.

D. Finish Application: Mix and apply finish to drywall and other surfaces indicated to receive finish in strict accordance with manufacturer's instructions to produce a uniform texture without starved spots or other evidence of thin application, and free of application patterns.

E. Remove any texture droppings or overspray from door frames, windows and other adjoining work.

4.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

4.08 CLEAN-UP

A. During the progress of this portion of the Work, do not allow the accumulation of scrap and debris resulting from the gypsum drywall installation and finishing. Take all means necessary to prevent spilling and splashing compound. In the event of spilling or splashing of compound on other surfaces, immediately remove the spilled or splashed material and all traces of residue.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints and other coatings.
C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. See Division 1 for submittal requirements.
B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

1.04 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
   1. Provide ready mixed paints and coatings, except field-catalyzed coatings.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS
A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

2.04 EXTERIOR PAINT SYSTEMS
A. Ferrous- Flat- Acrylic: Surfaces:
   1. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   2. First Coat: KM 1240 - [Acrylic Exterior Flat Finish
   3. Finish Coat: KM 1240 - Acrylic Exterior Flat Finish
B. Ferrous-Semi Gloss - Acrylic:
   1. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   2. First Coat: KM 1250 -
   3. Finish Coat: KM 1250 -
C. Galvanized Steel and Aluminum - Flat - Acrylic:
   1. Surface Preparation: Kelly Moore JASCO
   2. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   3. Finish Coat: Two coats KM 1240 -
D. Galvanized Steel and Aluminum - Semi-Gloss - Acrylic:
   1. Surface Preparation: Kelly Moore JASCO
   2. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   3. Finish Coat: Two coats KM 1250

2.05 INTERIOR PAINT SYSTEMS
A. Interior Gypsum Board: Eggshell Surfaces:
   1. First Coat: KM 971 - Acry-Plex Interior PVA Primer/Sealer.
   2. Second Coat: KM 1500 - Enviro Coat Interior Acrylic Eggshell Enamel
   3. Third Coat: KM 1500 - Enviro Coat Interior Acrylic Eggshell Enamel
B. Interior Gypsum Board: Semi-Gloss Surfaces:
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
C. Metal Piping: Ferrous Metals
   1. Prime Coat: KM 1725 - Kel-Guard 100% Acrylic Metal Primer
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
D. Metal Piping: Galvanized Metals
   1. Prime Coat: KM 1725 - Kel-Guard 100% Acrylic Metal Primer
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
PART 3 EXECUTION

3.01 SCOPE – SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
   4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
   5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars and supports occurring in finished areas to match background surfaces, unless otherwise indicated.
   7. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
   8. Paint shop-primed mechanical and electrical items occurring in finished areas.
   9. Paint interior surfaces of air ducts and convectors and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
  10. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to match face panels.
  11. Paint condenser water piping.

C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Engineer’s approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

E. Measure the pH factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
   1. Report results in writing to Engineer before starting work.
   2. If results of test indicate need for remedial action, provide written description of remedial action. If a different primer or paint system is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Engineer.
3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
   1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
   2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
   4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.
D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer’s recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.
   2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
   3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
   1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
   2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
   3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
   4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
   5. If manufacturer’s instructions recommend sanding to produce a smooth, even surface, sand between coats.
   6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.05 CLEANING AND PROTECTION
   A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
   B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.
   C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Engineer.
   D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION
SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Room and door signs.
B. Emergency evacuation maps.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Manufacturer’s printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from District through Engineer at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by District through Engineer prior to fabrication.
D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Manufacturer’s Installation Instructions: Include installation templates and attachment devices.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Flat Signs:
B. Other Signs:

2.02 SIGNAGE APPLICATIONS
A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with injection molded panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 1 inch.
4. Sign Height: 6 inches, unless otherwise indicated.
5. Rooms: Identify with the room names and numbers shown on the drawings.

C. Emergency Evacuation Maps:
1. Update existing evacuation maps to match existing type and style.

2.03 SIGN TYPES
A. Flat Signs: Signage media in matching plastic frame.
   1. Edges: Square.
   2. Corners: Square.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only. Characters on sign shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width to height ratio of between 1:5 and 1:10.
   3. Background Color: As scheduled.

2.04 TACTILE SIGNAGE MEDIA
A. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
   1. Total Thickness: 1/8 inch.

2.05 ACCESSORIES
A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install neatly, with horizontal edges level.
C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain District's instructions.
D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION
SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Fire extinguishers.
   B. Fire extinguisher cabinets.
   C. Accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Division 1 for submittal procedures.
   B. Product Data: Provide extinguisher operational features and color and finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Fire Extinguishers:
   B. Fire Extinguisher Cabinets and Accessories:

2.02 FIRE EXTINGUISHERS
   A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
      1. Class: A:B:C.
      2. Size and classification as scheduled.
      3. Finish: Baked polyester powder coat, match existing color.

2.03 FIRE EXTINGUISHER CABINETS
   A. Metal: Formed galvanized steel sheet; 0.036 inch thick base metal.
   B. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.
   C. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
   D. Finish of Cabinet Exterior Trim and Door: match existing finish and color.
   E. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES
   A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify existing conditions before starting work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer’s instructions.
   B. Install cabinets plumb and level, 48 inches from finished floor to handle.
   C. Secure rigidly in place.

END OF SECTION
SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.

1.02 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).
E. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
N. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).
R. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

DSA Re-submittal 6/21/2012
C. Pipe Test Reports: Submit pipe pressure test reports for all piping installed under this contract indicating that piping systems have been tested in accordance with the California Plumbing Code.

1.04 QUALITY ASSURANCE
A. Welder Qualifications: Certified in accordance with ASME (BPV IX).
B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS
A. Perform Work in accordance with State of California plumbing code.
B. Conform to applicable code for installation of backflow prevention devices.
C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS
A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING
A. Cast Iron Pipe: ASTM A 74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C 564 neoprene gaskets, or lead and oakum.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING
A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.03 SANITARY SEWER PIPING, ABOVE GRADE
A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.04 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING
   1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2.05 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
   1. Fittings: Ductile or gray iron, standard thickness.

2.06 WATER PIPING, ABOVE GRADE
A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

DSA Re-submittal 6/21/2012

22 10 05 - 2

PLUMBING PIPING

2.07 FLANGES, UNIONS, AND COUPLINGS
A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.08 PIPE HANGERS AND SUPPORTS
A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
B. Plumbing Piping - Drain, Waste, and Vent
C. Plumbing Piping - Water:

2.09 BALL VALVES
A. Manufacturers:
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Construction, 2 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, stainless steel ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION
A. Install and test all plumbing piping systems in strict accordance with the California Plumbing Code.
B. Install in accordance with manufacturer's instructions.
C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
D. Group piping whenever practical at common elevations.
E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
F. Install water piping to ASME B31.9.
G. Sleeve pipes passing through partitions, walls and floors.
H. Inserts:
   1. Provide inserts for placement in concrete formwork.
I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

3.04 APPLICATION
   A. Install unions downstream of valves and at equipment or apparatus connections.
   B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
   C. Install ball valves for throttling, bypass, or manual flow control services.

3.05 TOLERANCES
   A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
   B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

END OF SECTION
SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Floor drains.
B. Cleanouts.
C. Hose bibbs.
D. Backflow preventers.

1.02 REFERENCE STANDARDS
A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers;
   2001 (R2007).
B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering;
   2004 (ANSI/ASSE 1011).

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions. Indicate assembly
   and support requirements.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in
   this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 DRAINS
A. Manufacturers:
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Floor Drain (Indoor):
   1. ASME A112.21; cast iron floor drain with anchor flange, weepholes, adjustable round cast
      iron head.
C. Floor Drain (Outdoor):
   1. ASME A112.21.1M; cast iron area drain with anchor flange, membrane clamp with
      weepholes, cast iron grate and sediment bucket.

2.02 CLEANOUTS
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

2.03 HOSE BIBBS
A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

2.04 BACKFLOW PREVENTERS
   A. Manufacturers:
      4. Substitutions: See Section 01 60 00 - Product Requirements.
   B. Reduced Pressure Backflow Preventers:
      1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART 3 EXECUTION
3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
   C. Encase exterior cleanouts in concrete flush with grade.

END OF SECTION
10200 - Merritt College CHW Infrastructure

SECTION 23 05 19
METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Positive displacement meters.
B. Pressure gages and pressure gage taps.
C. Thermometers and thermometer wells.
D. Test Plugs.

1.02 REFERENCE STANDARDS
A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS
A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)
A. Manufacturers:
   1. Badger Meter Inc.: Model Recordall Disc Meter; www.badgermeter.com
      a. Substitutions: See Section 01 60 00 - Product Requirements.
   2. AWWA C700, positive displacement disc type for fluid in cast bronze and lead-free alloy.
   3. Electronic Transmitter
      a. Provide and install for water meter.
      b. Badger Meter Model RET Recordall Electronic Transmitter or equal.
      c. Transmitter shall include:
         1) Liquid crystal display, permanently sealed, magnetic pickups, multiple outputs, water proof connection.
         2) Unit of measure: U.S. Gallons
         3) Rate of flow: U.S. Gallons per hour
         4) Totalization function
         5) Pulse output for 10 gallons per pulse
         6) 4-20mA output for instantaneous flow rate
         7) Internal power source: One Lithium, 2.4A-hr battery
         8) External power source: 9.0 - 50.0 VDC for 4-20 mA.

2.02 PRESSURE GAGES
A. Manufacturers:
   1. Ashcroft Model Duragage; Model 1279;
   2. Substitutions: See Section 01 60 00 - Product Requirements

DSA Re-submittal 6/21/2012

METERS AND GAGES FOR HVAC PIPING

23 05 19 - 1
B. Gage: ASME B40.1, phenolic case, phosphor bronze bourdon tube, rotary geared brass
movement, brass socket, with front recalibration adjustment, black scale on white background.
1/2" NPT bottom system connection.
1. Size: 4-1/2 inch diameter.
2. Mid-Scale Accuracy: 1/2 percent.
3. Scale: Psi.

2.03 DIGITAL THERMOMETERS
A. Manufacturers:
2. Substitutions: See Section 01 60 00 - Product Requirements.
1. Size: 3-1/2 inch industrial stem
2. Display: 3/8" LCD digits, wide ambient formula.
3. Accuracy: 1 percent.
4. Resolution: 1/10 Degrees F between -19.9/199.9 Degrees F
5. Range: -40/300 Degrees F
6. Ambient Operating Temperatures: -30/140 Degrees F
7. Power: Integrated Photo Voltaic Cells

2.04 THERMOMETER SUPPORTS
A. Socket: Brass separable sockets for thermometer stems with or without extensions as
required, with and cap and chain.

2.05 CONTROLS SUPPORTS
A. Provide taps: Forged, ASTM A105 carbon steel, threaded branch connection suitable for sizes
and schedules to be connected for 180 psig working pressure. Bonney Forge Thred-o-let or
approved equal. Coordinate with Controls Subcontractor for size, location and quantities.
B. Differential Pressure Transmitter Support: Provide taps, 1/4" stainless steel tubing with
swagelok fittings and needle valves for shut off, bypass and drain connections.

2.06 TEST PLUGS
A. Manufacturer: Peterson Equipment Company Model Pete's Plug II.
B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter
pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6.
Provide full line size valved bypass with globe valve for liquid service meters.
C. Provide one pressure gage per pump, installing tops before strainers and on suction and
discharge of pump. Pipe to gage.
D. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage.
Extend nipples to allow clearance from insulation.
E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller
than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from
insulation.
F. Provide instruments with scale ranges selected according to service with largest appropriate
scale.
G. Install gages and thermometers in locations where they are easily read from normal operating
level. Install vertical to 45 degrees off vertical.
H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
1. Locate test plugs adjacent to thermometers and thermometer sockets.

END OF SECTION
SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Nameplates.
B. Tags.
C. Pipe Markers.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS
2.01 IDENTIFICATION APPLICATIONS
A. Major Control Components: Nameplates.
B. Piping: Pipe Markers.
C. Pumps: Nameplates.
D. Chillers: Nameplates.
E. Cooling Towers: Nameplates.
F. Valves: Tags.
G. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Laminated three-layer plastic with engraved letters.
   2. Letter Height: 1/4 inch.

2.03 TAGS
A. Manufacturers:
B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Color: Conform to ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

E. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify control panels and major control components outside panels with plastic nameplates.

F. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow, direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Testing, adjustment, and balancing of air systems.
B. Testing, adjustment, and balancing of hydronic and refrigerating systems.
C. Commissioning activities.

1.02 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Engineer.
   2. Submit to the Commissioning Authority.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Total flow calculations.
         2) Rechecking.
         3) Diversity issues.
      h. Expected problems and solutions, etc.
      i. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      j. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
      k. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in I-P (inch-pound) units only.
6. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Engineer.
   g. Project Contractor.
   h. Project altitude.
   i. Report date.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Test Instruments:
   1. Balancing Contractor shall provide all necessary test instruments required to take readings including, but not limited to: Pressure gauges, thermometers, humidity instruments, sling psychrometers, flow meter read out instruments (differential pressure gauges, etc.), air flow hoods, pitot tubes, anemometers, ammeters, voltmeters, tachometers, sound level meters, vibration analyzers, etc., as required to perform measurements required to perform the work of this section and applicable Commissioning specifications. These instruments are considered to be the property of the balancing contractor and required for usual performance of testing and balancing work. No allowance will be made for contractor’s failure to provide adequate test instruments.

B. Incidental Equipment and Materials:
   1. Balancing Contractor shall provide at his own expense incidental and/or temporary equipment required to make such readings as required for the performance of this work. Such incidentals include but are not limited to: pipe nipples, couplings, tees, elbows, plugs and caps, gauge valves, teflon tape, and other miscellaneous fittings required to make readings required for balancing work. Incidental materials and fittings shall be removed and the facility restored to ‘as found’ condition after completion of readings and balancing activities.

C. Tools and Labor:
   1. Balancing Contractor shall provide all tools and labor required to effect necessary readings for balancing work, including but not limited to electric drill and bits, wrenches, pliers, screwdrivers, teflon tape, flashlights, rags, pocket knife or leatherman, pencils, pens, test forms, paper, and other minor tools required for work of this section.
   2. Provide labor to alter minor piping and other systems to allow temporary installation of test gages and thermometers, etc., required to make necessary readings. This includes removal of plugs on pump castings and temporary installation of piping, valves, gauges and nipples required to attach pressure gauges for readings, drilling required holes in ductwork and subsequent installation of plugs to allow ductwork pitot tube traverses, connections to flow elements, including a reasonable effort to clear obstructions from test ports, etc. Remove temporary fittings, valves and gauges at completion of readings and restore equipment to ‘as found’ condition.

DSA Re-submittal 6/21/2012
HVAC
TESTING, ADJUSTING, AND BALANCING FOR
23 05 93 - 2
PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work
   prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this
      section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit
         AABC National Performance Guaranty.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following
   conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Access doors are closed and duct end caps are in place.
   7. Air outlets are installed and connected.
   8. Duct system leakage is minimized.
   9. Hydronic systems are flushed, filled, and vented.
  10. Pumps are rotating correctly.
  11. Proper strainer baskets are clean and in place.
  12. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system
   balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
      Required attendance by personnel that will actually be performing the balancing work.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments
   available to Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.
3.04 ADJUSTMENT TOLERANCES
   A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
   B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING
   A. Field Logs: Maintain written logs including:
      1. Running log of events and issues.
      2. Discrepancies, deficient or uncompleted work by others.
      4. Lists of completed tests.
   B. Ensure recorded data represents actual measured or observed conditions.
   C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
   D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
   E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE
   A. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
   B. Measure air quantities at air inlets and outlets.
   C. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required, including sheaves and labor. See RMS and Controls sequence of operation.

3.07 WATER SYSTEM PROCEDURE
   A. After systems are balanced, work with the controls contractor to determine optimal final setpoint of pump system static pressure controls. Final setpoint shall be determined by supplying design water flow to all zones with no valves throttling.
   B. Adjust water systems to provide required or design quantities.
   C. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
   D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
   E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING (BY CONTRACTOR)
   A. Perform prerequisites prior to starting commissioning activities.
   B. Fill out Prefunctional Checklists for:
      1. Air side systems.
      2. Water side systems.
   C. Verify that:
      1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
      2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off
downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. Chilled Water Loop
   2. Condenser Water System
   3. Exhaust Fan
   4. HVAC Pumps
   5. Centrifugal Water Chillers
   6. Induced Draft Cooling Tower

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP
   7. Actual flow rate, pressure drop, BHP
   8. Discharge pressure
   9. Suction pressure
   10. Total operating head pressure
   11. Shut off, discharge and suction pressures
   12. Shut off, total head pressure

D. Chillers:
   1. Identification/number
   2. Manufacturer
   3. Capacity
   4. Model number
   5. Serial number
6. Evaporator entering water temperature, design and actual
7. Evaporator leaving water temperature, design and actual
8. Evaporator pressure drop, design and actual
9. Evaporator water flow rate, design and actual
10. Condenser entering water temperature, design and actual
11. Condenser leaving water temperature, design and actual
12. Condenser pressure drop, design and actual
13. Condenser water flow rate, design and actual

E. Cooling Tower:
1. Tower identification/number
2. Manufacturer
3. Model number
4. Serial number
5. Rated capacity
6. Entering air WB temperature, specified and actual
7. Leaving air WB temperature, specified and actual
8. Ambient air DB temperature
9. Condenser water entering temperature
10. Condenser water leaving temperature
11. Condenser water flow rate
12. Fan RPM

F. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

G. Tower and Chilled Water Loop Balancing:
1. Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-1, CHWP-1 @ 461 GPM
2. Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-2, CHWP-1 @ 461 GPM
3. Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-1, CHWP-2 @ 461 GPM
4. Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-2, CHWP-2 @ 461 GPM
5. Test CT-1 and CT-2, CWP-1 and CWP-2 together @ 750 gpm each, CH-1 and CH-2 together and CHWP-1 & 2 @ 461 GPM each.
6. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-3, CHWP-1 @ 461 GPM
7. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-3, CHWP-2 @ 461 GPM
8. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-1 and CWP-2 together @ 1125 gpm each, CH-1, CH-2 and CH-3 together and CHWP-1 & 2 @ 692 GPM each.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Jackets and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS
A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.
PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C 795; rigid molded, noncombustible.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.

   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.04 THERMAL HANGER SHIELDS

A. Thermal hanger shields shall be designed for use with pipe rollers or strut framing systems and shall provide structural calcium silicate inserts to provide insulation and pipe supports at all new support locations. Piping Technology and Products, Pipe Shields, Inc. or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.
C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including but not necessarily limited to fittings, control valves, valves (including drain and vent valves), unions, flanges, reducers, elbows, tees, branch fittings, strainers, flexible connections, pump bodies, air separators, air scoops, piping to air vents, thermometer wells, instrumentation wells, pressure gage piping and other instrument piping, flow meter bodies, flow conditioners, pipe guides and anchors, pipe supports, expansion joints, expansion loops and expansion fittings, sample lines, heat exchangers and any other cold surface. Any surface that may condense water vapor shall be insulated and covered with a vapor barrier, and jacketed as required for weather protection. Flow balancing valves shall be insulated with removable insulation covers for access, measurement and adjustment, or field insulated to allow adjustment and measurement without disturbing adjacent insulation. These ‘full insulation’ requirements shall apply to all systems, regardless of location: interior, exterior, in manholes, accessible trenches, direct buried or any other location. For insulation systems to be used in manholes, trenches or direct buried, see Section 33 61 13 Underground Hydronic Energy Distribution.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with All Service Jacket.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping and elbows.

J. Buried Piping: See Section 33 61 13 Underground Hydronic Energy Distribution.

3.03 SCHEDULE

A. Cooling Systems:
   1. Chilled Water: Glass Fiber Insulation with all service jacket and vapor barrier:
      a. 40 to 60 degrees F. Through 2" pipe size - 1/2" thickness; Above 2" pipe size - 1" thickness.

END OF SECTION
SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1  GENERAL

1.01  SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Contractor or Subcontractors will be responsible for coordinating and documenting their own commissioning activities and providing all prefunctional and functional checklists as part of the close-out documentation.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Controls sequence of operation.
   3. Central plant water and air balancing.
   4. Major and minor equipment items.
   5. Chiller control components and sequence of operation including BACnet interface.
   6. Piping systems and equipment.
   7. Ductwork and accessories.
   8. RMS system.
   9. Variable frequency drives.
   10. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02  REFERENCE STANDARDS

A. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996

1.03  SUBMITTALS

A. Updated Submittals: Keep the District's representative informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.

DSA Re-submittal 6/21/2012
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the District's representative and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of District's representative.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Reference drawing number.
      e. HVAC equipment ID.
      f. Control Valve ID.
      g. Minimum air flow rate.
      h. Maximum air flow rate.
      i. Minimum water flow rate.
      j. Maximum water flow rate.
   5. Full print out of all schedules and set points after testing and acceptance of the system.
   6. Full as-built print out of software program.
   7. Electronic copy on disk of the entire program for this facility.
   8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
   9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
   10. Control equipment component submittals, parts lists, etc.
   11. Warranty requirements.
   12. Copies of all checkout tests and calibrations (not commissioning tests).
   13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
      a. Sequences of operation.
      b. Control drawings.
      c. Points lists.
      d. Controller and/or module data.
      e. Thermostats and timers.
      f. Sensors and DP switches.
      g. Valves and valve actuators.
      h. Dampers and damper actuators.
      i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
   1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 79 00 for additional requirements.
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of District.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to District; such equipment, tools, and instruments are to become the property of District.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the District's representative in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the District's representative.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the District's representative; update the schedule as appropriate.

D. Notify the District's representative when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the District's representative has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the District's representative for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to District.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

DSA Re-submittal 6/21/2012

COMMISSIONING OF HVAC
E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the District's representative prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the District's representative.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to District.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the District's representative during testing of controlled equipment; coordinate with commissioning of equipment.
1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the District's representative:
1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to District.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to District.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to District.
3.05 OPERATION AND MAINTENANCE MANUALS
A. See Section 01 78 00 for additional requirements.
B. Add design intent documentation furnished by Engineer to manuals prior to submission to District.
C. Submit manuals related to items that were commissioned to District’s representative for review; make changes recommended by District’s representative.
D. District’s representative will add commissioning records to manuals after submission to District.

3.06 DEMONSTRATION AND TRAINING
A. See Section 01 79 00 for additional requirements.
B. Demonstrate operation and maintenance of HVAC system to District’s personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the District’s representative during Functional Testing.
D. Provide classroom and hands-on training of District’s designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.
E. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer’s facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered; energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from District. Also be prepared to address topics brought up and answer questions concerning operation of the system.
F. Provide the services of manufacturer representatives to assist instructors where necessary.
G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION
Part 1  General

1.0  SECTION INCLUDES
A. Products Furnished But Not Installed Under This Section
B. Products Installed But Not Furnished Under This Section
C. Products Not Furnished Or Installed But Integrated With The Work Of This Section
D. Related Sections
E. Description
F. Approved Control System Contractors and Manufacturers
G. Quality Assurance
H. Codes and Standards
I. System Performance
J. Submittals
K. Warranty
L. Ownership of Proprietary Material

1.1  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
A. Section 23 21 13– Hydronic Piping:
   1. Control Valves
   2. Flow Switches
   3. Temperature Sensor Wells and Sockets
   4. Temperature Sensor and Wet Bulb Sensor
   5. Flow meters
   6. Differential Pressure Transmitters
   7. Electric Meter

1.2  PRODUCTS INSTALLED AND FURNISHED UNDER THIS SECTION
A. Section 23 35 00 – Refrigerant Monitoring System:
   1. Refrigerant Leak Detection System:

1.3  PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION
A. Section 23 60 00 – Central Cooling Equipment:
   1. Chiller Controls
   2. Cooling Tower Controls
B. Section 23 09 30 - Variable Frequency Drives

1.4 DESCRIPTION

A. General: The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and operator workstation residing and communicating on a BACnet IP (Internet Protocol) network. The existing operator workstation will be used. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics. A modem shall be provided for remote access to the network. Systems using gateways to route proprietary devices and objects to BACnet are not acceptable.

B. The system will provide for future expansion to include monitoring fire alarm, and lighting control systems.

C. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement.

1.5 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. The base bid shall be Delta Controls, installed by EMCOR Services / Mesa Energy Systems Inc. Delta controls is the only acceptable controls manufacture to meet the standards of the existing system.

Note:

1. The Contractor shall use only products from the corresponding manufacturer and product line listed.

2. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, Building Controllers, Advanced Application Controllers, and Application Specific Controllers. All other products specified herein (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

3. The installing contractor must have, under their direct employ, IBEW Inside Wiremen to provide the labor for the installation of the control system. Sub-contracting of this labor is not acceptable.
1.6 QUALITY ASSURANCE

A. Contractor/Manufacturer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer, and be the authorized representative of the Manufacturer at bid time.

2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.

3. All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.7 CODES AND STANDARDS

A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. California Building Code (CBC)

3. California Mechanical Code (CMC)
4. ASHRAE 135-2004
5. FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference
6. Underwriters Laboratories UL916
1.8 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:

1. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 1 second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

2. Performance. Programmable controllers shall be able to execute DDC PID control loops at a frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

3. Reporting Accuracy. The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.

4. Stability of Control. Control loops shall maintain measured variable at setpoint within the tolerances listed in Table 2.
### TABLE 1: Reporting Accuracy

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C ±1°F</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>±0.5°C ±1°F</td>
</tr>
<tr>
<td>Outside Air</td>
<td>±1.0°C ±2°F</td>
</tr>
<tr>
<td>Dewpoint</td>
<td>±1.5°C ±3°F</td>
</tr>
<tr>
<td>Water Temperature</td>
<td>±0.5°C ±1°F</td>
</tr>
<tr>
<td>Delta-T</td>
<td>±0.15°C ±0.25°F</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>±5% RH</td>
</tr>
<tr>
<td>Water Flow</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Airflow (terminal)</td>
<td>±10% of full scale (see Note 1)</td>
</tr>
<tr>
<td>Airflow (measuring stations)</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Air Pressure (ducts)</td>
<td>±25 Pa ±0.1 &quot;W.G.&quot;</td>
</tr>
<tr>
<td>Air Pressure (space)</td>
<td>±3 Pa ±0.01 &quot;W.G.&quot;</td>
</tr>
<tr>
<td>Water Pressure</td>
<td>±2% of full scale (see Note 2)</td>
</tr>
<tr>
<td>Electrical (A, V, W, Power factor)</td>
<td>5% of reading (see Note 3)</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>±5% of reading</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>±50 ppm</td>
</tr>
</tbody>
</table>

**Note 1:** 10%-100% of scale  
**Note 2:** For both absolute and differential pressure  
**Note 3:** Not including utility-supplied meters

### TABLE 2: Control Stability and Accuracy

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
</table>
| Air Pressure        | ±5 Pa ±0.2" w.g. | 0-1.5 kPa [0-6" w.g.]  
                   | ±3 Pa ±0.01" w.g. | -25 to 25 Pa [-0.1 to 0.1" w.g.] |
| Airflow             | ±10% of full scale | |
| Temperature         | ±0.5°C ±1.0°F     |                 |
| Humidity            | ±5% RH            |                 |
| Fluid Pressure      | ±10 kPa ±1.5 psi  | 0-1 kPa [0-150 psi] |
| " " differential    | ±250 Pa ±1.0" w.g.| 0-12.5 kPa [0-50" w.g.] |
1.9 SUBMITTALS

A. Product Data and Shop Drawings: Meet requirements of Division 01. In addition, Contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been reviewed and approved for conformity with the design intent. Six copies are required. All drawings shall be done in VSI format and provided on optical disk and as 11x17 drawings. When manufacturer’s cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. Direct Digital Control System Hardware:

   a) A complete bill of materials of equipment to be used shall be listed indicating quantity, manufacturer, model number, and other relevant technical data.

   b) Manufacturer’s description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

      i  Direct Digital Controller (controller panels)
      ii Transducers/Transmitters
      iii Sensors (including accuracy data)
      iv Actuators
      v  Valves
      vi  Relays/Switches
      vii Control Panels
      viii Power Supply
      ix  Batteries
      x  Wiring

   c) Wiring diagrams and layouts for each control panel. Show all termination numbers

   d) Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware

2. Central System Hardware and Software

   a) A complete bill of material of equipment used indicating quantity, manufacturer, model number, and other relevant technical data.
Section 23 09 23
Direct-Digital Controls

b) Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions for the items listed below and other relevant items not listed below:
   i. Interface Equipment Between CPU and Control Panels
   ii. Third-party Software

c) A schematic diagram for all control wiring, communication wiring and power wiring shall be provided. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers, function and data link protocol(s). Show all interface wiring to the control system.

d) Provide detailed riser diagrams of wiring between central control unit, operator workstation(s), routers, gateways and all control panels.

e) A list of the color graphic screens shall be provided. For each screen, provide a conceptual layout of pictures and data, and show or explain which other screens can be directly accessed.

3. Controlled Systems:

   a) A schematic diagram of each controlled system. The schematics shall have all control points/objects labeled and with point/object names shown or listed. The schematics shall graphically show the location of all control elements in the system.

   b) A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled.

   c) A mounting, wiring, and routing plan view drawing. The design shall take into account HVAC, electrical and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.

   d) A complete description of the operation of the control system, including sequences of operation.

4. Quantities of items submitted shall be reviewed, but are the responsibility of the Contractor.

5. A description of the proposed process along with all report formats and checklists to be used in Part 3: “Control System Demonstration and Acceptance.”

6. A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and Operator Workstation included in the submittal. PICS to include for each product, as a minimum, a list of BACnet functional groups supported, BACnet services supported, BACnet data link options available and BACnet objects provided.
B. Schedules:

1. **Within one month of contract award, provide a schedule of the work indicating the following:**
   
   a) Intended sequence of work items  
   b) Start dates of individual work items. 
   c) Duration of individual work items 
   d) Planned delivery dates for major material and equipment, and expected lead times 
   e) Milestones indicating possible restraints on work by other trades or situations. 

2. **Provide monthly written status reports indicating work completed, revisions to expected delivery dates, etc. An updated project schedule shall be included.**
C. Project Record Documents: Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:

1. **Project Record Drawings.** These shall be as-built versions of the submittal shop drawings. One set of optical media including VSI drawing files also shall be provided.

2. **Testing and Commissioning Reports and Checklists.** Completed versions of all reports and checklists, along with all trend logs, used to meet the requirements of Part 3: “Control System Demonstration and Acceptance.”

3. **Operation and Maintenance (O & M) Manual.** This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M manual shall include:
   
   a) Names, addresses, and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representatives of each.

   b) Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point/object reports, trending data, overriding computer control, and changing setpoints and other variables.

   c) One set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point/object database creation and modification, program creation and modification, and use of the editor.

   d) Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points/objects, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.

   e) A listing and documentation of all custom software created using the programming language, including the setpoints, tuning parameters, and object database. One set of optical media containing files of the software and database also shall be provided.

   f) One set of optical media containing files of all color graphic screens created for the project.

   g) A list of recommended spare parts with part numbers and suppliers.

   h) Complete original issue documentation, installation, and maintenance information for all third-party hardware provided, including computer equipment and sensors.

   i) Complete original issue diskettes for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

   j) Licenses, guarantee, and warranty documents for all equipment and systems.

   k) Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.
1.10 WARRANTY

A. Warrant all work as follows:

1. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.

3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Engineer, the Engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.

4. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to the Owner by purchasing an in-warranty technical support agreement from the Contractor. Written authorization by the Owner must, however, be granted prior to the installation of any of the above-mentioned items.

5. Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Engineer's acceptance.
1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code
5. All documentation
Part 2 Products

2.0 SECTION INCLUDES

A. Materials
B. Communication
C. Controller Software
D. Building Controllers
E. Advanced Application Controllers
F. Application Specific Controllers
G. Input/Output Interface
H. Power Supplies and Line Filtering
I. Auxiliary Control Devices
J. Wiring and Raceways

2.1 MATERIALS

A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner’s Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2004, BACnet.

B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this section.

C. The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.

D. All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/Physical layer protocol.

E. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:
1. Connection of an Operator Workstation device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.

2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller’s database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.

F. The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.

G. The network shall have the following minimum capacity for future expansion:
   1. Each Building Controller shall have routing capacity for 99 controllers.
   2. The Building Controller network shall have capacity for 1000 Building Controllers.
   3. The system shall have an overall capacity for 12,500 Building Controller, Advanced Application Controller, and Application Specific Controller input/output objects.

2.3 CONTROLLER SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security
   1. User access shall be secured using individual security passwords and user names.
   2. Passwords shall restrict the user to the site, objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts shall be recorded.

C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
   1. Provide an event scheduling system that allows the operator to specify a single event, multiple day event and/or recurring events. The event schedule specifies both the on/off times and the date in a calendar planning format similar to Microsoft Outlook®.
   2. Calendar Schedules. Provide the capability for the operator to define up to 99 special schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each calendar period.
D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

E. Remote Communication. The system shall have the ability to dial out in the event of an alarm using BACnet Point-To-Point at a minimum of 56K baud and text messaging to cell phones and email messages via SMTP protocol.

F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

G. Sequencing. Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.

H. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.

I. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage.

J. Energy Calculations. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.

K. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

L. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.

M. Run-time Totalization. Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.4 BUILDING CONTROLLERS

A. General. Provide an adequate number of BACnet® Building Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements. Additionally, provide Building Controllers where shown on the drawings.

1. The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

3. Data shall be shared between networked Building Controllers.

4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

5. Controllers that perform scheduling shall have a battery or super-cap backed up real-time clock.

6. The Building Controller shall support the following BACnet Interoperability Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-WP-A,B</td>
<td>AE-N-E-B</td>
<td></td>
<td>T-ATR-B</td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-WPM-B</td>
<td>AE-ACK-B</td>
<td></td>
<td></td>
<td>DM-TS-A,B</td>
</tr>
<tr>
<td></td>
<td>AE-INF-B</td>
<td></td>
<td></td>
<td>DM-ATS-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-RD-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-BR-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-R-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-OCD-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NM-CE-A</td>
</tr>
</tbody>
</table>

DSA Re-submittal 6/21/12    23 09 23 - 15    Direct-Digital Controls
B. Communication

1. Each Building Controller shall support direct Ethernet or a communications card. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol, or BACnet IP (Annex J).

2. Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.

3. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol P-T-P for connection to a hand-held workstation/and/or modem.

4. The Building Controller secondary communication network shall support BACnet MS/TP.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 100°F and 10 to 90% RH.

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Building Controllers shall be fully peer to peer.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips — or to a termination card connected by a ribbon cable.

F. Memory. The Building Controller shall have as a minimum standard SRAM of 256 KB, standard DRAM of 1MB and standard non-volatile 1 MB of flash memory in lieu of EPROM. Memory shall be user extendible through RAM chip sockets and SIMMs for future memory expansion.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. The Building Controller shall maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

H. Inputs/Outputs.

1. Inputs. Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA-current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be minimum 10-bit A to D.
2. Outputs. Controller input/output board shall support plug-and-play I/O modules or built in HAO modules configured with manual-auto-off override switch, potentiometer and input channel for feedback status or an unrelated analog or digital input. Output supported shall be 0-10 VDC. All HAO's shall be supervised.

3. Diagnostics. Controller input board shall have variable intensity LEDs providing input status indication. Outputs shall have variable intensity LEDs indicating the output voltage with Color indication of HAO's status when present.

4. Bump-less Transfer. On analog outputs with override switches, provide a Hand-Auto-Off switch either built-in or external to the board that allows for manual positioning of the output, then transferring the output to automatic without any “bump” in the output voltage (don’t go through off before transferring from manual to auto).

2.5 ADVANCED APPLICATION CONTROLLERS

A. General. Provide an adequate number of BACnet®Advanced Application Controllers to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these panels shall meet the following requirements.

1. The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.

2. Advanced Application Controllers shall be fully peer to peer.

3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

4. All equipment that requires scheduling shall be scheduled in that equipments controller.

5. Both firmware and controller database shall be loadable over the network.

6. Advanced Application Controllers shall support the following BACnet Interoperability Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-WP-A,B</td>
<td>AE-ACK-B</td>
<td>T-ATR-B</td>
<td></td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-WPM-B</td>
<td>AE-ASUM-B</td>
<td>T-ATR-B</td>
<td></td>
<td>DM-TS-B</td>
</tr>
<tr>
<td>DS-COV-A,B</td>
<td>AE-ESUM-B</td>
<td>T-ATR-B</td>
<td></td>
<td>DM-RD-B</td>
</tr>
<tr>
<td></td>
<td>AE-INFO-B</td>
<td></td>
<td></td>
<td>DM-BR-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-R-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-OCD-B</td>
</tr>
</tbody>
</table>
B. Communication.
   1. Each Advanced Application Controller shall reside on a BACnet network using the
      MS/TP or Ethernet Data Link/Physical layer protocol.
   2. The controller shall provide a service communication port using BACnet Data Link/
      Physical layer protocol for connection to portable operators workstation and allow
      access to the entire network.

C. Environment. Controller hardware shall be suitable for the anticipated ambient
   conditions.
   1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within
      waterproof enclosures, and shall be rated for operation at 32°F to 100°F.
   2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and
      shall be rated for operation at 32°F to 120°F.

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor.
   All wiring connections shall be made to field-removable, modular terminal strips —
   or to a termination card connected by a ribbon cable.

E. Memory. The Advanced Application Controller shall be non-volatile FLASH
   memory.

F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of
   nominal voltage rating and shall perform an orderly shutdown below 80% nominal
   voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from
   keyed radios up to 5 W at 3 ft.

2.6 APPLICATION SPECIFIC CONTROLLERS

A. General. Provide BACnet® Application Specific Controllers (ASCs) as required to
   execute the sequence of operations. ASC’s are microprocessor-based DDC
   controllers which through hardware or firmware design are able to control a wide
   variety of equipment. They shall be fully user-configurable.
   1. Each ASC shall be capable of standalone operation and shall continue to provide
      control functions without being connected to the network.
   2. Each ASC will contain sufficient I/O capacity to control the target system.
   3. Both firmware and controller database shall be loadable over the network
   4. ASC’s shall come with an integrated housing to allow for easy mounting and protection
      of the circuit board. Only wiring terminals shall be exposed.
   5. Application Specific Controllers shall support the following BACnet Interoperability
      Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-RP-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DDB-B</td>
</tr>
<tr>
<td>DS-RPM-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DOB-B</td>
</tr>
<tr>
<td>DS-WP-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-COV-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-TS-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-RD-B</td>
</tr>
</tbody>
</table>
Section 23 09 23
Direct-Digital Controls

B. Communication
1. The controller shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol or BACnet® over ZigBee protocol.
2. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator’s tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.

C. Environment. The hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°F to 150°F and/or suitably installed in a heated or fan cooled enclosure.
2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.

E. Memory. The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.

F. Immunity to power and noise. ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 3 ft.

G. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

H. Input/Output. ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC.

2.7 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and output points/objects may be wired into the system through Building, Advanced Application, or Application Specific Controllers.

B. All input and output points shall be protected such that shorting of the point to itself, to another point, or to ground, will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 volts of any duration, such that contact with this voltage will cause no damage to the controller.
C. Digital inputs shall allow the monitoring of ON/OFF signals from remote devices. The digital inputs shall provide a current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.

D. Analog inputs shall allow the monitoring of 0-5 VDC, 0-10 VDC-voltage, 4-20 mA-current, or thermistors. Analog inputs shall be compatible, and be field configurable to commonly available sensing devices.

E. Digital outputs shall provide for ON/OFF operation. Digital outputs on Building and Advanced Application Controllers shall have three-position override switches, Hand-Off-Auto with status lights. Outputs shall be selectable for either normally open or normally closed operation.

F. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide a 0 to 10 VDC signal as required to provide proper control of the output device. Analog outputs on Building or Advanced Application Controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

G. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.)

H. Input/Output points/objects shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point/object with appropriate properties. Application Specific Controllers are exempted from this requirement.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.8 AUXILIARY CONTROL DEVICES

A. Control valves.
   1. See control valve schedule on drawings.

B. Temperature sensors.
   1. Temperature sensors shall be thermistors.
2. Immersion sensors shall be provided with a separable brass well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
3. Space sensors shall be equipped with the following:
   a) Communication port connected to entire network
4. Provide matched temperature sensors for differential temperature measurement.

C. Flow switches.
   1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
   2. Paddle type switches (water service only) shall be UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.
   3. Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as specified.

D. Relays.
   1. Control relays shall be UL Listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application
   2. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

E. Current transmitters
   1. AC current transmitters shall be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0 – 5vdc two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, internal zero and span adjustment, and ±1% full scale accuracy at 500 ohm maximum burden
   2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
   3. Unit shall be split-core type for clamp-on installation.

F. Current transformers
   1. AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.
   2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full scale output.
   3. Transformers shall be split-core type for installation on new or existing wiring.

G. Voltage transmitters
   1. AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with ±1% full-scale accuracy with 500 ohm maximum burden.

3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

H. Voltage transformers.
1. AC voltage transformers shall be UL/CSA recognized, 600 VAC rated, complete with built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 40 to 130°F and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

I. Power monitors.
1. Power monitors shall be three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers and UL Listed split-core current transformers
2. Shall provide a selectable rate pulse output for kWh reading and a 1 –5vdc or 4 to 20 mA output for kW reading. Shall operate with 5 A current inputs with a maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

J. Current switches
1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

K. Pressure transducers
1. Transducer shall have linear output signal. Zero and span shall be field-adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage
3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.
4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

L. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

M. Local control panels
Section 23 09 23
Direct-Digital Controls

1. *All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels*

2. *Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings*

3. *Provide 120v receptacle at each local panel location.*

### 2.9 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26.

B. All insulated wire to be copper conductors, UL labeled for 90C minimum service.
Part 3 Execution

3.0 SECTION INCLUDES

A. Examination
B. Protection
C. Coordination
D. General Workmanship
E. Field Quality Control
F. Existing Equipment
G. Wiring
H. Communication Wiring
I. Installation of Sensors
J. Flow Switch Installation
K. Actuators
L. Warning Labels
M. Identification of Hardware and Wiring
N. Controllers
O. Programming
P. Control System Checkout and Testing
Q. Control System Demonstration and Acceptance
R. Cleaning
S. Training
T. Sequences of Operation

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started

B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started
C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.2 PROTECTION

A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site

1. *Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge.*

2. *Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.*

B. Submittals. Refer to the "Submittals" Article in Part 1 of this specification for requirements.

C. Test and Balance

1. *The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.*

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:
1. All communication media and equipment shall be provided as specified in Part 2: "Communication" of this specification.

2. Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship

C. Contractor shall have work inspected by local and/or state/provincial authorities having jurisdiction over the work

3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where the requirements of this section differ with those in Division 26, the requirements of this section shall take precedence

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 26 requirement
C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations including ceiling return air plenum, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenum shall be UL Listed specifically for that purpose.

E. All wiring in mechanical, electrical, or service rooms — or where subject to mechanical damage — shall be installed in raceway at levels below 10ft.

F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. Do not install wiring in raceway containing tubing

H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it, and neatly tied at 6ft intervals

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems

J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals

L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.

M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points/objects

N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations

O. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer’s recommendation and NEC requirements, except as noted elsewhere.

P. Include one pull string in each raceway 1" or larger

Q. Use coded conductors throughout with different colored conductors

R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
Section 23 09 23
Direct-Digital Controls

S. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6” from high-temperature equipment (e.g., steam pipes or flues).

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

W. The Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

X. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Flexible metal raceway less than 1/2” electrical trade size shall not be used. In areas exposed to moisture — including chiller and boiler rooms — liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING

A. The Contractor shall adhere to the items listed in the “Wiring” Article in Part 3 of the specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrester must be installed between the lines and ground. The lighting arrester shall be installed according to the manufacturer's instructions.
G. All runs of communication wiring shall be un-spliced when that length is commercially available
H. All communication wiring shall be labeled to indicate origination and destination data.
I. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding

3.8 INSTALLATION OF SENSORS
A. Install all sensors in accordance with the manufacturer's recommendations.
B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
E. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
F. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.9 FLOW SWITCH INSTALLATION
A. Use correct paddle for pipe diameter.
B. Adjust flow switch in accordance with manufacturer's instructions.

3.10 ACTUATORS
A. Electric/Electronic
   1. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.11 WARNING LABELS
A. Permanent warning labels shall be affixed to all equipment which can be automatically started by the DDC system
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows:
      CAUTION
      This equipment is operating under automatic control
and may start or stop at any time without warning.

Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and all control panels which are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows
   
   CAUTION

   This equipment is fed from more than one power source with separate disconnects.

   Disconnect all power sources before servicing.
3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with the DDC address or termination number.

B. Permanently label or code each point/object of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum ½" letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Identify room sensors relating to terminal box or valves with nameplates.

F. Manufacturers' nameplates

G. Identifiers shall match record documents

3.13 CONTROLLERS

A. Provide a separate controller for each HVAC system.

B. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.

1. *Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points*

3.14 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Object names shall be case-sensitive and clearly spell out the function of each object. Submit naming scheme to owner for prior approval. Do not use cryptic abbreviations. Valid examples are:

1. *AHU-1 Supply Air Temperature*
2. *CH-1 Chilled Water Supply Temperature*
3. *FC-1 Room Temperature*
4. **VAV-103 Room Temperature Trend**

C. **Software Programming**

1. Provide programming for the system and adhere to the sequences of operation provided. The Contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:

   a) **Text-based**:
      
      i. must provide actions for all possible situations
      
      ii. must be modular and structured
      
      iii. must be commented

   b) **Graphic-based**
      
      i. must provide actions for all possible situations
      
      ii. must be documented

   c) **Parameter-based**
      
      i. must provide actions for all possible situations
      
      ii. must be documented

D. **Operator Interface**

1. **Standard Graphics.** Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints

2. **Show terminal equipment information on a "graphic" summary table.** Provide dynamic information for each point/object

3. **The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all Operator Workstation software and their functions as described in this section.** This includes any operating system software, the Operator Workstation database, and any third-party software installation and integration required for successful operation of the operator interface

### 3.15 CONTROL SYSTEM CHECKOUT AND TESTING

A. **Start-up Testing:** All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration.
1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers’ recommendations.

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.

7. Alarms and Interlocks
   a) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
   b) Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
   c) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests.

2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the “Control System Checkout and Testing” Article in Part 3 of this specification. The Engineer will be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1: “Submittals.” The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician’s initials, and any corrective action taken or needed.


7. Demonstrate compliance with Sequences of Operation through all modes of operation

8. Demonstrate complete operation of Operator Workstation

9. Additionally, the following items shall be demonstrated:

   a) DDC Loop Response. The Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

   b) Demand limiting. The Contractor shall supply a trend data output showing the action of the demand-limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting setpoint, and the status of shed-able equipment outputs.

   c) Optimum Start. The Contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

   d) Interface to the building fire alarm system

   e) Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Architect/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

   f) Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: "Submittals."
3.17 CLEANING

A. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 TRAINING

A. General

1. Provide a minimum of one onsite training class 8 hours in length during the construction period for personnel designated by the owner.

2. Provide two additional training sessions at 6 and 12 months following building’s turnover. Each session shall be 8 hrs in length and must be coordinated with the building Owner.

B. Train the designated staff of Owner's Representative and Owner to enable Day-to-day Operators to:

1. Proficiently operate the system.

2. Understand control system architecture and configuration.

3. Understand DDC system components.

4. Understand system operation, including DDC system control and optimizing routines (algorithms).

5. Operate the workstation and peripherals.

6. Log on and off the system.

7. Access graphics, point/object reports, and logs.

8. Adjust and change system setpoints, time schedules, and holiday schedules.

9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.

10. Understand system drawings, and Operation and Maintenance manual.

11. Understand the job layout and location of control components.

12. Access data from DDC controllers and Application Specific Controllers (ASC’s).

13. Operate portable operator’s terminals.

C. Train the designated staff of Owner’s Representative and Owner to enable Advanced Operators to:

1. Make and change graphics on the workstation
2. Create, delete, and modify alarms, including annunciation and routing of these
3. Create, delete, and modify point/object trend logs, and graph or print these
4. Create, delete, and modify reports
5. Add, remove, and modify system's physical points/objects
6. Create, modify, and delete programming
7. Add panels when required
8. Add Operator Workstation stations
9. Create, delete, and modify system displays — both graphical and otherwise
10. Perform DDC system field checkout procedures
11. Perform DDC controller unit operation and maintenance procedures
12. Perform workstation and peripheral operation and maintenance procedures
13. Perform DDC system diagnostic procedures
14. Configure hardware including PC boards, switches, communication, and I/O points/objects
15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
16. Adjust, calibrate, and replace system components

D. Train the designated staff of Owner's Representative and Owner to enable System Managers/Administrators to:
   1. Maintain software and prepare backups
   2. Interface with job-specific, third-party operator software
   3. Add new users and understand password security procedures

E. Provide course outline and materials as per "Submittals" Article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.

F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

G. Classroom training shall be done using a network of working controllers representative of the installed hardware.

3.19 SEQUENCES OF OPERATION

A. See Drawings.
Part 4 Instructions to Other Contractors

4.0 CONTROL VALVE INSTALLATION

A. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

B. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the vertical position.

C. Valves shall be installed in accordance with the manufacturer's recommendations.

D. Control valves shall be installed so that they are accessible and serviceable, and such that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

E. Isolation valves shall be installed such that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at all connections to screw-type control valves.

F. Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5” in diameter, with ¾ ” high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.
4.1 CONTROLS COMMUNICATION PROTOCOL

A. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points/object list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ASHRAE Standard 135-2004 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of ASHRAE Standard 135-2004.

B. Distributed Processing. The Controller shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.

C. I/O Capacity. The Controller shall contain sufficient I/O capacity to control and monitor the target system.

D. Communication. The Controller shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol. Each network of controllers shall be connected to one Building Controller. The Controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool.

E. Environment. The hardware shall be suitable for the anticipated ambient conditions. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 3 days.

H. Immunity to Power and Noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

I. Transformer. Power supply for the Controller must be rated at minimum of 125% of power consumption, and shall be fused or current limiting type.

J. Protocol Implementation Conformance Statement (PICS). Supplier of the electronic controls packaged with this equipment shall provide to the controls contractor a PICS list, complete with object list and wiring diagrams for proper and complete interface.

4.2 STARTUP AND CHECKOUT PROCEDURES
Section 23 09 23
Direct-Digital Controls

A. Start up, check out, and test all hardware and software, and verify communication between all components

B. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

C. Verify that all analog and binary input/output points/objects read properly.

D. Verify alarms and interlocks.

E. Verify operation of the integrated system
SECTION 23 09 30
ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification is to cover a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. It is required that the drive manufacturer have an existing:
   1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
   2. An independent service organization.
B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.
C. Specification is for ABB ACH drive to match District standard. No known equal

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronic Engineers (IEEE)
   2. Underwriters laboratories
      a. UL508C
   3. National Electrical Manufacturer's Association (NEMA)
      a. ICS 7.0, AC Adjustable Speed Drives
   4. IEC 16800 Parts 1 and 2

B. Qualifications:
   1. AFDs and options shall be UL listed as a complete assembly. AFD's that require the customer to supply external fuses for the AFD to be UL listed are not acceptable. The base AFD shall be UL listed for 100 KVAR without the need for input fuses.
   2. CE Mark - The AFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
   3. Acceptable Manufacturers
      a. ABB ACH Series.
   4. The AFD manufacturer shall have available a comprehensive, HVAC Drive Web Based Training (WBT) product. The WBT product shall include detailed, interactive sections covering AFD unpacking, proper mechanical and electrical installation, and programming. The WBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The WBT product shall be repeatable, precise and shall include record keeping capability. The WBT product shall record answers to simulations and tests by student ID. The WBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.03 WARRANTY

A. Warranty AFD for a period of two years after installation, 2-1/2 years from shipment.
B. See DIVISION 1 - Closeout Submittals, for additional warranty requirements.
C. Correct defective Work within a two year period after Date of Substantial Completion.

1.04 SUBMITTALS

A. Submittals shall include the following information:

DSA Re-submittal 6/21/2012

ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS

23 09 30 - 1
1. Outline dimensions, clearance requirements, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided.
4. Compliance to IEEE 519 - harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
   a. The AFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5% and the TDD complies with IEEE limits for the application. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519. All AFD's shall include a minimum of 5% impedance reactors, no exceptions.

PART 2 PRODUCTS

2.01 ADJUSTABLE FREQUENCY DRIVES

A. The AFD package as specified herein shall be enclosed in a UL Listed Type 1, 12 or weatherproof enclosure as per the VFD schedule, completely assembled and tested by the manufacturer in an ISO9001 facility. If there is not a VFD schedule on the plans, then VFDs mounted indoors in dry environments shall be UL Type 1, indoor wet or air plenums shall be UL Type 12, and outdoor shall be NEMA 3R with hinged viewing door. The AFD tolerated voltage window shall allow the AFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

   1. Environmental operating conditions; 0 to 40 °C continuous. AFD's that can operate at 40 °C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
   2. Enclosure shall be rated per above and shall be UL listed as a plenum rated AFD. AFD's without these ratings are not acceptable.

B. All AFDs shall have the following standard features:

   1. All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.
   2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
   3. There shall be a built-in time clock in the AFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the AFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The AFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
   4. The AFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The AFD shall have two user macros to allow the end-user to create and save custom settings.
   5. The AFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the AFD from the wall or removal of circuit boards. The AFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
6. The AFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

7. The AFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.

9. The AFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. AFD's with only one DC reactor shall add AC line reactors.

10. The input current rating of the AFD shall be no more than 3% greater than the output current rating. AFD's with higher input current ratings require the upstream wiring, protection devices and source transformers to be oversized per NEC 430-2.

11. The AFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

12. The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

13. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

14. The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

C. All AFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.

2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.

3. Two (2) programmable analog inputs shall accept current or voltage signals.

4. Two (2) programmable analog outputs (0-20mA or 4-20mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
a. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the AFD shall provide a dry contact closure that will signal the damper to open (AFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to an AFD digital input and allows AFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing." The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.

7. Seven (7) programmable preset speeds.

8. Two independently adjustable accel and decel ramps with 1 - 1800 seconds adjustable time ramps.

9. The AFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

10. The AFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual AFD temperature that allows the highest carrier frequency without derating the AFD or operating at high carrier frequency only at low speeds.

11. The AFD shall include password protection against parameter changes.

D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:

1. Start-up assistants
2. Parameter assistants
3. Maintenance assistant
4. Troubleshooting assistant

E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Calculated Motor Power (kW)
5. DC Bus Voltage
6. Output Voltage

F. The AFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the AFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the AFD shall resume normal operation.

G. Serial Communications:

1. The AFD shall have an RS-485 port as standard. The standard protocols shall be BACnet (BTL lab approved), Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Provide optional protocol for LonWorks. Each individual drive shall
have the protocol in the base AFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.

2. Serial communication capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the AFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote AFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus - keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

3. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any AFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.

4. The AFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve control, etc. Both the AFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The AFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.

H. EMI / RFI filters. All AFD's shall include EMI/RFI filters. The onboard filters shall allow the AFD assembly to be CE Marked and the AFD shall meet product standard EN 61800-3 for the First Environment restricted level.

I. All AFD's through 50HP shall be protected from input and output power mis-wiring. The AFD shall sense this condition and display an alarm on the keypad.

J. OPTIONAL FEATURES TO BE PROVIDED: All features shall be furnished and mounted by the drive manufacturer. All features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.

1. A complete factory wired and tested bypass system (if scheduled) consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted.

2. Door interlocked padlockable circuit breaker (if scheduled or if bypass is provided) that will disconnect all input power from the drive and all internally mounted options.

3. The following shall be provided with the Bypass:
   a. Bypass Hand-Off-Auto
   b. Drive mode selector and light
   c. Bypass mode selector and light
   d. Bypass fault reset pushbutton
   e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications

DSA Re-submittal 6/21/2012
VARIABLE TORQUE APPLICATIONS

ADJUSTABLE FREQUENCY DRIVES FOR

23 09 30 - 5
f. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.

g. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.

h. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.

i. Serial communications - the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1), Lonworks, and BACnet in the bypass controller. Provide communications interface required by the site.

j. Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus - keypad "Hand" or "Auto" selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

k. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

l. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.

m. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 - 120 seconds.

n. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.

o. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.
p. The bypass controller shall have six programmable digital inputs, and five
programmable Form-C relay outputs.
q. The relay outputs from the bypass shall programmable for any of the following
indications:
   1) a. System started
   2) b. System running
   3) c. Bypass override enabled
   4) d. Drive fault
   5) e. Bypass fault
   6) f. Bypass H-O-A position
   7) g. Motor proof of flow (broken belt)
   8) h. Overload
   9) i. Bypass selected
  10) j. Bypass run
  11) k. System started (damper opening)
  12) l. Bypass alarm
  13) m. Over temperature
r. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall
incorporate internally sourced power supply and not require an external control power
source. The bypass power board shall supply 250 ma of 24 VDC for use by others to
power external devices.
s. Customer Interlock Terminal Strip - provide a separate terminal strip for connection of
freeze, fire, smoke contacts, and external start command. All external safety
interlocks shall remain fully functional whether the system is in VFD or Bypass mode.
The remote start/stop contact shall operate in VFD and bypass modes. The terminal
strip shall allow for independent connection of up to four (4) unique safety inputs.
t. The user shall be able to select the text to be displayed on the keypad when the
safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over
pressure” and “Low pressure”. The user shall also be able to determine which of the
four (4) safety contacts is open over the serial communications connection.
u. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Provide bracing, anchorage and/or seismic restraints for all mechanical and electrical
      equipment as determined from 2007 CBC chapter 10, chapter 16A and ASCE 7-05.
   C. Installation shall be the responsibility of the mechanical contractor. The contractor shall install
      the drive in accordance with the recommendations of the AFD manufacturer as outlined in the
      installation manual.
   D. Power wiring shall be completed by the electrical contractor. The contractor shall complete all
      wiring in accordance with the recommendations of the AFD manufacturer as outlined in the
      installation manual.

3.02 INTERFACE WITH OTHER WORK
   A. Coordinate with Electrical Subcontractor for power connections.
   B. Coordinate with Controls Subcontractor for controls connections.

3.03 SCHEDULES
   A. See Contract Drawings for AFD schedule.
3.04 START-UP
   A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the District, and a copy kept on file at the manufacturer.
   B. Drive and connected load shall be operated by a factory authorized representative at all speeds between min. and max. and any critical frequencies noted shall be locked out.

3.05 PRODUCT SUPPORT
   A. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.
   B. A web based training module or 8-hour professionally generated video (VCR format) shall be provided to the District at the time of project closeout. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

3.06 WARRANTY
   A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

END OF SECTION
SECTION 23 21 13

HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings for:
   1. Chilled water piping system.
   2. Condenser water piping system.
   3. Refrigerant vent and purge piping system.
   4. Equipment drains and overflows.

B. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

1.02 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2008).


D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2006.

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).


1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Submit complete shop drawings for piping system showing all fittings, elevations, pipe accessories, hanger locations and all connected equipment. Submit on reproducible velum, and compact disk. Drawings shall be produced in AutoCad 2008 or later release.
C. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
D. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).
E. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
F. Project Record Documents: Record actual locations of pipe routing, valve locations and unforeseen utilities.
G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
H. Piping Pressure Test Reports: Provide piping pressure test reports indicating:
   1. District
   2. Project Address
   3. Project Name
   4. Testing Contractor
   5. Pipe Segment Tested
   6. Pipe Size, Service and material (including wall thickness information (schedule, SDR, etc.)
   7. Test Medium
   8. Date and Time of Test Start
   9. Starting Pressure and Temperature of Test Medium
  10. Starting Ambient Temperature
  11. Date and Time of Test End
  12. Ending Pressure and Temperature of Test Medium
  13. Ending Ambient Temperature
  14. Observations and Conclusions
I. As-Built Drawings: At project closeout, provide as-built drawings of the piping systems installed. Drawings shall be prepared using AutoCad 2008 or later release. Submit two reproducible copies and two complete sets of drawing files on a compact disc.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.
C. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only, if specified for the application.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Engineer.
      b. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated and as follows:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
   2. On discharge of condenser water pumps, use spring loaded check valves.
   3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.02 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe Sizes 10" and under: ASTM A 53, Grade A or B, electric resistance welded or seamless, Schedule 40, black.
   1. Fittings: ASME B16.3, malleable iron threaded or ASTM A 234/A 234M, forged steel welding type, or 150 lb factory fabricated grooved.
   2. Joints: Threaded (2" and under), Grooved, Victaulic Style 07 - Zero Flex, no known equal, Flanged or Welded.

2.03 CONDENSER WATER PIPING, ABOVE GRADE

A. EPOXY COATED
   1. Steel Pipe: ASTM A 53, Grade A or B, electric resistance welded or seamless, Schedule 40, black, with fusion epoxy coating, inside and out.
      a. Fittings: ASTM A 234/A 234M, forged steel welding type with fusion epoxy coating, inside and out.
      b. Joints: Threaded for pipe 2 inch and under, welded for pipe over 2 inch.
   2. Steel Pipe Sizes 12 Inch and Over: ASTM A 53, Grade A or B, electric resistance welded or seamless, 0.375 inch wall, black, with fusion epoxy coating, inside and out.
   3. Fusion epoxy Coating System:
      a. Epoxy coating for piping system shall be 3M Scotchkote 226N+ (no known equal). Field welds, connections and otherwise damaged areas shall be field coated and patched according to the manufacturer’s instructions and recommendations with 3M™ Scotchkote™ Hot Melt Patch Compound 226P Green (no known equal).
   4. Ultraviolet (UV) Protective Coating:
a. Fusion epoxy systems for use in sunlight shall be coated with 2 coats of a UV resistant coating suitable for outdoor use, such as Alkyd Enamel, semi gloss, color as specified in other sections, or as selected by Engineer.

2.04 REFRIGERANT VENT AND PURGE LINES

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40 black, using one of the following joint types:
   1. Threaded Joints (2" and under): Galvanized cast iron, or ASME B16.3 malleable iron fittings.
   3. Flanged: ASTM A105 weld neck or slip on flanges, class 150.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

D. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

H. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

I. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

J. Vertical Support: Steel riser clamp.

K. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.07 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.
C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   4. When pipe is field grooved, provide coupling manufacturer's grooving tools.


2.08 BALL VALVES
A. Up To and Including 2 Inches:
B. Manufacturers:
   6. Substitutions: See Section 01 60 00 - Product Requirements.

C. Up To and Including 2 Inches:
   1. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends.

2.09 BUTTERFLY VALVES
A. Manufacturers:
   3. CenterlineSeries 200
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Body: ANSI Class 150, Cast or ductile iron with resilient replaceable EPDM seat, lug ends, extended neck where required for insulation.

C. Shaft: Stainless steel, one piece through disc design

D. Disc (for general duty): Aluminum bronze.

E. Disc (for condenser water service): Stainless steel.

F. Manual Operators: 10 position lever handle up through 4", above 4", provide gear operator and handwheel. Where mounted higher than 7' above floor, provide chain wheel and chain to 3' above floor.

2.10 SWING CHECK VALVES
A. Up To and Including 2 Inches:
B. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Up To and Including 2 Inches:
   1. Class 150 bronze body, bronze trim, renewable seat and disc, with composition disc, threaded ends.
D. Over 2 Inches:
   1. Class 150, iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable
disc and seat, flanged ends.

2.11 BALANCING VALVES

A. Manufacturers:

B. Construction:
   1. 1/2" to 2" Pipe Size
      a. Bronze body, brass ball construction with glass and carbon filled TFE seat rings.
         Valves to have differential pressure read-out ports across valve seat area. Read-out
         ports shall have integral EPT insert and check valve. Valve bodies shall have 1/4"
         tapped drain/purge point. Valve to have memory stop feature and integral calibrated
         nameplate with position indication. 300 psig design pressure, NPT connections. 250
         F operating temperature.

   2. 2-1/2" to 12" Pipe Size
      a. Cast iron, flanged construction with 125 psig flanged connections suitable up to 175
         psig working pressure at 250 F. Valves 2-1/2" - 3" shall have a brass ball with glass
         and carbon filled TFE seat rings. Valves 4" - 12" shall be fitted with a bronze seat,
         replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves shall
         have memory stop feature and calibrated nameplate with position indication.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
C. Remove scale and dirt on inside and outside before assembly.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or
caps.
E. After completion, fill, clean, and treat system.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Route piping in orderly manner, parallel to building structure, and maintain gradient.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors.
E. Slope piping and arrange to drain at low points.
F. Provide stainless steel escutcheon plates or other trim/flashing wherever pipes penetrate walls
above grade, exterior and interior.
G. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

3.03 FUSION EPOXY COATED PIPING (CONDENSER WATER)

A. All fusion epoxy coated piping, supports and appurtenances shall be fully assembled, either in
the shop, or in the field, prior to coating.
   1. Fabricate all piping sections, in lengths and configurations suitable for fluidized bed
dimensions. Fabrication shall include all required couplings, thread-ends, taps, welded
pipe supports, etc. Surface shall be blast cleaned to SSPC-SP 10. Application method
shall be by the fluidized bed method, comprised of heating the pipe segment to 450 to 475
degrees F (as recommended by manufacturer) and dipping into the fluidized bed of
powder, effectively fusing the epoxy powder to the part. Flange faces and other areas
requiring exposed metal surfaces shall be masked from the epoxy coating.
2. Field connections for all epoxy coated piping systems shall be of mechanical means. Field welding is not acceptable.
3. Any sections requiring modifications shall be modified, test fit, and returned to the furnace for coating. Allow sufficient fabricated and coated spool pieces to allow fit up in the field.
4. Touch up any damaged surfaces after installation as specified above.
5. All structural attachments welded to condenser water piping shall be fusion epoxy coated.
6. Coat all epoxy coated piping with UV inhibitor paint to prevent UV degradation of the epoxy coating.

3.04 TESTING

A. Unless otherwise noted, hydrostatically test all piping installed under this contract to 1-1/2 times the normal working pressure or 150 psig, whichever is higher for a period of not less than 4 hours with no visible signs of leakage.

B. Provide necessary caps or blinds to protect equipment not rated for test pressure (safety valves, regulators, etc.).

C. Refrigerant Vent and Purge Lines:
   1. Test purge and/or vent lines with air or nitrogen at 15 psig for 2 hours with no visible drop in pressure.

D. Pneumatic Testing:
   1. Pneumatic testing is expressly prohibited on any non-metallic piping.
   2. Other than as excepted above, pneumatic testing will not be considered without written consent from District or Engineer, and substantiation as to why hydrotesting is inapplicable. Additional testing requirements and measures may be required for a pneumatic test and will be considered on a case-by-case basis.

E. Reports: Submit test reports for all pipeline sections tested per Submittals requirements in Part 1 of this specification.

END OF SECTION
SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Expansion tanks.
B. Air vents.
C. Air separators.
D. Strainers.
E. Pump suction fittings.
F. Combination fittings.
G. Flow indicators, controls, meters.
H. Relief valves.
I. Pressure regulating valves.
J. Link Seals.

1.02 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

1.03 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS
2.01 BLADDER-TYPE EXPANSION TANKS
A. Manufacturers:
   3. Wessels Company; Series NLA; www.westank.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Construction: Pre-charged steel expansion tank with heavy-duty butyl rubber bladder. The tank shall have NPT system connections and a .302"-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet the system requirements. The tank must be constructed in accordance with most recent addition of Section VIII of the ASME Boiler and Pressure Vessel Code.
C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to as scheduled psi.
D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valve by-pass.
E. Size: As scheduled on Drawings
2.02 AIR VENTS

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Standard Duty: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. High Capacity: Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.03 AIR SEPARATORS

A. Combination Air Separators/Strainers:
   1. Manufacturers:
      b. ITT Bell & Gossett; Model Rolairrol: www.bellgossett.com.
   2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.04 STRAINERS

A. Size 2 inch and Under:
   1. Manufacturers:
      a. Mueller Steam Specialty Model 11MFCB or 351M
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Screwwed bronze, steel or iron body for 150 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Flanged carbon steel or cast iron body for 150 psig (WOG) working pressure, Y pattern with 1/16" stainless steel perforated screen.

C. Size 5 inch and Larger:
   1. Manufacturers:
      2. Substitutions: See Section 01 60 00 - Product Requirements.
      3. Flanged carbon steel or iron body for 150 psig (WOG) working pressure, Y pattern with 1/8" stainless steel perforated screen.

D. Startup Screens
   1. Provide 20 mesh start up screens with all chilled and condenser water strainers.
      a. Run condenser water through strainers at minimum 70% of design flow for 4 hours or until pressure drop becomes excessive.
      b. Remove screens, thoroughly clean, replace, and operate system for 12 additional hours.
      c. Remove startup screens and put system back in operation.
2.05 SUCTION DIFFUSERS

A. Manufacturers:
   1. Mueller Steam Specialties, Model 1011
   2. ITT Bell & Gossett; Model SD: www.bellgossett.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.06 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. Mueller Steam Specialties, Model 721.
   2. Bell & Gossett; Model 3D.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slamm check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.07 BTU METERS AND FLOW METERS

A. BTU meters and flow meters specified and provided under 23 09 23 Direct-Digital Control System for HVAC, installed by mechanical contractor.

2.08 MOTORIZED CONTROL VALVES

A. Motorized control valves specified and provided under 23 09 23 Direct-Digital Control System for HVAC, installed by mechanical contractor.

2.09 RELIEF VALVES

A. Manufacturers:
   3. Hoffman Specialty.

B. Bronze body and spring cage, silicone seat, fabric reinforced molded diaphragm shall isolate spring from water at all times, automatic, direct pressure actuated, capacities ASME certified and labelled. Size and setting as shown on drawings.

2.10 PRESSURE REGULATING VALVES

A. Manufacturers:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Bronze body and spring cage, stainless steel spring, seat, adjusting screw and fasteners. Maximum working pressure of 400 psig, temperature range 33 to 180 degrees F. Integral bypass relief. Water tight sealed cage design and replaceable seat.

2.11 LINK SEALS

A. The pipe to wall penetration closures shall be Link-Seal, as manufactured by Thunderline Corporation, or approved equal.

B. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely
assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.

C. After the seal assembly is positioned in the opening, tightening of the bolts shall cause the rubber sealing elements to expand and effect a watertight seal between the pipe and opening.

D. Manufacturer shall be consulted for exact size of opening and model/construction of seal to be used for each application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer’s instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blow down connection.

E. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

F. Support pump fittings with floor mounted pipe and flange supports.

G. Provide relief valves on low pressure side of reducing valves, and expansion tanks.

H. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

I. Pipe relief valve outlet to nearest floor drain.

END OF SECTION
SECTION 23.21.23
HYDРОНІC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Base mounted pumps.

1.02 REFERENCE STANDARDS
   A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.
   B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
   C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
   D. Millwright's Certificate: Certify that base mounted pumps have been aligned.
   E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. ITT Bell & Gossett: www.bellgossett.com.
   B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HVAC PUMPS - GENERAL
   A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
   B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 BASE MOUNTED PUMPS
   A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 175 psi maximum working pressure.
   B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
   C. Impeller: Bronze, fully enclosed, keyed to shaft.
   D. Bearings: Oil lubricated roller or ball bearings.
   E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.
   F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.
PART 3  EXECUTION

3.01  PREPARATION

3.02  INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
E. Provide air cock and drain connection on horizontal pump casings.
F. Provide drains for bases and seals, piped to and discharging into floor drains.
G. Check, align, and certify alignment of base mounted pumps prior to start-up.
H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.
I. Lubricate pumps before start-up.

END OF SECTION
SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Cleaning of piping systems.
B. Chemical treatment.
C. Non-chemical treatment.

1.02 SUBMITTALS
A. See Division 1 for Submittal Procedures.
B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
D. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
E. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
F. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.03 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.04 REGULATORY REQUIREMENTS
A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

1.05 COORDINATION
A. Coordinate with chemical supplier for means and methods of flushing and cleaning operations.
B. Coordinate with District for final filling and chemical treatment of the chilled water system.

1.06 ESTIMATED SYSTEM VOLUMES
A. The following are estimates of the volumes of the systems installed under this contract. Bidders are encouraged to perform their own estimates for verification and accuracy. Actual chemical requirements shall be based on the as-built volume of the systems as determined by the fill metering specified herein. These estimates are provided as a courtesy and shall not be binding for determination of quantity or cost of chemicals for the final installed system. Any deviations from the quantities listed below shall not result in any increase in cost.
   1. Chilled Water System: approximately 8,500 gallons
   2. Condenser Water System: approximately 1,450 gallons

PART 2 PRODUCTS

2.01 CLEANING OF PIPING SYSTEMS
A. MANUFACTURERS
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. MATERIALS
   1. Temporary Materials
      a. Pumps: Provide temporary circulating/injection pumps to flush and clean the new piping systems. Pumps shall be of the size and capacity as required for the chemical cleaning operation as recommended by the chemical supplier/cleaning agency.
      b. Piping Systems: Provide necessary pipe, valves, fittings, hoses, etc. as required to complete piping loops to provide circulation necessary for cleaning operations.
      c. Power: Provide necessary power connections and safety devices to operate temporary pumps.
      d. Provide temporary water meters as required for determination of system volumes.
   2. System Cleaner:
      a. Manufacturers:
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
      c. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.
   3. Closed System Treatment (Chilled Water - steel):
      a. Manufacturers:
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Sequestering agent to reduce deposits and adjust pH.
      c. Corrosion inhibitorsMolybdate based inhibitor. Provide a 15 gallon container of treatment listed above - deliver to the Central Plant. DO NOT treat system. system will be filled from Central Plant treated water. Note that fill rate will be extremely prolonged due to limited make up rate of the Central Plant.

2.02 BY-PASS (POT) FEEDER

   A. Manufacturers:
      1. J.L. Wingert.
   B. 5.0 gal quick opening cap for working pressure of 175 psi.
   C. Feeder body shall be welded steel, with minimum 3-1/2" opening for chemicals, and a minimum of two system connection fittings. Feeder shall be primed and finished with corrosion resistant coating.

2.03 WATER METER

A. Specified in Section 15128 - Gages and Meters

2.04 NON-CHEMICAL TREATMENT (CONDENSER WATER)

A. Manufacturers:
   1. Dolphin WaterCare

B. Description:
   1. Dolphin System shall consist of a components delivering alternating current pulse power from a Signal Generator panel to a Treatment Module piping assembly via an Umbilical Cable. Each Treatment Module assembly shall be equipped with a dedicated individual Signal Generator panel.

C. Functions:
   1. To keep system free from mineral scale on the fill material, pipes, heat exchangers, pipes, valves and other components in the system by changing calcium carbonate nucleation from surface nucleation to colloidal nucleation, thereby lowering activation energy of colloidal nucleation.
   2. To control the population of microorganisms such as bacteria to 10,000 CFU/ml or below, by incorporation into colloidal precipitates (encapsulation) or through the pulsed power fields (electroporation) within the coil pipe assembly, regardless of what species are
present and how they may have mutated. Typically the total bacteria count (TBC) is in the range of 1,000 - 3,000 CFU/mL.

3. Blowdown shall contain no added water treatment chemicals required to achieve performance listed.

D. Signal Generator
1. Wall mounted a minimum of NEMA 3R metal enclosure, 304 brushed stainless steel case. Painted enclosure is not acceptable.
2. Terminal block for hard wiring to electrical power service.
3. Fused primary on 115v/1ph, or 208-230v/1ph (1" to 6" Dolphins) and primary and secondary on 208-230v/1ph, 460v/1ph powered units (8" to 16" Dolphins)
4. Dry form C contact (for building management system).
5. Remote Start-Stop capability with switch field installed.
6. Female locking receptacle for connecting the Signal Generator to the Treatment Module. Connection cored based on unit size to prevent mismatching of components.
7. LED Status indicating lights.
8. Powered fan ventilation with inlet screen filter.
9. Pulsed power transformer and circuitry, which through a single set of coils uses alternating current of 60 cycles per second combined with over layered high frequency pulse signal to create a harmonic “ringing” signal of increasingly higher frequency until the decreasingly lower amplitude of this echo signal is damped down to zero. This effect imparts high frequency electric fields into the flowing water that includes frequencies in the kilohertz and megahertz range.
   a. A total of 240 pulses per second shall be provided.
   b. Devices which separately generate the high and low frequency signals shall not be acceptable.
   c. Devices which utilize separate sets of coils to independently receive the high and low frequency signals shall not be acceptable.
10. Primary service:
   a. 1" thru 6": 120 VAC or 208-230 VAC, 60 cycle, 1 ph, primary service.
   b. 8" thru 16": 208-230 VAC or 460 VAC, 60 cycle, 1 ph, primary service.
   c. 11 to 45 VAC secondary (depending on size).
11. 140 to 1770 VA primary (depending on size).

E. Treatment Module
1. PVC Sch. 80 with bare pipe ends for sizes 1" thru 16".
2. High temperature coil bobbin assemblies secured to pipe by circular clamps.
3. The Coils contained within a larger diameter PVC covering cylinder around the pipe and closed with PVC end caps with ventilation ports.
   a. Equipment requiring field modification by addition of ventilation or weep holes shall not be approved.
4. Integral Umbilical Cable for connection between the Treatment Module and the locking fitting on the Signal Generator.
   a. Standard Umbilical cables are:
      1) 10 ft. (Size 1" to 6")
      2) 26 ft. (size 8" to 16").
5. Built in thermal protection which shall automatically turn the Treatment Module to the OFF status when the operating temperature exceeds 200°F (PVC units 1" thru 6") or 190°F (PVC units 8" thru 16").
   a. The thermal protection for PVC units protects the internal circuitry from internally generated heat.
   b. The maximum applied fluid temperature of PVC units shall not exceed 140°F.
6. Building Management System Interface within the Signal Generator Panel:
   a. The interface to the building management system shall be through a FORM "C" dry relay contact located on the circuit board in the Signal Generator.
   b. The interface shall verify the following Dolphin operating status conditions.
1) Primary Power Status - e.g. Loss of utility power, tripped circuit breaker, blown fuse or unit unplugged.
2) Secondary Power Status - e.g. Severed or removed coil assembly cable connection, defective transformer.
3) Treatment Module Operation Status - e.g. coil overheated.
4) Circuit Board Operation Status - e.g. Board overheated, electronic failure
5) In the event of one of the above anomalies, the supervisory contact shall change relay status.
   (a) Supervisory Contact power rating
   (b) 0.6 A at 125 VAC
   (c) 0.6 A at 110 VDC
   (d) 2.0 A at 30 VDC
7. Remote Start-Stop capabilities within the Signal Generator from external switch furnished by others:
   a. Shall turn off the Dolphin Treatment Module, while maintaining power to the Signal Generator.
      1) Status shall be indicated by a flashing green LED
   b. Switch shall be wired into predetermined contacts in the Signal Generator.
      1) 24v rated normally closed switch shall be provided by others.
8. Optional Field Connections: [OPTION SELECT]
   a. Furnish PVC Van Stone style (Slip-on) flanges for field mounting of Treatment Module.
   b. Furnish Straub type couplings (Flex-L or Grip-L) for field connections

2.05 CONDUCTIVITY CONTROLLER
A. Packaged Conductivity Meter/Controller: Provide a Conductivity meter/controller equal to Pulsafeeder MicroTRAC with electrodeless sensor
   1. Provide NEMA 4x enclosure
   2. LCD Display for setpoint and actual conductivity readout, Solid-state circuitry, 5 percent accuracy.
   3. Control function lights, 120v/1ph output to control motorized bleed valve.
   4. Furnish with preassembled conductivity sensor in SCH 80 PVC Tee, PVC socket weld connections with preassembled cable connector to conductivity meter/controller.
   5. Conductivity sensor-probe shall be electrodeless. A contact-type electrode sensor shall not be accepted.
   6. Furnish with optional flow switch to disable motorized bleed valve when pumping system is off.

2.06 BLOWDOWN OR BLEED VALVE
A. Provide Blowdown Solenoid valve or motorized ball valve equal to Belimo LF120 US, 115volt, single phase:
   1. Furnish cord with plug to connect to "Bleed" receptacle of the conductivity controller.
   2. Furnish with watertight cover to maintain NEMA 3R if installed outdoors.
   3. Install valved bypass around blowdown valve for servicing and emergency manual blowdown operation.
   4. Do not install strainer(s) in blowdown valve.
   5. Install throttling valve downstream of the blowdown valve to make adjustments in blowdown volume rate if required.

2.07 CORROSION TEST COUPON ASSEMBLY
A. Provide a corrosion coupon rack suitable for corrosion monitoring according to ASTM G-4-01(2008) equal to Advantage Controls Model ACR.
   1. Constructed of PVC pipe and fittings
   2. Furnish piping, isolation valves, and a visual water flow balancing device.
   3. Mount on a polyethylene panel suitable for wall mounting.
PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system, and to determine cleaning agent and final chemical dosing requirements.
B. Bypass terminal control valves during cleaning. Provide bypasses at each terminal unit.
C. Provide taps/nozzles and valves for temporary pump connections.
D. Do not chemically clean permanent pumps, heat transfer devices or control components. Isolate prior to cleaning.
E. Verify that electric power is available and of the correct characteristics.

3.02 CLEANING SEQUENCE

A. Clean the condenser water and chilled water system installed under this contract.
B. Concentration:
   1. As recommended by manufacturer.
C. Temporary Materials:
   1. Pumps: Provide temporary circulating/injection pumps to flush and clean the new piping systems. Pumps shall be of the size and capacity as required for the chemical cleaning operation as recommended by the chemical supplier/cleaning agency.
   2. Piping Systems: Provide necessary pipe, valves, fittings, hoses, etc. as required to complete piping loops to provide circulation necessary for cleaning operations. Provide necessary temporary piping and hoses to drain systems to sanitary sewer.
   3. Power: Provide necessary power connections and safety devices to operate temporary pumps.
D. Drainage: All systems draining shall be to sanitary sewer.
E. Chilled Water Systems:
   1. Provide temporary bypasses, nozzles, valves and crossovers to allow circulation of systems without the use of the permanent pumps (if any).
   2. Fill the system with water and initially circulate and flush the system without cleaner to remove large debris.
   3. After the initial flush is complete, circulate system with temporary pumps while injecting chemical. Test system at remote points to ensure chemical is being distributed throughout the system. Circulate with chemicals for a duration as recommended by the chemical supplier.
   4. Drain and flush system with clean water. Test for residual chemical. Re-flush as required to attain dilution as per supplier’s recommendation.
   5. Fill hydronic systems with clean water and treat with final chemicals.
F. Use neutralizer agents on recommendation of system cleaner supplier and approval of Engineer.
G. Remove, clean, and replace strainer screens.

3.03 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

3.04 CLOSEOUT ACTIVITIES

A. Training: Train District’s personnel on operation and maintenance of non-chemical and chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION

DSA Re-submittal 6/21/2012

HVAC WATER TREATMENT

23 26 00 - 5
SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Metal ductwork.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.
F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
G. SMACNA Guidelines for Seismic Restraints of Mechanical Systems

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for duct materials.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

2.02 MATERIALS
A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
C. All Ducts: Galvanized steel, unless otherwise indicated.
D. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Install ductwork in accordance with SMACNA Guidelines for Seismic Restraints of Mechanical Systems.

END OF SECTION
SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Inline exhaust fan.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS
B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL
A. Base fan performance at standard conditions (density 0.075 Lb/ft3).
B. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
C. Each fan shall be belt drive in AMCA arrangement 9.
D. Fans are to be equipped with lifting lugs.
E. After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc. Fan shall then be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be Industrial gray. Coating must exceed 1,000-hour salt spray under ASTM B117 test method.

DSA Re-submittal 6/21/2012

23 34 23 - 1
HVAC POWER VENTILATORS
2.03 FAN HOUSING AND OUTLET
A. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
B. Tubular fan housing shall be completely welded and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be gray. No uncoated metal fan parts will be allowed.
C. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
D. All mixed flow housings shall include welded steel vanes to straighten airflow prior to exiting the fan discharge.
E. Units up to size 27 shall incorporate a universal mounting system that allows the fan to be mounted in either vertical or horizontal configurations and field rotation of the motor position in 90 degree increments. Bearing life shall not be reduced below specified level in different configurations. Units size 30 and larger shall allow for field rotation of motor positions. Units shall accommodate base mount or ceiling hung mounting without structural modifications to the fan.
F. An access door shall be supplied for impeller inspection and service.
G. OSHA compliant belt guard or motor cover to be included to completely cover the motor pulley and belt(s).

2.04 FAN IMPELLER
A. Fan impeller shall be mixed flow design. The impeller shall be electronically balanced both statically and dynamically to balance grade G6.3 per ANSI S2.19.
B. Fan impeller shall be manufactured with continuously welded steel airfoils and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be industrial gray
C. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

2.05 FAN MOTORS AND DRIVE
A. Motors shall meet or exceed EPACT (Energy Policy ACT) efficiencies. Motors to be NEMA T-frame, 1800 or 3600 RPM, Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor.
B. Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
C. Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
D. Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.
E. Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.
F. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class Average Life or (L-50) of 400,000 hours.
G. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
H. Bearings shall have extended lube lines with Zerk fittings to allow for lubrication.
PART 3 EXECUTION
3.01 EXAMINATION
   A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION
   A. Install in accordance with contract drawings and manufacturer's instructions.
   B. Provide sheaves required for final air balance.

END OF SECTION
SECTION 23 64 16
CENTRIFUGAL WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Chiller package.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.
D. Test Reports: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature.
E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
F. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.
G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in District's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.06 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide a five year warranty to include coverage for compressor including materials only.
C. A refrigerant warranty shall be provided for a period of 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. McQuay: www.mcquay.com

2.02 UNIT DESCRIPTION
A. Provide and install as shown on the plans a factory assembled, charged, and tested water-cooled packaged centrifugal chiller. Chillers shall have no more than two oil-free, magnetic bearing, semi-hermetic centrifugal compressors (no exceptions). Each compressor shall have an integrated variable-frequency drive operating in concert with inlet guide vanes for optimized full and part load efficiency. On two-compressor units, the evaporator and condenser...
refrigerant sides and the expansion valve shall be common and the chiller shall be capable of running on one compressor with the other compressor or any of its auxiliaries inoperable or removed.

B. Each chiller shall be factory run-tested under load conditions for a minimum of one hour on an AHRI certified test stand with evaporator and condenser waterflow at job conditions (excluding glycol applications). Operating controls shall be adjusted and checked. The refrigerant charge shall be adjusted for optimum operation and recorded on the unit nameplate. Units operating with 50-Hz power shall be tested with a 50-Hz power supply. Any deviation in performance or operation shall be remedied prior to shipment and the unit retested if necessary to confirm repairs or adjustments. Manufacturer shall supply a certificate of completion of a successful run-test upon request.

2.03 DESIGN REQUIREMENTS

A. General: Provide a complete water-cooled, semi-hermetic oil-free centrifugal compressor water chiller as specified herein. The unit shall be provided according to standards indicated in Section 1.02. In general, unit shall consist of one or two magnetic bearing, completely oil-free centrifugal compressors, refrigerant, condenser and evaporator, and control systems including integrated variable frequency drive, operating controls and equipment protection controls. Chillers shall be charged with refrigerant HFC-134a. If manufacturer offers a chiller using any HCFC refrigerant that is subject to phase out by the Montreal Protocol or the U.S. Clean Air Act, manufacturer shall provide, in writing, documentation signed by an officer of the company assuring refrigerant availability and price schedule for a 20-year period.

B. The entire chiller system, including all pressure vessels, shall remain above atmospheric pressure during all operating conditions and during shut down to ensure that non-condensables and moisture do not contaminate the refrigerant and chiller system. If any portion of the chiller system is below atmospheric pressure during either operation or shut down, the manufacturer shall include, at no charge:

1. Purge System
   a. A complete purge system capable of removing non-condensables and moisture during operation and shut-down. The system shall consist of an air cooled condensing unit, purge condensing tank, pumpout compressor, and control system.
   b. A dedicated condensing unit shall be provided with the purge system to provide a cooling source whether or not the chiller is running. The condensing unit shall provide a low purge coil temperature to result in a maximum loss of 0.1 pounds of refrigerant per pound of purged air.
   c. The purge system shall be connected to a 100% reclaim device.
   d. A 20-year purge maintenance agreement that provides parts, labor, and all preventative maintenance required by the manufacturer's operating and maintenance instructions.

2. Annual Oil/Refrigerant Analysis
   a. The manufacturer shall also include at no charge for a period of 20 years an annual oil and refrigerant analysis report to identify chiller contamination due to vacuum leaks.
   b. If the analysis identifies water, acid, or other contaminant levels higher than specified by the manufacturer, the oil and/or refrigerant must be replaced or returned to the manufacturer's original specification at no cost to the owner.

3. Shell Pressurization System
   a. The manufacturer shall include a factory-installed and wired system that will enable service personnel to readily elevate the vessel pressure during shutdown to facilitate leak testing.
   b. A shell pressurization system shall be provided to keep air out of the chiller when the unit is not in service. Electric blanket or hot water circulation system are both acceptable.

C. Performance: Refer to chiller performance rating.
D. Acoustics: Sound pressure for the unit shall not exceed the following specified levels. Provide the necessary acoustic treatment to chiller as required. Sound data shall be measured in dB according to AHRI Standard 575 and shall include overall dBA. Data shall be the highest levels recorded at all load points. (Sound Pressure (dB) measured in accordance with ANSI/AHRI Standard 575-2008 (A-weighted))

<table>
<thead>
<tr>
<th>Load</th>
<th>Overall (A Weighted)</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1000Hz</th>
<th>2000Hz</th>
<th>4000Hz</th>
<th>8000Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>80.5</td>
<td>37.5</td>
<td>51.5</td>
<td>59.5</td>
<td>72.0</td>
<td>75.0</td>
<td>72.5</td>
<td>76.5</td>
<td>75.0</td>
</tr>
<tr>
<td>75</td>
<td>78.0</td>
<td>37.0</td>
<td>50.5</td>
<td>62.5</td>
<td>66.5</td>
<td>70.0</td>
<td>69.5</td>
<td>74.0</td>
<td>70.5</td>
</tr>
<tr>
<td>50</td>
<td>75.0</td>
<td>37.0</td>
<td>50.0</td>
<td>60.0</td>
<td>65.0</td>
<td>65.5</td>
<td>66.0</td>
<td>71.5</td>
<td>66.0</td>
</tr>
<tr>
<td>20</td>
<td>73.5</td>
<td>37.0</td>
<td>49.0</td>
<td>59.0</td>
<td>63.0</td>
<td>65.0</td>
<td>66.0</td>
<td>69.5</td>
<td>64.0</td>
</tr>
</tbody>
</table>

2.04 CHILLER COMPONENTS

A. Compressors:

1. The unit shall utilize magnetic bearing, oil-free, semi-hermetic centrifugal compressors. The levitated shaft position shall be digitally controlled and shall be monitored by X-axis position sensor, Y-axis position sensor, and Z-axis position sensor. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure by diverting stored power to the magnetic bearing controls system.

2. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be compatible with variable frequency drive operation.

3. If the unit contains an atmospheric shaft seal, the manufacturer shall provide the following at no additional charge:
   a. 20 year warranty and all preventive maintenance required to maintain the shaft seal including appropriate disposal of all oil lost through the shaft seal. Such disposal shall be done in a manner consistent with all Federal, state, and local laws pertaining to disposal and documentation of appropriate disposal shall be provided.
   b. Replacement and re-charging on a semi-annual basis, or more often if required, of all oil lost through the shaft seal.
   c. 20 year refrigerant replacement warranty for any loss of refrigerant that can be directly attributable to the failure of the atmospheric shaft seal.

4. If the compressor drive motor is an open design the chiller manufacturer shall provide at no additional charge a self-contained air conditioning system in the mechanical space sized to handle the maximum heat output of the open drive motor. The energy required to operate this air conditioning system shall be added to the chiller power at all rating points for energy evaluation purposes.

5. If the compressor drive motor uses any form of antifriction bearings (roller, ball, etc) the chiller manufacturer shall provide the following at no additional charge:
   a. A 20 year motor bearing warranty and all preventative maintenance, including lubrication, required to maintain the bearings as specified in the manufacturer's operating and maintenance instructions
   b. At start up a three axis vibration analysis and written report which establishes a baseline of motor bearing condition.
   c. An annual three axis vibration analysis and written report to indicate the trend of bearing wear.

6. The chiller shall be equipped with an integrated Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. Movable inlet guide vanes and variable compressor speed acting together, shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.

7. Each compressor circuit shall be equipped with a 5% rated line reactor to help protect against incoming power surges and help reduce harmonic distortion.
8. The unit shall have a minimum of a 0.90 power factor at compressor full load.

B. Evaporator and Condenser:
1. The evaporator and condenser shall be separate vessels of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII. Regardless of the operating pressure, the refrigerant side of each vessel will bear the ASME stamp indicating compliance with the code and indicating a test pressure of 1.1 times the working pressure, but not less than 100 psig. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.

2. The evaporator shall be flooded type with 0.025 in. wall copper internally and externally enhanced tubes rolled into carbon steel tubesheets. The water side shall be designed for a minimum of 150 psig. The refrigerant side shall be designed for a minimum of 200 psi. Provide intermediate tube supports at a maximum of 18 inch spacing. The heads shall be carbon steel and the tubesheets shall be carbon steel. Water connections shall be grooved suitable for Victaulic couplings. The evaporator shall have dished heads with valved drain and vent connections. The evaporator shall have left-hand connections when looking at the unit control panel.

3. The condenser shall have 0.025 in. wall copper internally and externally enhanced tubes rolled into carbon steel. Water connections shall be grooved suitable for Victaulic couplings. The water side shall be designed for a minimum of 150 psig and the refrigerant side shall be designed for a minimum of 200 psi. Provide intermediate tube supports at a maximum of 18 inch spacing. The condenser shall have dished heads with valved drain and vent connections. The heads shall be carbon steel and the tubesheets shall be carbon steel. The condenser shall have left-hand connections when looking at the unit control panel.

4. Provide sufficient isolation valves and condenser volume to hold the full unit refrigerant charge in the condenser at 90°F in accordance with ANSI ASHRAE 15.1 during servicing or provide a storage tank sufficient to hold the charge of the largest unit being furnished.

5. An electronic expansion valve shall control refrigerant flow to the evaporator. Fixed orifice devices or float controls with hot gas bypass are not acceptable because of inefficient control at low load conditions. The liquid line shall have moisture indicating sight glass.

6. Re-seating type spring loaded pressure relief valves according to ASHRAE-15 safety code shall be furnished. The evaporator shall be provided with single or multiple valves. The condenser shall be provided with dual relief valves equipped with a transfer valve so one relief valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the condenser. Rupture disks are not acceptable. If rupture disks are required on negative pressure units to prevent air and moisture ingress, then factory mounted spring loaded pressure relief valves shall be provided in series with the rupture disks to contain the remaining refrigerant in the event of vessel over-pressurization. The space between the rupture disk and the relief valve shall include a suitable telltale indicator integrated into the chiller control system to alert the operator that a potential safety issue exists in the pressure relief system.

7. The evaporator, including water heads, suction line, and any other component or part of a component subject to condensing moisture shall be insulated with UL recognized 3/4 inch closed cell insulation. All joints and seams shall be carefully sealed to form a vapor barrier.

8. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow. Paddle and pressure differential type switches are not acceptable due to high rates of failure and false indications from these types of flow indicators.

C. Long Term Reliability:
1. All compressor/motor designs that require oil to lubricate their respective roller/ball bearing system must denote exactly how many gallons of oil are required for safe operation. The manufacturer must then provide the engineer and owner with a real world energy analysis showing the energy degradation over time due oil contamination of heat transfer surfaces.
2. Chillers containing oil shall include a 10 year parts and labor warranty on all oil system components including:
   a. Pumps
   b. Starter
   c. Piping
   d. Tank
   e. Heater
   f. Cooler
   g. Controls
   h. Valves
3. Manufacturer shall be responsible for covering all costs associated with annual oil and oil filter changes plus oil analysis as required

D. Vibration Isolation
   1. Provide neoprene waffle-type vibration isolators for each corner of the unit.

E. Power Connections
   1. Power connection shall be single point to a factory-mounted disconnect switch.

F. Chiller Control
   1. The unit shall have a microprocessor-based control system consisting of a 15-inch VGA touch-screen operator interface and a unit controller.
   2. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:
      a. Entering and leaving chilled water temperatures
      b. Entering and leaving condenser water temperatures
      c. Evaporator saturated refrigerant pressure
      d. Condenser saturated refrigerant pressure
      e. Percent of 100% speed (per compressor)
      f. % of rated load amps for entire unit

3. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following critical areas must be monitored:
   a. Compressor actual speed, maximum speed, percent speed
   b. Liquid line temperature
   c. Chilled water setpoint
   d. Compressor and unit state and input and output digital and analog values

4. A fault history shall be displayed using an easy to decipher, color coded set of messages that are date and time stamped. Time interval scale shall be user selectable as 20 mins, 2 hours, or 8 hours. The alarm history shall be downloadable from the unit's USB port. An operating and maintenance manual specific for the unit shall be viewable on the screen.

5. All setpoints shall be viewable and changeable (multi-level password protected) on the touch screen and include setpoint description and range of set values.

6. Automatic corrective action to reduce unnecessary cycling shall be accomplished through preemptive control of low evaporator or high discharge pressure conditions to keep the unit operating through abnormal transient conditions.

7. Chiller plant optimization software for multiple chillers shall be provided including automatic control of at least two (2) chillers, evaporator and condenser pumps (primary and standby), up to 3 stages of cooling tower fan cycling control and a tower modulating bypass valve or cooling tower fan variable frequency drives.

8. The factory mounted controller(s) shall support operation on a BACnet® network via one of the data link / physical layers as specified by the successful Building Automation System (BAS) supplier. BACnet MS/TP master (Clause 9).
9. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

10. Energy saving software logic shall at a minimum offer the following
   a. User programmable compressor soft loading
   b. Chilled water reset
   c. Demand limit control
   d. Staging options lead lag between multiple compressors on a single chiller or on multiple chillers
   e. Plotting of historic trends for optimizing efficiency

G. Insulation
   1. Insulation shall be factory installed to reduce heat loss and prevent condensation from forming. Insulation should cover:
      a. The evaporator barrel, tube sheet, and water heads.
      b. The suction line from the top of the evaporator to the compressor inlet flange.
      c. The compressor support brackets welded to the evaporator
      d. The liquid line from the expansion valve outlet to the evaporator inlet.

   2. Insulation shall be UL recognized (File # E55475), 3/4" thick ABS/PVC flexible foam with a skin. The K factor shall be 0.28 at 75°F. Sheet insulation shall be fitted and cemented in place forming a vapor barrier, then painted with a resilient epoxy finish that resists cracking.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide for connection to electrical service.
C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
D. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.
E. Arrange piping for easy dismantling to permit tube cleaning.
F. Provide piping from chiller relief valves to outdoors. Size as recommended by manufacturer.
G. Arrange piping to allow for dismantling to permit head removal and tube cleaning.
H. Coordinate electrical installation with electrical contractor.
I. Coordinate controls with controls contractor.
J. Provide material required for a fully operational and functional chiller.

3.02 SYSTEM STARTUP

A. Factory Start-up Services: Provide for as long a time is necessary to ensure proper operation of the unit, but in no case for less than two full working days. During the period of start-up, the start-up technician shall instruct the owner's representative in proper care and operation of the unit.
B. Interconnection of the RS485 wiring interconnecting between each chiller with the addition of the communication isolation boards 485OPDR shall be made.
C. Supply initial charge of refrigerant and oil.
D. Demonstrate system operation and verify specified performance.

END OF SECTION
SECTION 23 65 13
INDUCED DRAFT COOLING TOWERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Cooling tower.
B. Centrifugal Separator

1.02 REFERENCE STANDARDS
A. CTI ATC-105 - Acceptance Test Code; Cooling Technology Institute; 2000.
C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.
C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.
D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
E. Manufacturer's Certificate: Certify that cooling tower performance, based on CTI ATC-105 or CTI STD-201 meet or exceed specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.
F. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories.
G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in District's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 10 years of experience and approved by manufacturer.

1.05 REGULATORY REQUIREMENTS
A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.
B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide a five year warranty to include coverage for corrosion resistance of cooling tower structure labor only.

DSA Re-submittal 6/21/2012

23 65 13 - 1
INDUCED DRAFT COOLING TOWERS
PART 2 PRODUCTS

2.01 MANUFACTURERS
   B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COOLING TOWER
   A. 1500 SERIES
      1. General: Furnish and install, as shown on plans, factory-assembled, induced draft,
         crossflow cooling tower(s) with vertical air discharge conforming in all aspects to the
         specifications, schedules and as shown on the plans.
      2. Thermal Capacity: The cooling tower(s) shall be warranted by the manufacturer to meet
         performance as shown on plans. Additionally, the thermal performance shall be certified by
         the Cooling Technology Institute in accordance with CTI Certification Standard STD-201.
         Lacking such certification, a field acceptance test shall be conducted within the warranty
         period in accordance with CTI Acceptance Test Code ATC-105, by the Cooling
         Technology Institute or other qualified independent third party testing agency.
         Manufacturer’s performance guarantees or performance bonds without CTI Certification or
         independent field thermal performance test shall not be accepted. The cooling tower shall
         comply with the energy efficiency requirements of ASHRAE Standard 90.1.
      3. Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel
         panels and structural members must be protected with the BALTBOND® Corrosion
         Protection System. The system shall consist of G-235 (Z700 metric) hot-dip galvanized
         steel prepared in a four-step (clean, pretreat, rinse, dry) process with an electrostatically
         sprayed, thermosetting hybrid polymer fuse-bonded to the substrate during a thermally
         activated curing stage and monitored by a 23-step quality assurance program. Coatings
         other than the BALTBOND® Corrosion Protection System must be submitted to the
         engineer for pre-approval. Approved equals must have undergone testing, resulting in
         the following results as a minimum:
            a. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of 5%
               salt spray per ASTM B117 without blistering, chipping, or loss of adhesion;
            b. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of
               exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95°F (35°C)
               without signs of chemical attack;
      4. Shall withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of
         the polymer layer;
      5. Shall withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime
         sun exposure without loss of functional properties;
      6. Shall withstand 200 thermal shock cycles between -25°F and +180°F (-32°C and 82°C)
         without loss of adhesion or other deterioration;
         a. Shall withstand 6000 hours of exposure to 60 psi (42184.2 kg/m2) water jet without
            signs of wear or erosion.
   B. CONSTRUCTION DETAILS
      1. Cold Water Basin: The cold water basin shall be constructed of heavy-gauge Type 304
         stainless steel panels and structural members. All factory seams shall be welded to ensure
         watertight construction and welded seams shall be warranted against leaks for a period of
         five (5) years from date of shipment. Stainless steel basins with bolted seams are not
         acceptable. Basin shall include a depressed section with drain/clean-out connection. The
         basin area under the fill shall be sloped toward the depressed center section to facilitate
         cleaning. Standard basin accessories shall include a corrosion resistant make-up valve
         with large diameter plastic float for easy adjustment of the operating water level.
      2. Water Outlet: The water outlet connection shall be beveled for welding and grooved for
         mechanical coupling or bolt hole circle designed to accept an ASME Class 150 flat face
         flange. The outlet shall be provided with large area lift out strainers with perforated
         openings sized smaller than the water nozzles and an anti-vortexing device to prevent air.
entrainment. The strainer and vortex device shall be constructed of the same materials as the cold water basin to prevent dissimilar metal corrosion.

3. Water Distribution System: The distribution system shall be furnished with a single water inlet. The pipe stub connection shall be beveled for welding and grooved for mechanical coupling. The hot water distribution system shall consist of an integral strainer that feeds to an open gravity type basin, for easy cleaning, and constructed of heavy-gauge G-235 (Z700 metric) hot-dip galvanized steel. The basins must be accessible from outside the unit and serviceable during tower operation. Basin weirs and plastic metering orifices shall be provided to assure even distribution of the water over the fill. Lift-off distribution covers shall be constructed of heavy-gauge G-235 (Z700) hot-dip galvanized steel. Gravity flow nozzles shall be snap-in type for easy removal. Should pressurized nozzles be used, they shall utilize grommets, which ensure easy removal.

C. MECHANICAL EQUIPMENT
1. Fan(s): Fan(s) shall be axial flow with aluminum alloy blades selected to provide optimum cooling tower thermal performance with minimal sound levels. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum tip clearance for maximum fan efficiency. The top of the fan cylinder shall be equipped with a conical, non-sagging removable fan guard.
2. Bearings: Fan(s) and shaft(s) shall be supported by heavy-duty, self-aligning, grease packed ball bearings with moisture proof seals and integral slinger collars, designed for a minimum L10 life of 40,000 hours (280,000 Hr. Avg. Life).
3. Fan Drive: The fan(s) shall be driven by a one-piece, multi-groove, solid back V-type powerband with taper lock sheaves designed for 150% of the motor nameplate horsepower. The powerband shall be constructed of neoprene reinforced polyester cord and be specifically designed for cooling tower service.
4. Sheaves: Fan and motor sheave(s) shall be fabricated from corrosion-resistant materials to minimize maintenance and ensure maximum drive and powerband operating life.
5. Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type designed specifically for cooling tower service. The motor shall be furnished with special moisture protection on winding, shafts, and bearings and appropriately labeled for “cooling tower duty.” Fan motors shall be inverter duty type designed per NEMA Standard MG1, Section IV Part 31.
6. Mechanical Equipment Warranty: The fan(s), fan shaft(s), bearings, mechanical equipment support, and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

D. FILL AND DRIFT ELIMINATORS
1. Fill and Drift Eliminators: The fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM-588) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The fill shall be suitable for entering water temperatures up to and including 120°F (48.8°C). The fill shall be manufactured, tested and rated by the cooling tower manufacturer and shall be elevated above the cold water basin to facilitate cleaning.

E. AIR INLET LOUVERS
1. Air Inlet Louvers: Air inlet louvers shall be separate from the fill and be removable to provide easy access for inspection of the air/water interface at the louver surface. Louvers shall prevent water splash-out during fan cycling and be constructed of maintenance free, corrosion resistant, UV protected, fiberglass reinforced polyester (FRP).

F. ACCESS
1. Plenum Access: Hinged access doors shall be provided on two sides of the tower for access into plenum section.

G. ACCESSORIES
1. Vibration Cutout Switch: Provide local mechanical reset style, one pole, double throw, contacts rated for 15 amps 125 vac or 480 vac. Switch shall not require external power source, and shall be connected to fan controls by installing contractor.

DSA Re-submittal 6/21/2012

23 65 13 - 3
2. Basin Sweeper Piping: The cold water basin of the cooling tower shall be equipped with PVC basin sweeper piping with plastic eductor nozzles. The piping should create a grid under the fill section and force all dirt and debris to the depressed section of the cold water basin.


4. Internal Platform: An internal platform shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf (244 kg/m²) live load or 200 pound (90.7 kg) concentrated load. Other components of the cooling tower, i.e. basin floor and fill/drift eliminators, shall not be considered an internal working surface. Cooling tower manufacturers that require that these surfaces be used as a working platform shall provide a 5-year extended warranty to the Owner to repair any damage to these surfaces caused by routine maintenance.

5. Provide extended tube lines to facilitate lubrication from outside of cooling tower.

2.03 CENTRIFUGAL SEPARATOR

A. MANUFACTURER
   1. LAKOS Filtration Systems

B. PERFORMANCE
   1. Flow Capacity -- Unit shall have a flow capacity as scheduled. Shall be between 3-12 psi (.2 to .8 bar) remaining constant, varying only when the flow rate changes.
   2. Solids Removal Effectiveness
      a. All Systems - In a single pass through the separator, given solids with a specific gravity of 2.6 and water at 1.0, performance is expected to be 99% of 74 microns and larger. Additionally, particles finer in size, heavier by specific gravity and some lighter by specific gravity will also be removed, resulting in an appreciable aggregate removal of particles (up to 75%) as fine as 5 microns.
      b. In Recirculating Systems -- 98% performance is predictable to as fine as 40 microns (given solids with a specific gravity of 2.6), with correspondingly higher aggregate performance percentages (up to 90%) of solids as fine as 5 microns.
   3. Maximum working pressure: 150 psi (10.3 bar); Maximum operating temperature: 100° F (38° C).

C. CONSTRUCTION
   1. The separator package -- Shall provide for initial pre-straining prior to pump suction, followed by direct pumping through a specific centrifugal-action solids-from-liquid separator and immediate return of flow to the HydroBoosters. Separated solids shall be continuously bled from the separator's collection chamber into the package's integral solids recovery vessel and solids collection bag. Excess liquid shall pass through the bag and return to system flow via piping connected to the package's pump suction line. The separated solids shall be purged periodically to desired disposal with an automatic purge valve.
   2. Strainer -- Cast-iron housing; manual-cleaning; 9/32-inch (7 mm) minimum mesh rating; stainless steel basket.
   3. Pump -- End-suction, single stage; cast iron housing; iron impeller; bronze shaft sleeve; silicon carbide mechanical shaft seal; flooded suction required.
   4. Separator -- Centrifugal-action design, incorporating a true tangential inlet and mutually tangential Swirl flow internal accelerating slots, employed to promote the proper velocity necessary for the removal of the separable solids. The internal accelerating slots shall be spiral-cut for optimum flow transfer, laminar action and particle influence into the separation barrel. The separator's internal vortex shall allow this process to occur without wear to the accelerating slots. Separated particle matter shall spiral downward along the perimeter of the inner separation barrel, in a manner which does not promote wear of the separation barrel, and into the solids collection chamber, located below the vortex deflector.
plate. The separator shall be of unishell construction with SA-36, SA-53B or equivalent quality carbon steel, minimum thickness of .25 inches (6.35 mm).

5. Automatic Purge Valve — In place of the solids recovery vessel, an electrically-actuated valve shall be programmed at appropriate intervals and duration in order to efficiently and regularly purge solids from the separator's collection chamber. Valve body shall be bronze (optional stainless steel also available). Valve ball shall be stainless steel with Teflon seat.

6. Inlet and Outlet - Shall be grooved couplings, size 3" inlet & 3" outlet.

7. Purge Outlet - Shall be threaded with a screw-on flange, size 3/4".

8. Piping — Schedule 40 galvanized carbon steel; reinforced rubber hose to solids recovery vessel.

9. Electrical Control — IEC starter with overload module; HOA selector switch; NEMA-4x enclosure; re-set/disconnect/trip switch; 120 volt, single phase control voltage; CSA-approved. Power requirement: 208/230/460/575 volt, 3 phase, 60 Hz; or 380/415 volt, 3 phase, 50 Hz.

10. Valves — Ball valves on purge line for isolation of solids-handling/purging equipment. Provide inlet/outlet valve kit.

11. Paint Coating - Shall be oil-based enamel.

D. Purging and Solids Handling

1. Evacuation of separated solids shall be accomplished automatically, employing a motorized ball valve with integrally-equipped programming for controlling the frequency and duration of solids purging.

E. Piping between Lakos and Cooling Tower

1. PVC Pipe: ASTM D1785 or ASTM D2241, Schedule 80, coat with UV resistant coating suitable for outdoor use.
   a. Fittings: ASTM D2665, PVC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide the services of the manufacturer's field representative to supervise rigging, hoisting, and installation, allowing for minimum of one eight hour day per tower.

C. Install tower on structural concrete curbs.

D. Connect condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

E. Connect make-up water piping with flanged or union connections to tower. Pitch to tower.

F. Connect overflow, bleed, and drain, to floor drain.

G. Connect vibration switch to fan controls to provide shut down upon trip. Adjust vibration switch per manufacturer's instructions.

H. Provide factory-designed configuration of HydroBoosters for maximum efficiency and effectiveness.

3.02 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's field representative to inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

3.03 SYSTEM STARTUP

A. Start-up tower in presence of and instruct District's operating personnel.

END OF SECTION
SECTION 26 05 01
MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Electrical demolition.

PART 2 PRODUCTS
2.01 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify field measurements and circuiting arrangements are as shown on Drawings.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition drawings are based on casual field observation and existing record documents.
   D. Report discrepancies to Engineer before disturbing existing installation.
   E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   B. Coordinate utility service outages with utility company and Merritt College Campus.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized (480 volts or less) equipment or circuits, use personnel experienced in such operations.
   D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
   A. Remove, relocate, and extend existing installations to accommodate new construction.
   B. Remove abandoned wiring to source of supply.
   C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Remove electrical devices made abandoned by removal of mechanical equipment. Cut conduit flush with walls and floors, and patch surfaces.
   D. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
   E. Repair adjacent construction and finishes damaged during demolition and extension work.
   F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR
   A. Clean and repair existing materials and equipment that remain or that are to be reused.
   B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION
SECTION 26 05 10
ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working electrical installation, as shown on the drawings or described in these specifications.

1.02 REFERENCES

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean the latest edition of such publications adopted and published prior to submittal of the bid proposed. Such codes or standards shall be considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc., allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the drawings and specifications.

C. FM P7825 - Approval Guide; Factory Mutual

D. NEMA MG 1 - Motors and Generators

E. California Code of Regulations (CCR) Title 24, Part 3, Basic Electrical Requirements, State Building Standards Electrical Code

F. National Fire Protection Association (NFPA).


I. Equipment and materials specified under this Division shall conform to the following standards where applicable:
   1. UL Underwriters' Laboratories
   2. ASTM American Society for Testing Materials
   3. CMB Certified Ballast Manufacturers
   4. IPCIA Insulated Power Cable Engineer Assoc.
   5. NEMA National Electrical Manufacturer's Assn.
   6. ANSI American National Standards Institute
   7. ETL Electrical Testing Laboratories

J. All base material shall be ASTM and/or ANSI standards.

K. All electrical apparatus furnished under this Section shall conform to National Electrical Manufacturers Association (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

L. NECA (INST) Standard of Installation; National Electrical Contractors Association.

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Where items are noted as "or equal" a product of equal design, construction and performance will be considered. Contractor must submit all pertinent test data, catalog cuts and product information required to substantiate that the product is in fact equal. Refer to Division 1, General Requirement for additional requirements. Only ONE substitution will be considered for each product specified.

C. Submittals shall consist of detailed shop drawings, specifications, "catalog cuts" and data sheets containing physical and dimensioned information, performance data, electrical characteristics, material used in fabrication, material finish and shall clearly indicate those optional accessories which are included and those which are excluded. Furnish one reproducible and 4 prints of each shop drawing.
1.04 CUTTING, PAINTING AND PATCHING
A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Engineer.

B. Cutting and digging shall be under the direct supervision of the General Contractor. Include as necessary for the work in this section.

C. The contractor shall be responsible for returning any surface from which he has removed equipment or devices to the condition and finish of the adjacent surfaces.

1.05 SUPERVISION
A. Contractor shall personally or through an authorized and competent representative constantly supervise the work from beginning to completion and, within reason, keep the same workmen and foreman on the project throughout the project duration.

1.06 PROTECTION
A. Keep conduits, junction boxes, and outlet boxes, and other openings closed to prevent entry of foreign matter; cover fixtures, equipment, and apparatus and protect against dirt, paint, water, chemical, or mechanical damage, before and during construction period. Restore to original condition any fixture, apparatus, or equipment damaged prior to final acceptance, including restoration of damaged shop coats of paint, before final acceptance. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

1.07 EXAMINATION OF SITE
A. The Contractor shall visit the site prior to submitting bid, and determine the locale, working conditions, conflicting utilities, and the conditions in which the electrical work will take place. No allowances will be made subsequently for any costs which may be incurred because of any error or omission due to failure to examine the site and to notify the Engineer of any discrepancies between drawings and specifications and actual site conditions. Schedule visits at least 1 week in advance with District's Maintenance staff.

1.08 PROJECT CONDITIONS
A. Coordinate new 15 KV substation installation with size, location and installation of service utilities.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.09 ENVIRONMENTAL REQUIREMENTS
A. After other work such as sanding, painting etc. has been completed, clean lighting fixtures, panelboards, switchboards, and other electrical equipment to remove dust, dirt, and grease, or other marks, and leave work in clean condition.

1.10 VOLTAGE CHECK
A. At the start and completion of job, check voltage at several points of utilization on the system which has been installed and reinstalled under this contract. During test, energize all loads installed. Measure 3-Phase voltages and note percentage differences. Verify phase rotation at the start and completion of job and prior to re-energizing electrical systems and before and after shutdowns. Submit report to Engineer. Include copy in O&M Manual.

1.11 WARRANTY
A. See Division 1 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

1.12 TESTS
A. Perform tests as specified to prove installation is in accordance with contract requirements. Perform tests in the presence of the Engineer and furnish test equipment, facilities, and technical personnel required to perform tests. Tests shall be conducted during the construction
period and at completion to determine conformity with applicable codes and with these Specifications. Tests, in addition to specific system test described elsewhere, shall include:

1. Insulation Resistance: All 600 volt insulation shall be tested at 1,000 volts D.C for one minute on all feeder and branch circuit conductors including the neutral, and make a typed record of all readings to be included in the maintenance instructions. The direct current amperes shall be recorded at start and at one minute. The value shall be declining and not more than one microampere. All 15KV insulation shall be tested at 5,000 volts D.C for 15 minutes, under IEEE 400.(3) Acceptance Test Standard.

2. Circuit Continuity: Test all feeder and branch circuits for continuity. Test all neutrals for improper ground.

B. Equipment Operations: Test motors for correct operation and rotation.

C. Product Failure: Any products which fail during the tests or are ruled unsatisfactory by the Engineer shall be replaced, repaired, or corrected as prescribed by the Engineer at the expense of the Contractor. Tests shall be performed after repairs, replacements, or corrections until satisfactory performance is demonstrated.

D. Miscellaneous: Include all test results in the maintenance manual. Cost, if any, for all tests shall be paid by the Contractor.

1.13 DRAWINGS

A. Layout: General layout shown on the drawing shall be followed except where other work may conflict with the drawings.

B. Accuracy:

1. Drawings for the work under this section are diagrammatic.

2. Contractor shall verify lines, levels, and dimensions shown on the drawings and shall be responsible for the accuracy of the setting out of work and for its strict conformance with existing conditions at the site.

3. Contractor shall insure reconnection of existing equipment and circuits affected by contract demolition whether or not reconnection is specifically shown on the contract documents.

1.14 PROJECT RECORD DRAWINGS

A. Refer to General Conditions for contractual requirements. Provide project record drawings as required by the General Provisions of the specifications and as required herein. Such drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit and wire sizing as well as routing, revised fixture schedule listing the manufacturer and products actually installed and revised panel schedule. All changes to drawings shall be made by qualified draftspersons to match existing linework and lettering as close as possible. When all the changes have been made to the trade drawings, contractor shall produce one (1) full size (E-Size) updated set of trade drawing(s) utilizing AutoCad 2008 or newer and supply one (1) set of Compact Discs (CD's) reflecting same.

1.15 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Furnish to the Engineer four (4) hard back 3-ring binders containing all bulletins, operating and maintenance instructions and part lists and other pertinent information for each and every piece of equipment furnished under this specification. Include service telephone numbers. Each binder shall be indexed into sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

B. At the time of completion, a period of not less than eight hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with manufacturer's representative. The equipment manufacturer shall be requested to provide product literature and application guides for the user's reference. Costs, if any for the above services shall be paid by the Contractor.
1.16 Warranties
   A. Furnish to the Campus three (3) and to the Engineer one (1) hard back 3-ring binders
      containing all warranties of every piece of equipment furnished under this specification. Include
      terms and limitations of warranties, contact names, addresses, and telephone numbers of
      manufacturer. Each binder shall be indexed into sections and labeled for easy reference for
      each equipment warranty.

1.17 Extra Materials
   A. See Division 1 - Product Requirements, for additional provisions.
   B. All special tools for proper operation and maintenance of the equipment provided under this
      Section shall be delivered to the District's representative

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 Workmanship
   A. Preparation, handling, and installation shall be in accordance with manufacturer's written
      instructions and technical data particular to the product specified and/or accepted equal except
      as otherwise specified. Coordinate work and cooperate with others in furnishing and placing
      this work. Work to reviewed shop drawings for work done by others and to field measurements
      as necessary to properly fit the work.
   B. Conform to the National Electrical Contractor's Association "Standard of Installation" for general
      installation practice.

3.02 Installation
   A. Install in accordance with manufacturer's instructions.

3.03 Starting Equipment and Systems
   A. Provide manufacturer's field representative to prepare and start equipment.
   B. Adjust for proper operation within manufacturer's published tolerances.
   C. Demonstrate proper operation of equipment to Campus's designated representative.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit, raceways and fittings.
B. Wires and Cables for 600 Volts and less.
C. Wire connections.
D. Wire devices.
E. Outlet boxes.
F. Pull and junction boxes.
G. Disconnect Switches.
H. Fuses.
I. Supporting Devices.
J. Identifying Devices.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Division 1 the following items:
B. A list of conduit types indicating where each type of conduit will be used. Indicate conduit manufacturers and fittings to be used.
C. Wires and Cables.
D. Wiring Devices and Plates
E. Nameplates, including engraving schedules where engraved plates are specified.

1.03 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCES

B. ANSI C80.3 - American National Standard for Steel; Electrical Metallic Tubing, Zinc Coated - latest edition.
C. ANSI C80.5 - Rigid Aluminum Conduit - latest edition.
D. NECA (INST) - National Electrical Contractors Association; Standard for Installing Steel (Rigid, IMC, EMT) - latest edition.
E. NEMA FB 1 - National Electrical Manufacturers Association; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable Assemblies; latest edition.
F. NECA 1 - National Electrical Contractor Association; Standard Practices for Good Workmanship in Electrical Contracting; 2006
I. NEMA 3R - National Electrical Manufacturer Association; Indoor and Outdoor Protected Enclosure; 2005

PART 2 PRODUCTS

2.01 CONDUIT, RACEWAYS AND FITTINGS

A. Rigid Steel Conduit
   1. Rigid steel conduit shall be full weight, pipe size, finished inside and out by hot-dip galvanizing after fabrication, and shall conform with ANSI C80.1 and UL.
   2. Couplings shall be electroplated steel.
   3. Insulating Bushings: Threaded polypropylene or thermo-setting phenolic rated 150°C minimum.
   4. Insulated grounding Bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
   5. Insulated Metallic Bushings: Threaded cast malleable iron body with plastic insulated throat rated 150°C.
   6. Running threads are not acceptable.

B. Electrical Metallic Tubing (EMT):
   1. Conduit: Conduit shall be formed of cold rolled strip steel, and shall comply with ANSI C80.3 and UL requirements.
   2. Couplings: Electroplated steel, UL listed rain and concrete tight through 1-1/4" trade size. All EMT fittings shall be compression type.
   3. Connectors: Steel, gland compression type with insulated plastic throat, 150°C temperature rated. All EMT fittings shall be compression type.

C. Liquid Tight Flexible Metal Conduit:
   1. Conduit: Conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound. Flexible conduit, except where installed in concealed dry locations, shall be liquid tight with plastic jacket extruded over the outer zinc coating. No aluminum substitute will be accepted.
   2. Fittings: Connectors shall be the screw clamp on screw-in (Jake) variety with cast malleable iron bodies and threaded male hubs with insulated throat or insulated bushings. Set screw type connectors are not acceptable. Liquid tight fittings shall be of cadmium plated cast malleable iron, with insulated throat.

D. Rigid Non-Metallic Conduit:
   1. Conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could damage conductors or cables.

2.02 WIRING AND CABLES

A. Acceptable manufacturers: Cerro Wire Inc, Southwire, Industrial Wire & Cable or approved equal.

B. Conductor material: All wire and cable shall be insulated, stranded copper conductors. Soft drawn annealed copper wire 98% conductivity, bearing the UL label.

C. Minimum conductor size: AWG No. 12 for all power and lighting branch circuits. AWG No. 14 for all signal and control circuits.

D. Color Coding: System conductors shall be identified as to voltage and phase connections by means of color impregnated insulation or approved colored marking tape as follows:

   E. For 120/240 volt, single phase, 3 wire system.
      1. Phase A - Black
      2. Phase B - Red
      3. Phase C - Orange for High Leg (208v to neutral)
      4. Neutral - White
      5. Ground - Green
F. For 120/208 volt, 3 phase, 4 wire systems.
   1. Phase A - Black
   2. Phase B - Red
   3. Phase C - Blue
   4. Neutral - White
   5. Ground - Green

G. For 277/480 Volt, 3 phase, 4 wire system
   1. Phase A - Brown
   2. Phase B - Orange
   3. Phase C - Yellow
   4. Neutral - Grey
   5. Ground - Green

H. Secondary Wire and Cable, 0 to 600 Volts;
   1. NEC Type THWN, or Type XHHW for feeders and branch circuits in wet or dry locations.
      NEC type THHN for branch circuits in dry locations.

2.03 WIRE CONNECTION

A. Wire Joints: Wires in sizes from #18 to #8 AWG, stranded conductor, with insulation rated 105
   degrees C, or less shall be joined with electrical spring connectors of three part construction
   incorporating a non-restricted, zinc coated steel spring enclosed in a steel shell with an outer
   jacket of vinyl plastic with a flexible insulating skirt.

B. Mechanical Compression Connectors and Taps: Stranded conductors from #6 AWG to 750
   Kcmil shall be joined or tapped using bolted pressure connectors having cast bronze
   compression bolts. Fittings shall be wide range-taking and designed to facilitate the making of
   parallel taps, tees, crosses or end-to-end connections. Split-bolt connectors will not be
   acceptable.

C. Fixture Connections: Splice fixture wire to circuit wiring with solderless connectors as specified
   above in paragraph A.

D. Terminating Lugs: Conductors from size No. 6 AWG to 750 Kcmil, copper, shall be terminated
   using tin plated hydraulically operated crimping tools and dies as stipulated by the lug
   manufacturer. Lugs shall be 3M "Scotchlok" series 30000, Burndy Type Ya-L series, or equal.

E. Splicing and Insulating Tape (600 volts and below): General purpose electrical tape shall be
   suitable for temperatures from minus 18 degrees C to 105 degrees C, shall be black, ultraviolet
   proof, self-extinguishing, 7 mil thick vinyl with a dielectric strength of 10,000 volts. Apply 4
   layers half-lap with 2" over-lay on each conductor.

F. Insulating Putty (600 volts and below): Pads or rolls of non-corrosive, self-fusing, one eight inch
   thick rubber putty with PVC backing sheet. Putty shall be suitable for temperatures from minus
   17.8 degrees C to 37.8 degrees C and shall have a dielectric strength of 570 volts/mil minimum.

G. Insulating Resin: Two Part liquid epoxy resin with resin and catalyst in pre measured, sealed
   mixing pouch. Resin shall have a set up time of approximately 30 minutes at 21.1 degrees C,
   and shall have thermal and dielectric properties equal to the insulation properties of the cables
   immersed in the resin.

H. Terminal Strip Connectors: Terminate wire in locking tongue style, pressure type, solderless lug
   where applicable.

2.04 WIRING DEVICES

A. Switches: Specification grade, flush mounting, quiet operating AC type, with toggle operator,
   heat resistant plastic housing and self grounding metal strap. Silver or silver alloy contact. Rated
   20A at 120-277V and capable of full capacity on tungsten or fluorescent lamp load. Design for
   up to #10 wire. Use single pole, double pole, three-way, four-way, lighted, pilot, or keyed type,
   as indicated on drawings or required. Provide ivory color unless otherwise noted. Manufacturer:
   Leviton, Arrow Hart, or Hubbell.
B. Receptacles: Specification grade, flush mounting receptacles with nylon face. High grade brass allow triple wipe contacts. Provide 2 pole, 3 wire grounding type with a green colored brass hexagonal equipment grounding screw. Grounding shall be rivetless, single piece brass with no mechanical connections in the primary path between point of ground wire termination and ground blades. Use 20A rated receptacles, ivory in color, unless otherwise noted. Manufacturer: Leviton, Arrow Hart, or Hubbell.
   1. Isolated Ground - Provide separate path to ground, with orange faceplate or triangle to indicated isolated ground
   2. GFCI - Equipped with diagnostic indicator for miswiring.
   3. Weatherproof - GFCI type, outdoor rated, with metal lockable while in use cover
C. Faceplates: Provide nylon cover faceplates for wall receptacles, outlets, and switches. Include thermal mounting screws that match plate and device color. Manufacturer: Leviton, Arrow Hart, or Hubbell.

2.05 OUTLET BOXES
A. Standard outlet boxes: Galvanized, die formed or drawn steel, knock-out type of size and configuration best suited to the application indicated on the plans. Minimum box size, 4 inch square by 1-1/2 inch deep, indoor use. FS cast boxes are required for outdoor use.
B. Cast Metal Outlet Boxes: FS/FD cast boxes are required for outdoor use. Malleable iron alloy with threaded hubs and mounting lugs as required. Boxes shall be furnished with cast cover plates of the same material as the box and neoprene cover gaskets. Thomas and Betts, Crouse-Hinds, Appleton or equal.
C. Conduit Outlet Bodies: Cadmium plated, cast iron alloy. Obround conduit outlet bodies with threaded conduit hubs and neoprene gasketed, cast iron covers. Outlet bodies shall be used to facilitate pulling of conductors or to make changes in conduit direction only. Splices are not permitted in conduit outlet bodies. Thomas and Betts, Crouse Hinds Form 8 Condulets, Appleton form 35 Unilets, or equal.

2.06 PULL AND JUNCTION
A. Sheet Metal Boxes: Use standard outlet or concrete ring boxes wherever possible; otherwise use minimum 15 gauge get metal, NEMA 1 boxes, sized to code requirements with covers secured by cadmium plated machine screws located 8 inches on centers. Circle AW Products, Hoffman Engineering Co., or equal.
B. Cast Metal Boxes: Use standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron junction boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets. Appleton FS/FD series; Crouse Hinds FS/FD series, or equal.

2.07 DISCONNECT SWITCHES
A. All disconnect switches shall be heavy-duty type and have the number of poles, voltage rating, and horsepower rating as required by the motor or equipment. Disconnect switches shall be in enclosures to suit conditions, NEMA 1 for indoor and NEMA 3R for outdoor. Disconnect switches shall be fused unless otherwise noted on the drawings. As manufactured by: Eaton Cutler-Hammer, Square D - Class 3110, or equal.

2.08 COMBINATION MOTOR STARTER DISCONNECTS
A. NEMA 1, for indoors, sized per motor nameplate. Minimum size 1
B. NEMA 3R, for outdoors, sized per motor nameplate. Minimum size 1
C. Fuminish with Hand Off Auto (HOA) with indicator lights and disconnect handle switch

2.09 FUSES
A. Dual Element, Time Delay, UL Class RK5. Rejection type. Size and Voltage as indicated on equipment. Bussman, Little Fuse, or approved equal.
2.10 ELECTRICAL SUPPORTING DEVICES

A. Concrete Fasteners: Phillips "Red-Head" or equal, self drilling expansion type concrete anchor.

B. Conduit Straps: Hot-dip galvanized, cast malleable iron, two hole type strap with cast clamp-backs and spacers as required. OZ/Gedney No. 14-50G strap and #141G spacer; Efor No. 231 strap, and No. 131 spacer; or approved equal.

C. Construction Channel: 1-1/2 inch by 1-1/2 inch 12 gauge galvanized steel channel with 9/16 inch diameter bolt holes, 1-1/2 inch on center, in the base of the channel. Kindorf 905 series, Unistrut P-1000-HS or equal.

D. Cable Ties and Clamps: Thomas and Betts Co. "Ty-Raps" Panduit "Pan-Ty" or equal one piece, nylon, reusable type lashing ties.

E. Fasteners (General): Wood screws for fastening to wood. Machine screws for fastening to steel. Toggle bolts for fastening to hollow concrete block, gypsum board, or plaster walls. Expansion anchors for attachments to pre-poured concrete.

2.11 IDENTIFYING DEVICES

A. Nameplates: Type NP: Engraved black bakelite, 1 inch by 3-1/2 inch, 1/8 inch high white letters, machine screw retained. For permanent identification of all switchboards, panelboards, circuit breakers in separate enclosures, motor starters, relays, time switches, disconnect switches and other cabinet-enclosed apparatus including terminal cabinets or match existing as closely as possible.

B. Legend Plates: Type LP: Die-stamped metal legend plate with mounting hole and positioning key for attachment to panel mounted operators' devices. Engraved paint-filled characters as specified.

C. Wire & Terminal Markers: Self-adhering, pre-printed vinyl with self-laminating wrap around strip. Markers shall be legible after termination. Brady B191 series, Thomas & Betts WSL series or equal.

D. Conductor Phase Markers: Thomas & Betts WCPHAS series or similar in addition to colored marking as specified under this section of the specifications.

PART 3 EXECUTION

3.01 CONDUIT AND RACEWAY APPLICATIONS

A. Rigid Steel Conduit: Use rigid steel conduit for the following locations or conditions:
   1. All exterior applications
   2. All conduits larger than 2" trade diameter.
   3. All conduits indoor below eight (8) feet above finished floor.

B. Electrical Metallic Tubing (EMT): EMT is allowed for the following conditions:
   1. Interior only and above eight (8) feet from finished floor.
   2. Interior only and when entering a panel from above.

C. Liquidtight Flexible Metallic Conduit: Use Liquidtight for the following conditions:
   1. In damp and wet locations for connections to motors, transformers, vibrating equipment and machinery.
   2. Connections to all pump motors, flow switches, and similar devices.

D. Rigid Non-Metallic Conduit, Polyvinyl Chloride (PVC) Schedule 40:
   1. Underground installation.

3.02 CONDUIT INSTALLATION

A. General
   1. All conduit runs shown on the plans are sized based on the use of rigid steel conduit and THWN copper conductors. If conductor type is changed the contractor shall be responsible for resizing conduits to meet code. In no case is conduit to be sized smaller than 3/4" trade diameter.
   2. Low voltage wiring shall be installed in conduit, minimum 3/4" trade diameter.
3. Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.
4. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading.
5. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field threaded joints to prevent corrosion.
6. In all empty conduits or ducts, install an 1100 pound tensile strength polyethylene pulling rope.
7. Conduit systems shall be electrically continuous throughout. Install code size, uninsulated, copper grounding conductors in all conduit runs, grounding conductor shall be bonded to conduit, equipment frames and properly grounded.

B. Layout:
1. All new conduits shall be concealed. Any field conditions that does not allow concealment of conduits shall be reviewed with the Engineer prior to rough-in.
2. Locations of conduit runs shall be planned in advance of the installation and coordinated with concrete work, plumbing and framing.
3. Where practical install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary off-sets.
4. Low voltage conduit shall be grouped separately and labelled every 10 ft interval as to system (i.e. fire, control, etc)
5. Exposed conduit shall be run parallel or at right angles to the centerlines of the columns and beams.
6. Conduits shall not be placed closer than 12 inches from a parallel hot water or steam line or three inches from such lines crossing perpendicular to the runs.
7. In long runs of conduit, provide sufficient pull boxes per NEC inside buildings to facilitate pulling wires and cables. Support pull boxes from structure independent of conduit supports. These pull boxes are not shown on the plans.

C. Supports:
1. All raceway systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to Code.
2. Support single runs of conduit using two hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp blocks" to space conduit off the surface.
3. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from 3/8 inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard two hole pipe clamps. Provide lateral seismic bracing for hangers.
4. Installation
   a. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
      1) Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
      2) Do not drill or cut structural members.
   b. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
   c. Install surface-mounted cabinets and panelboards with minimum of four anchors.
   d. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
   e. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

D. Terminations and Joints:
1. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
2. Rigid conduit connection to enclosures shall be made by Myers type grounding hubs only. EMT connections to enclosures shall be made with compression connector with grounding lock-nuts or bushings.
3. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using appropriate connectors and hubs.
4. Install expansion couplings where any conduit crosses a building separation or expansion joint.
5. Install cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or caulk conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.

E. Penetrations:
1. Furnish and install metal sleeves for all exposed interior conduit runs passing through concrete floors or walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack, grouting compound.
2. Install specified watertight conduit entrance seals and membrane clamps at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be insulated rigid steel.
3. Conduits penetrating rated walls, floors, etc. shall be fireproofed.

3.03 CABLE AND WIRE INSTALLATION

A. Examination
1. Verify that interior of building has been protected from weather.
2. Verify that mechanical work likely to damage wire and cable has been completed.
3. Verify that raceway installation is complete and supported.
4. Verify that field measurements are as indicated.

B. Preparation
1. In existing conduits that will be reused, pull out existing conductors.
2. Completely and thoroughly swab raceway before installing wire.
3. Use 50/50 solution of Simple Green. Use CO2 to blow water and soap into conduit - let soak to break up dried out pulling compounds, then pull conductors. Pull one conductor at a time if will not pull all out together.

C. General:
1. Conductors shall not be in conduit until all work of any nature that may cause injury is completed. Care should be taken in pulling conductors that insulation is not damaged. U.L. approved non-petroleum base and insulating type pulling compound shall be used as needed.
2. All cables shall be installed and tested in accordance with manufacturer’s requirements and warranty.
3. Block and tackle, power driven winch or other mechanical means shall not be used in pulling conductors of size smaller than AWG #1.

D. Splicing and Terminating:
1. All aspects of splicing and terminating shall be in accordance with cable manufacturer’s published procedures.
2. Make up all splices in outlet boxes with connectors as specified herein with separate tails of correct color to be made up to splice. Provide at least six (6) inches of tails packed in box after splice is made up.
3. All wire and cable in panels, control centers and equipment enclosures shall be bundled and clamped.
4. Encapsulate splices in exterior outlet, junction and pull boxes using insulating resin kits. All splices for exterior equipment in pump rooms shall be made up watertight.
5. Insulate mechanical compression taps AWG #1/0 and larger using pre-molded, snap-on insulating boots or specified conformable insulating putty overwrapped with two half-lapped layers of insulating tape.

E. Identification:
1. Securely tag all branch circuits, noting the purpose of each. Mark conductors with vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each circuit with the corresponding circuit number at the panelboard.
2. Color code conductors size #6 and larger using specified phase color markers and identification tags.
3. All terminal strips are to have each individual terminal identified with specified vinyl markers.
4. All identification shall be legible and readable after completion of installation.

3.04 INSTALLATION:

A. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
   3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

B. Install wire and cable in accordance with the NECA "Standard of Installation."

C. Use wiring methods indicated.

D. Pull all conductors into raceway at same time.

E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

F. Protect exposed cable from damage.

G. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

H. Use suitable cable fittings and connectors.

I. Neatly train and lace wiring inside boxes, equipment, and panelboards.

J. Clean conductor surfaces before installing lugs and connectors.

K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

L. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.

M. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Q. Trench and backfill for direct burial cable installation as specified in Underground Structure Section. Install warning tape along entire length of direct burial cable.

3.05 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.
E. Provide cord and cap where field-supplied attachment plug is required.
F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
H. Install terminal block jumpers to complete equipment wiring requirements.
I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.06 INSTALLATION OF BOXES
A. General:
1. Leave no un-used openings in any box. Install close-up plugs as required to seal openings.
2. Exposed outlet boxes and boxes in damp or wet locations shall be cast metal with gasketed cast metal cover plates.

B. Box Layout:
1. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
2. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Consult wire and cable manufacturer.

3.07 INSTALLATION OF WIRING DEVICES
A. General
1. Install all devices flushmounted unless otherwise noted on the drawings. Comply with layout drawings for general locations. Consult Engineer or District's Representative for locations that have conflict with other devices or manner not suitable for installation. Avoid placing devices behind open doors.
2. Align devices horizontally and vertically. Device plates shall be aligned vertically with tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
3. Mounting height as indicated on the drawings and according to ADA requirements.
4. Install device plates on all outlet boxes. Provide blank plates for all empty, spare, and boxes for future use.
5. Securely fasten devices into boxes and attach appropriate cover plates.
6. Caulk around edges or outdoor device plates and boxes when rough wall surfaces prevent raintight seal. Use caulking materials approved by Engineer. Fireproof around opening of devices located or penetrating firerated construction assemblies.
7. Fireproof around opening of devices located or penetrating firerated construction assemblies.

B. Switches
1. Where switches are indicated to be installed near doors, corner walls, etc. mount not less than 2 inches and not more than 18" from trim. Verify exact location with Architect or Engineer prior to rough-in.
2. Coordinate the location of switches to insure locations at the strike side of doors.
3. Furnish and install engraved legend of each switch that controls exhaust fans, motors, equipment systems, etc. not located within sight of the controlling switch.
4. Ganging of Switches - provide barriers for switches of difference phases and voltages. Otherwise switches shall be gauged in one faceplate.

C. Receptacles
1. Mount receptacles vertically with U-shaped ground position on bottom.
2. Do not combine GFCI protected circuits with other circuits in the same raceway. Limit number of GFI protect circuits in any one raceway to a maximum of one (1) circuit.
D. Identification
   1. Label all outlets and switches. Mark each wiring device where circuits and panel supply is derived from.
   2. All identification shall be legible and readable after completion of installation.

3.08 INSTALLATION OF FUSES AND DISCONNECT SWITCHES
   A. Fuses shall be installed where noted on plans. Sizes are based on design data provided by equipment mfg. Listed or labeled equipment must be in accordance with instructions included in the listing or labeling. Be sure to observe maximum branch circuit fuse size labels.
   B. Disconnect switches shall be mounted on the equipment, where possible. Coordinate with mechanical contractor to ensure switches are not mounted on a removable access panel.
   C. Label each disconnect fuse with equipment tag as indicated in the single line diagram, or as directed.

3.09 WORKMANSHIP
   A. Preparation, handling, and installation shall be in accordance with manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Coordinate work and cooperate with others in furnishing and placing this work. Work to reviewed shop drawings for work done by others and to field measurements as necessary to properly fit the work.
   B. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

3.10 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Coordinate with all other trades before installation. Notify engineer of any discrepancies immediately.
   C. Perform field inspection prior to installation of any equipment or devices.

END OF SECTION
SECTION 26 05 13
MEDIUM-VOLTAGE CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Medium voltage cable.
B. Cable terminations

1.02 REFERENCE STANDARDS
B. IEEE 386 - Separable Insulated Connectors for Power Distribution Systems above 600 volts.
C. IEEE 404 - Power Cable Joints
D. IEEE 592 - Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.
E. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
G. AEIC CS-6 - Association Electric Illuminating Company
H. ICEA S-68-516 - Insulated Cable Electric Association
I. UL MV-105 - Underwriter's Lab
J. NFPA 70 - National Electrical Code; 2008. Article 310 - Type MV-90-UL

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Provide for cable, terminations, and accessories.
C. Samples: Submit two samples of each size cable, 24 inches in length.
   1. Select each length to include complete set of manufacturer markings.
   2. Attach tag indicating cable size and application information.
D. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage. Submit six (6) copies of certified factory test reports and four (4) copies of field test reports.
   1. Perform Factory high voltage AC and DC corona level tests per NEMA WC-AEIC Standards on each length of cable. Submit certified reports of the factory tests, together with all data necessary to determine that cable is as specified, including type of conductor, AWG size and stranding; type and thickness of insulation and jacket; type of shielding; insulation resistance constant corrected to standard temperature; voltage rating. Use standard ICEA terminology in reports.
   2. Perform field tests as noted in these specifications and per NETA Standard Acceptance Testing.
E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Project Record Documents: Record actual sizes and locations of cables.
G. Certificate of Compliance: Indicate approval of installation by Campus Facilities electrical department.
H. Warranty: Cables shall be warranted for 40 years minimum.
I. Maintenance Data: Include instructions for testing and cleaning cable and accessories.
J. Prior to installation, submit for approval calculated allowable pulling tensions and projected tensions. Measure pulling tensions and submit for approval. State allowable sidewall pressure in pounds and calculated values. State and provide jaw ratio calculations.

1.04 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
C. Each reel shall have printed on reel or a weather-proof (metal or plastic) tag firmly attached indicating: Manufacturer's Name, Conductor Material, Conductor Size, Insulation type and thickness, Jacket thickness, Temperature rating, Length of cable, Manufacturer's type, Voltage class, PO Number, Cable weight, Reel weight, and if shielded or non-shielded.
D. Each reel shall be lagged with suitable lagging to protect cable from damage during shipping. Cable ends shall be sealed to prevent the entrance of water.
E. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.
1. Submit medium voltage cable splicer/terminator certification of competency and experience 20 days before splices or terminations are made in medium voltage cables. Splicer/Terminator experience during the immediate past 3 years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.
2. Utilize companies regularly engaged in cable splicing; Californina Splicing (Pleasanton, CA); High Voltage Splicing (Danville, CA); PCS Corp (Concord, CA), and STT.
F. Acceptance Testing: Contractor shall hire an independent testing agency experienced in high voltage testing to test medium voltage cable. Testing agency qualification shall be submitted to Engineer for review and approval. Acceptable testing agencies shall be as specified in section 26-08-02 - Electrical Acceptance Testing
G. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS
2.01 CABLE
A. Manufacturer: Okonite or approved equal
B. General: Furnish, install and test cable manufactured per latest applicable requirements of ASTM, IEC, UL, and AEIC for service specified.
1. All cable must have been manufactured within one year of purchase.
2. The Engineer may require that adequate service records be submitted to prove competence of cable manufacturer.
C. The cable shall be suitable for use in wet and dry locations in conduit, underground duct systems, direct burial, an aerial installation. The cable shall be rated 105 degree C for normal operation, 130 degree C for emergency overload operation and 250 degree C for short circuit conditions. Emergency overload operation may occur for periods up to 1500 hours cumulative during the life of the cable.
D. Technical Requirements
1. Voltage and Gauge: As per Construction Drawings
2. Conductor: Uncoated soft copper compact stranded.
3. Conductor shield: Extruded layer of semiconducting EPR thermosetting compound.
4. Insulation: The insulation shall be EPR. The ethylene content in the elastomer used shall not exceed 72% by weight of ethylene nor shall the insulation contain any polyethylene, both features to limit the degree of susceptibility to treeing experienced by highly crystalline materials. The minimum average insulation thickness shall be 220 mils (133% insulation level). The insulation shall be compounded by the cable manufacturer in its own facility.
using a closed system to insure maximum cleanliness. The EPR insulation system shall be triple tandem extruded with the EPR conductor and insulation shields to prevent intersurface contamination. The extrusion operation shall be performed by three separate in line extruder heads thereby permitting the measurement and accurate individual control of the wall thickness of each layer of compound as the cable is being manufactured.

5. Insulation shield: Extruded layer of semiconducting EPR thermosetting compound.
6. Metallic shield: Bare 5 mil copper tape helically applied.
7. Jacket: Black flame retardant PVC.

E. Cable Test: Cable shall be tested in accordance with AEIC CS-8

2.02 CONDUCTOR PULLING LUBRICANT:
A. Manufacturer: General Machine Products Inc., Trevose, PA or equal.
B. Winter grade lubricant, suitable for use at all temperatures down to 9 degrees F (-18C).
C. Slip X-300 compound available from the American Colloid Co. of Skokie, Illinois, or Winter Grade No. 7438-PC.

2.03 SPLICES
A. Manufacturer: Hubbel Power Systems, 3M, Elastimold, or Raychem.
B. The materials shall be compatible with the conductors, insulations and protective jackets on the cables and wires and as recommended by cable manufacturer. Submit vendor data of splicing material and obtain approval before proceeding with splicing operations.
C. The splices shall insulate and protect the conductors not less than the insulation and protective jackets on the cables and wires which protect the conductors. In locations where moisture might be present, the splices shall be watertight. In manholes, the splices shall be submersible.
D. Splicing and Terminating Fittings:
1. Shall be heavy duty, pressure type fittings which will assure satisfactory performance of the connections under conditions of temperature cycling and magnetic forces from available short circuit currents.
2. The fittings shall be suitably designed and the proper size for the cables and wires being spliced and terminated.
3. Where the Engineer determines that unsatisfactory fittings have been installed, remove the unsatisfactory installations and install approved fittings at no additional cost to the Owner.

2.04 TERMINATIONS
A. Manufacturer: Hubbel Power Systems, 3M, Elastimold, or approved equal.
B. Type: Class 1 terminations in accordance with IEEE Standard 48.
C. Ratings:
1. Maximum Voltage: 15kV
2. Continuous Current: 200A LoadBreak and 600A Non-LoadBreak
3. BIL Rating: 95kV BIL
4. AC Withstand Voltage: 34kV
5. DC Withstand Voltage: 53 kV
D. Terminations:
1. 2 Hole NEMA Pad Type Termination: Typical for Switchgear, Cold or Heat Shrink
E. Terminating Kits
1. General:
a. Shall be assembled by the manufacturer or supplier of the materials and shall be packaged for individual terminations.
b. Shall consist of materials designed for the cables being terminated and shall be suitable for the prevailing environmental conditions.
c. Shall include detail drawings and printed instructions for each type of termination being installed, as prepared by the manufacturers.
d. Detail drawings and printed instructions shall indicate the cable type, voltage rating, manufacturer’s name and catalog numbers for the materials indicated.
e. Cold Shrink Terminations shall be used from dry indoor type of terminations. Heat Shrink Terminations shall be used for damped, outdoor type of terminations.

2. Taped Terminations:
a. Insulating and semi-conducting rubber tapes shall withstand 200 percent elongation without cracking, rupturing or reducing their electrical and self-bonding characteristics by more than 5 percent.

3. Stress Cone: Stress cones shall be either of wrapped tape construction or preformed rubber cone with the semiconducting inlay for shield termination and shall be Class 1 terminations in accordance with IEEE Standard 48. Materials, procedures, and dimensions shall only be as supplied by 3M, Elastimold, or equal, for specific cable and size and type used. Finished termination shall be rated 95kV BIL minimum. Stress cones shall be provided with #8 AWG minimum, stranded copper, 24 inch length grounding lead clamped to cable shield with strap type clamp at base of stress cone. The entire outer surface of each stress cone projecting cable insulation and base of cable lug shall be taped and sealed to prevent intrusion of moisture into cable laminations.

4. Live End Seals: Heat shrink live end seals, for use with 5kV VCL cable and 15kV EPR cable, Raychem HVEC, Scotch 3M or equal.

F. Premolded Rubber Terminations
1. Shall be used to sectionalize cables or as feedthru’s for making lateral taps. Each tap/junction works independently of the others contained on the same unit. Number of junctions as specified in the drawings.
2. Material: All Copper designed
3. Mounting: Corrosion-resistant stainless steel mounting bracket. Provide for backplate mounting angles of 30, 45, or 60 degrees, and adjustable for horizontal mounting to a flat surface.
4. Terminations shall be in accordance with IEEE 48, 386, 404, and 592.
5. Premolded rubber devices shall have a minimum of 0.125 inch semi-conductive shield material covering the entire housing. Test each rubber part prior to shipment from the factory.
6. Grounding of metallic shields shall be accomplished by a solderless connector enclosed in a watertight rubber housing covering the entire assembly. The grounding device and splice or terminator shall be of same manufacturer to insure electrical integrity of the shielded parts.
7. The premolded parts shall be suitable for indoor, outdoor or submersible applications.

G. Elbow Connectors
1. Elbow Type: 600A Non-Load Break, as noted in plans.
2. Material: All Copper designed
3. Molded external shield-conductive, abrasion resistant 1/8- inch thick shield of peroxide cured EPDM
4. Cable entrance - has conductive rubber stress relief area which contacts extruded cable. Compression Connector - Sized for the specific conductor size. Crimped with standard tools and dies.
5. Test Point - Designed to allow voltage indication when readout is made with suitable high impedance measuring devices.
6. Grounding Tab - Designed to accept a single #14 awg copper wire that can be inserted into the eye. Provides a static ground to ensure personnel safety.
7. Elastimold 160 series equipment with stick operable connectors, or RTE, no substitutions. All equipment numbers are Elastimold:
a. Elbow connectors with voltage test point, 200A: #166LR.
b. Grounding devices: 20MA.
c. Load break operating kit.
1) Carry Case #1BG-1.
2) Test rod #370TR.
3) Grounding Elbow #160GLR (3).
4) Insulated Cap with Ground #160DRG (6).
5) Feed Thru #163FT (3).
6) Lubricant #SG-5.
7) Stand off Plug #600SOP (3).
8. System shall be rated: 15kV, BIL-95kV impulse voltage, 1.2 x 50 microsecond wave; AC withstand 34kV, 60Hz, 1 minute, DC withstand 53kV, 15 minutes: Corona extinction voltage 11kV; 900 amp continuous; 25,000 amp rms sym .17 sec.; reduction test Corona extinction voltage: 19kV minimum, (test at 3 pc. sensitivity), and either impulse or AC withstand to meet ratings above.

2.05 FIREPROOFING TAPE
A. Manufacturers Scotch 3M, Permacel or equal.
B. The tape shall consist of a flexible, conformable fabric coated on one side with flame-retardant flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick and shall weigh not less than 2.5 pounds per square yard.
C. The tape shall be noncorrosive to cable sheath, shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.
D. The tape shall not deteriorate when subjected to water, oil, gasses, salt water, sewage, or fungus. It shall be resistant to sunlight and ultraviolet light.
E. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.
F. Securing tape: Shall be glass cloth electrical tape not less than 7 mils thick, and 3/4 inch wide.

2.06 ACCESSORIES
A. Wire Tags Identify cables by engraved or embossed tags. Tags shall be minimum 3/4 inch wide, length as required by inscription. Manufacturer: Tech Products Inc. or Seton Nameplate Corp.
B. Markers: Pre-marked Self-Adhesive Tags. Thomas and Betts, W.H. Brady, or E-Z Code.
C. Cable Racks and Supports: Cable racks, supports, and fittings for use in corrosive underground location and shall be provided with a factory applied PVC coating of at least 20 mils thick. All racks, supports and fittings shall be UL listed heavy duty, non-metallic, and UL listed.
D. Fireproofing Tape:
   1. Product: The tape shall consist of a flexible, conformable fabric coated on one side with flame retardant flexible, polymeric coating and/or chlorinated elastomer not less than 0.050 inch thick and shall weight not less 2.5 pounds per square yard.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that conduit, duct, trench, or manholes are ready to receive cable.
B. Verify that field measurements are as indicated.
C. Verify routing and termination locations of cable bank prior to rough-in.
D. Observe all National Electric Code rules regarding installation. Check the conduit and wire sizes and actual overall diameters to be sure the approved conduit fill will not be exceeded.
E. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.
3.02 PREPARATION
A. Pull a short mandrel or plug closely approximating the diameter of the conduit through to loosen any burns, and check obstructions. Follow it up with a swab to clean out any remaining dirt or foreign matter.
B. Do not pull cable into duct or conduit until factory test reports of cable have been approved.
C. Use swab to clean conduits and ducts before pulling cables.
D. Verify and match existing system phase and rotation at each interface with existing cables or equipment. Provide the appropriate equipment to properly install cables.

3.03 INSTALLATION
A. Cable Installation
1. Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling-in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.
2. Avoid abrasion and other damage to cables during installation. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, hand turning reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation
3. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
4. Pulling shall be stopped immediately with any indication of binding or obstruction and shall not be resumed until such difficulty is corrected. Sufficient slack shall be provided for free movement of cable due to expansion or contraction.
5. Sustain cable pulling tensions and bending radii below recommended limits. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
6. Ground cable shield at each termination and splice.
7. Install cables in manholes along wall providing longest route, with a minimum of one full loop around the perimeter of the manhole.
8. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable outside diameter. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
9. Arrange cable in manholes to avoid interference with duct entrances.
10. Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture with heat-shrinkable molded cable end caps.
11. Cable splices made up in manholes shall be firmly supported on cable racks as indicated. No cable splices shall be pulled in ducts. Cable ends shall overlap at the ends of a section to provide sufficient undamaged cable for splicing. Cables to be spliced in manholes shall overlap the centerline of the proposed joint by not less than 2 feet.
12. In manholes, underground raceways and other outdoor locations:
   a. Seal the cable ends prior to pulling them in to prevent the entry of moisture.
   b. For ethylene propylene rubber cables, use cabs of epoxy resin which are not less than 1/4 inch larger in diameter than the overall diameter of the cable. Clean each end of each cable before installing the epoxy resin over it.
13. Where cable exits ducts in manholes, add cable restraints to keep cables from creeping. Secure restraints to concrete wall with drilled inserts and turnbuckle.
14. Ground cable metallic shield to grounding system.

B. Fireproofing Tape Installation
1. Strips of fireproofing tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in half-lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts. To prevent unraveling, the fireproofing tape shall be randomly wrapped the entire length of the fireproofing with pressure sensitive glass cloth tape.

2. All medium voltage cables in manholes and inside electric rooms shall be taped as specified above.

C. Splices and Terminations

1. Splices shall be not be made unless specified or approved by the electrical engineer. Splices shall be made in manholes except where cable terminations are specifically indicated. Splicing and terminating of cables shall be expedited to minimize exposure and cable deterioration.

2. Install the materials as recommended by their manufacturer, including special precautions pertaining to air temperature during installation.

3. All termination and splices shall be supported in such manner so as to minimize physical stress on the splice connections. Each cable end termination shall be secured using a pair of saddle type supports under the cable end termination and/or cable with a minimum 12 inches and a maximum 30 inches separation between the supports. Cable end termination and cable shall be secured to the supports in such a manner as to prevent movement of termination or cable at the support. Saddle type supports shall be installed on galvanized steel framing channel anchored to the wall or securely fastened to the cable tray or installed by other approved methods.

4. Ethylene Propylene Rubber and Polyethylene Insulated Cables:
   a. Cables rated more than 8000 volts: Install terminations of premolded rubber splices and terminations.

D. Connector Installation

1. Use tools which are designed for the connectors being installed.

2. Round and smooth the installed connectors to minimize localized voltage stressing of the insulating materials.

3. Remove contaminants from all surfaces within the splices and terminations before installing the insulating materials.

4. Use mirrors to observe the installation of materials on the back sides of the splices and terminations.

5. Eliminate air voids throughout the splices and terminations.

3.04 FEEDER IDENTIFICATION

A. In each manhole, pull hole, pullbox, cable tray, switchgear, and switch, install permanent tags on each circuit’s cables and wires to clearly designate their circuit identification, voltage and phase. The tags shall be the embossed type and shall also show the cable type, size, and voltage rating.

B. Position the tags so they will be easy to read, attach with #14 TW wire, tie snug, do not crimp or dent conductor insulation. See drawings for description and coding.

3.05 GROUNDING

A. Ground all non-current carrying hardwares and metals. Include racks, supports, mounting hardwares, cable metallic shield, ladder, and metallic conduits. Bond to grounding electrode.

3.06 FIELD TESTS

A. General:

1. Test all cable per ICEA Standards for high-voltage DC test. Notify Owner of proposed date of test sufficiently in advance so that arrangements can be made to witness test.

2. For all new cable installation, perform test after all splices, terminations and connections are complete, except at point where cable under this Subcontract is to be connected to existing system. Disconnect all equipment from cable system during test.
3. Test voltage for 15kV cable shall be 80% of original factory test voltage, sustained for 15 minutes.

4. Test cable jackets from shield to ground in manholes at 7 kVDC for 1 minute after pulling. The electrical resistance factor or constant shall be higher than 30 mego-ohms per 1000 linear feet. Submit results for approval.

5. Submit copies of tests, properly labeled, to the Engineer for review. Include all necessary test information such as ambient temperature, weather conditions, current, voltage, cable length, size, etc.

B. High Potential Test:
   1. Prior to high potential test, test the cable and shields for continuity, shorts, and grounds.
   2. High potential test shall measure the leakage current from each conductor to the insulation shield. Use corona shields, guard rings, taping, mason jars, or plastic bags to prevent corona current from influencing the readings. Unprepared cable shield ends shall be trimmed back one inch or more for each 10kv of test voltage.
   3. Use DC tester specifically designed for the purpose, with overload or current-limiting devices to limit short current current. Raise voltage gradually in 10 percent steps to 80 percent of final voltage, then in 5 percent steps to final test voltage, which shall be left on for 5 minutes. Take current readings at each step after current has been established. Plot readings on graph paper. If breakdown is indicated during test by sudden increase in current, discontinue test, locate and remedy trouble, and repeat test. If breakdown is indicated, replace cable. Current reading shall be declining after 15 minute test and insulation factor shall exceed 20,000 mego-ohms per 1000 feet.

C. Safety Precautions:
   1. Exercise suitable and adequate safety measures prior to, during, and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltages.
   2. Provide surge protection at end of cable at 10% above DC test voltage to prevent cable damage due to surge voltages.

D. Test Voltages:
   1. New shielded EPR cable D.C. voltages shall be 65KV insulation level, 15KV rated cable; do not exceed manufacturer's rated voltages for cable with connectors.

E. High Potential Test Method:
   1. Apply voltage in approximately 8 to 10 equal steps.
   2. Raise the voltage slowly between steps.
   3. At the end of each step, allow the charging currents to decay, and time the interval of decay.
   4. Read the leakage current and plot a curve of leakage current versus test voltage on graph paper as the test progresses. Read the leakage current at the same time interval for each voltage step.
   5. Stop the test if leakage currents increase excessively or a "knee" appears in the curve before maximum test voltage is reached.
      a. For new cable, repair or replace the cable and repeat the test.
      b. For existing cable interconnected to new cable, notify the Engineer for further instructions.
   6. Upon reaching maximum test voltage, hold the voltage for five minutes. Read the leakage current at 30 second intervals and plot a curve of leakage current versus time on the same graph paper as the step voltage curve.
      a. Stop the test if leakage current starts to rise, decreases, or again starts to rise. Leakage current should decrease and stabilize for good cable.
   7. Terminate test and allow sufficient discharge time before testing the next conductor.

3.07 FIELD QUALITY CONTROL

A. Inspect exposed cable sections for physical damage.

B. Inspect cable for proper connections as indicated.
C. Inspect shield grounding, cable supports, and terminations for proper installation.
D. Inspect and test in accordance with NETA STD ATS, except Section 4.
E. Perform inspections and tests listed in NETA STD ATS, Section 7.3.3.

3.08 PROTECTION

A. Protect installed cables from entrance of moisture.

END OF SECTION
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding components for 600V and below include:
   1. Grounding and bonding components includes grounding electrodes and conductors, equipment grounding conductors, and bonding.

B. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal underground water pipe.
   3. Metal frame of the building.
   4. Rod electrodes.
   5. Grounding Electrode Conductors
   6. Equipment grounding conductors
   7. Bonding Conductors
   8. Concrete-encased electrode.
   9. Rod electrodes.

C. Grounding and bonding components for 1kV systems and above include:
   1. Metal frame of the building.
   2. Rod electrodes.
   3. Grounding Electrode Conductors
   4. Grounding Well
   5. Chain link fence

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.


D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 PERFORMANCE REQUIREMENTS

A. Measure the resistance to ground of each ground rod before connection to the other ground rods. The resistance shall not exceed 25 ohms.

B. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 5 ohms.

1.04 SUBMITTALS

A. Division 1 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for grounding electrodes and connections.

C. Test Reports: Provide typed complete report indicating overall resistance to ground and resistance of each electrode.

D. Project Record Documents: Record actual locations of components and grounding electrodes.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

DSA Re-submit 8/21/2012
B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.
   2. Provide products listed and labeled as complying with UL 487 where applicable.

2.03 ELECTRODES

A. Manufacturers: Cooper Power Systems, CadWeld, Erico, or approved equal for rod electrode.
   1. Rod Electrode: Cooper Power Systems, CadWeld, Erico, or approval equal.
B. Rod Electrodes: Copper-clad steel.
   2. Length: 10 feet.
   3. Installed where indicated on drawings.
   4. Shape: Straight.
C. Foundation Electrodes: 2/0 AWG.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.
B. Exothermic Connections:
C. All electrical connections should be welded with the CADWELD copper-based exothermic welding process.
D. Exothermic Connections: (ERICO Cadweld)
   1. Cable to Ground Rod: Type NC
   2. Cable to Cable: Type XA, TA, PT
   3. Cable to Building Steel: Type DF (Column Bonding Bar), WV
   4. Cable to Rebar: Type RD, RC
   5. Cable to Equipment: Type LA, NEMA Lugs Connections
   6. Cable to Steel Pipes: Type HA
   7. Cable to Metallic Conduit: Pipe Clamp with Flexible Grounding Braids and Lug Connection
E. Wire: Bare, stranded copper.
F. Grounding Electrode Conductor: Bare, stranded copper. Size as per drawings. Minimum size to meet NFPA 70 requirements.
G. Grounding Well:
   1. Well Box: Christy G5 Traffic Valve Box with hold down bolts
   2. Well Cover: Cast iron ring with legend "GROUND" embossed on cover.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify existing conditions and resistivity prior to beginning work.
C. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NEC A 1.
C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
D. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
E. Provide grounding well at power transformer, main switchboard, and at rod locations where indicated. Install well pipe top flush with finished grade.
F. Install 2/0 AWG bare copper wire in foundation footing.
G. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
H. For distribution transformers located away from main service entrance, provide and connect to grounding electrode conductor to a ground rod and building steel.
I. Equipment Grounding Conductor:
   1. Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
   2. Grounding conductors shall be identified with green insulation, except where a bare ground conductor is specified. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure. Install a ground conductor in each raceway system in addition to conductors shown.
   3. Equipment ground conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per NEC 250 unless larger conductors are shown on the drawings.
J. Equipment Grounding:
   1. Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide insulated grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure and at concentric knock-outs.
   2. Motors shall be connected to equipment ground conductors with a conduit grounding bushing and with a bolted solderless lug connection on the metal frame.
3. Conduit terminating in concentric knockouts at panelboards, cabinets and gutters shall have insulated grounding bushings and bonding jumpers installed interconnecting all such conduits and the panelboard cabinet, gutter, etc.

K. Ground all non-current carrying hardwares and metals. Include racks, supports, mounting hardwares, cable metallic shield, ladder, underfloor raceways, metal siding, metallic conduits, etc. Bond to grounding electrode.

L. Provide ground connection at all signal and data enclosures, lines, and data/telcom room.

M. Bonding:
   1. Bonding shall be provided to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.
   2. Bonding shall be in accordance with NEC Article 250, Part V.
   3. Bond together metal siding not attached to grounded structure; bond to ground.

N. Interface grounding and bonding provided under Section 33 79 00 - Site Grounding

3.03 FIELD QUALITY CONTROL

A. Campus will provide field inspection in accordance with Division 1
B. Provide field inspection, testing, and adjusting in accordance with Division 1
C. Inspect and test in accordance with NETA STD ATS except Section 4.
D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION
SECTION 26 05 73
POWER SYSTEM STUDY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Short circuit study.
B. Protective device coordination study and analysis.
C. Arc flash hazard study.

1.02 SCOPE OF STUDIES
A. Short Circuit Study: The study shall begin at the utility service and shall include all new electrical distribution equipment shown on the single line drawings. Refer to project single line diagram for exact equipment to be included in the study. This includes switchgear, switchboards, panelboards, ATS's, transformer primary and secondary terminals, and other significant overcurrent protective device locations throughout the system.
B. Protective Device Coordination Study: The study shall include all new protective relays and circuit breakers associated with the distribution system in this project and as shown on the contract single line diagram. The study shall allow for optimum selective coordination of proper breakers, fuses, and current transformers and shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and include the largest protective device of the new equipment. If a standby source is available, the study shall include both the normal and standby sources.
C. Arc Flash Study: The study shall include all new electrical distribution equipment shown on the single line diagram. This includes all switchgear, switchboards, panelboards, motor control centers, ATS's, and transformers. The ARC Flash Hazard Analysis shall be as per NFPA 70E.

1.03 DATA COLLECTION FOR THE STUDY
A. The contractor shall provide the required data for the preparation of the studies, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.
B. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

1.04 REFERENCE STANDARDS
E. IEEE 1015 - IEEE Recommended Practice for Applying Low-Voltage Circuit Breaker used in Industrial and Commercial Power Systems
F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Study Preparer's Qualifications.

DSA Re-submit 6/21/2012

POWER SYSTEM STUDY 26 05 73 - 1
C. Study Report:
1. Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
2. The result of the power system study shall be summarized in a final report. Three (3) bound copies and one electronic copy, CD with system model/data base files from the software used in the study.
3. Evaluation of product data submittals by Engineer will not commence until acceptable studies have been submitted.
4. Submit arc flash hazard study and with a list of arc flash warning labels at least 30 days prior to energizing the electrical equipment.
5. Include stamp or seal and signature of preparing registered professional electrical engineer.

D. Product Data: In addition to submittals specified elsewhere, submit manufacturer's time-current curves for all protective devices.

E. Field Inspection Report: Show final adjusted settings of protective devices.

F. Certificates: Prior to final inspection, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

G. Project Record Documents: Revise protective device study as required to show as-built conditions.
   1. Submit not less than 60 days prior to final inspection of electrical system.
   2. Include hard copies in operation and maintenance data submittals.
   3. Include all files prepared using software packages, on CD-ROM, with file name cross-references to specific pieces of equipment and systems.

1.06 SHORT CIRCUIT STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on NFPA or IEEE Standards.

B. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
   1. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
   2. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

C. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   4. Identification of each bus, with voltage.
   5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

D. Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
   1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
   2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
   3. Primary Fault Level Assumptions: Obtain data from utility company.
4. Report: Include all pertinent data used in calculations and for each device include:
   a. Device identification.
   b. Operating voltage.
   c. Protective device.
   d. Device rating.
   e. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

1.07 PROTECTION DEVICE COORDINATION STUDY

A. Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions.
   1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
   2. Plot the specific time-current characteristics of each protective device on log-log paper.
   3. Organize plots so that all upstream devices are clearly depicted on one sheet.
   4. Also show the following on curve plot sheets:
      a. Device identification.
      b. Voltage and current transformer ratios for curves.
      c. 3-phase and 1-phase ANSI damage curves for each transformer.
      d. No-damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum short circuit cutoff point.
      h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
      i. Software report for each curve plot, labeled for identification.
   5. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
      a. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
      b. Identify any equipment that is underrated as specified.
      c. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
      d. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Campus and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in the same frame, time curve characteristics of induction relays, CT ranges, etc.
      e. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
      f. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Campus, provide a discussion of alternatives and logical compromises for best achievable coordination.
      g. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.

6. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
   a. Device identification.
   b. Relay CT ratios, tap, time dial, and instantaneous pickup.
   c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   d. Fuse rating and type.
e. Ground fault pickup and time delay.
f. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
g. Highlight all devices that as furnished by Contractor will not achieve required protection.

1.08 ARC FLASH STUDY

A. Provide an Arc Flash Hazard Study for all new electrical distribution system shown on the single line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the single line drawing. This includes switchgear, switchboards, panelboards, motor control centers, PDU’s, UPS, ATS’s, and transformers. The study shall include creation of Arc Flash Hazard Warning Labels.

B. The arc flash hazard study shall include the electrical distribution system equipment shown on the single line drawing. Use the data from the Fault/Coordination Study to perform the Arc Flash Study. The arc flash hazard study shall consider operation during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum arc flash hazard.

C. Arc flash hazard study shall be performed in accordance with NFPA - 70E, NEC 110.16, and IEEE 1584. Study shall include the following:
   1. Indicate arc flash boundaries.
   2. Incident energies.
   3. PPE (Personal Protective Equipment) requirements.
   4. Shock hazard voltage level.
   5. Approach distances; limited, restricted, and prohibited.

D. Produce an Arc Flash Warning label stating "DANGER, ARC FLASH HAZARD" and shall list the above items. Also include the bus name and voltage. Labels shall be printed in color on 3 inch x 5 inch, self adhesive backed Avery or DuraLabel labels. Electrical contractor shall furnish install the labels based on the study.

E. Produce an Arc Flash Evaluation Summary Sheet listing the following additional items:
   1. Bus name.
   2. Upstream Protective Device Name, Type, and Settings.
   5. Protective Device Bolted Fault Current.
   9. Equipment Type.
   11. Arc Flash Boundary.
   12. Working Distance.
   13. Incident Energy.
   14. Required Protective Fire Rated Clothing Type and Class.

1.09 QUALITY ASSURANCE

A. Study Preparer Qualifications: Registered professional electrical engineer licensed in the State in which the Project is located and not a full time employed of the equipment manufacturer.
   1. A minimum of (5) years experience in preparation of studies of similar type and magnitude.
   2. Familiar with the software analysis products specified.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Acceptable Software Products:
PART 2 PRODUCTS

2.01 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.

B. Replace existing protective devices to achieve specified performance.

C. The specified equipment has been designed and selected to achieve the specified performance; ensure that equipment actually installed provides that performance.

D. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to requirements determined by the coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

C. Submit report showing final adjusted settings of all protective devices.

3.02 ARC FLASH TRAINING

A. The testing agency shall train personnel of potential arc flash hazards associated with working on energized equipment (minimum 4 hours). Maintenance procedures in accordance with the requirements on NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided by the testing company.

END OF SECTION
SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL
1.01 SUMMARY
   A. Section Includes:
      1. System specific commissioning for all electrical equipment.

1.02 DESCRIPTION OF WORK
   A. The electrical equipment and conductors to be tested are specified herein and shown on the
electrical drawings of the Contract Documents. Refer to Division 1.
   B. The Contractor shall retain an independent InterNational Electrical Testing Association (NETA)
member Engineering and Testing Firm (Testing Firm) for specified on-site acceptance testing of
the project electrical power distribution system and utilization equipment covered by this
contract.
   C. The Testing Firm shall verify the protective device settings are implemented in accordance with
approved Power System Study as specified in Section 26 05 73.
   D. Tests performed by the Testing Firm shall be witnessed by the Engineer and/or Campus
Representative. Provide Engineer and Campus Representative 30-day advanced notice for
Testing Firm tests. Insulation tests by the Contractor typically will not be witnessed. Critical
equipment witness testing may be requested by the Engineer and/or Campus Representative.
   E. The manufacturer of the electrical equipment supplied for the project shall complete their on-site
factor y inspection, testing, and setup prior to the Testing Firm's Acceptance Testing and
subsequent Protective Device setting verification work. The power monitors shall be set up by
the factor y representatives and power monitor readings and settings verified by the Testing
Firm. Manufacturer work is specified in the respective equipment sections.
   F. The Installation Contractor shall perform pretesting of motors, conductors, and equipment as
specified and shown, prior to any testing performed by the Testing Firm. Contractor shall
provide the labor, tools, material, including quality power sources required to test equipment and
other services necessary to provide specified tests and retesting.
   G. Submit proposed electrical test procedures for tests to be performed by the Installing Contractor
and proposed test procedures for tests to be performed by the Testing Firm.
   H. Contractor shall coordinate and schedule Campus Personnel training of electrical equipmmt
with manufacturer.

1.03 REFERENCES
   A. This section contains references to the latest published version of the InterNational Electrical
Testing Association's (NETA) Acceptance Testing Specifications for Electrical Power
Distribution Equipment and Systems (ATS).
   B. The NETA acceptance testing specification (NETA ATS) including procedures and test forms is
part of this section as specified and modified for this project. In case of conflict between the
requirements of this section and NETA ATS document, the requirements of this section shall
prevail. Request clarification from the Engineer for document conflict resolution of the testing
requirements.

1.04 TESTING APPLICATION
   A. Calibrated test equipment with calibration stickers are required for electrical acceptance tests.
The required tests, including correction of defects where found, and subsequent retesting, shall
be completed prior to energizing electrical distribution system, utilization systems, and
conductors. Tests shall be completed prior to functional testing. The installation of protective
devices, breakers, and relay setting shall be completed and verified prior to testing.
1.05 TESTING FIRM QUALIFICATIONS

A. The Testing Firm and their proposed project team shall possess the following minimum qualifications:
   1. Testing Firm shall be an independent testing organization providing unbiased testing authority, professionally independent of the manufacturer, suppliers, and installers of equipment or systems to be evaluated by the Testing Firm.
   2. Testing Firm shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
   3. Testing Firm shall be a member company of the InterNational Electrical Testing Association (NETA) providing testing in accordance with NETA ATS published specifications or the pre-approve firms that use the NETA methods and published testing specifications.
   4. If Firm's own published testing specifications are proposed, then submit a copy to the Engineer for acceptance and submit the qualifications of the testing staff.
   5. Testing Firm's lead technical person shall be currently certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution systems testing. Submit proof of technical training and certification for performing testing work.
   6. Testing Firm's technicians shall be regularly employed, qualified testing staff.

PART 2 – PRODUCTS

2.01 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology.

B. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall submit a schedule for the Testing Firm work and notify the Engineer and Campus Representative 30 days prior to commencement of any witnessed testing.

3.02 INSTALLATION CONTRACTOR TESTING

A. Testing as required by Section 26 08 02

3.03 DOCUMENTATION

A. ACCEPTANCE TEST REPORTS:
   1. The Contractor shall maintain a written record of all inspection and test results and, upon completion of the project, shall assemble and certify a final test report.
   2. A copy of the preliminary test results shall be provided to the Engineer and Campus Representative at the end of each day of testing. Scanned PDF copies of preliminary test results are acceptable.
   3. For final report Acceptance Testing Report Requirements, refer to Section 26 08 02

B. TEST DOCUMENTATION
   1. The Contractor shall submit test documentation forms and a detailed description of the proposed inspection and test procedures to be performed by the Testing Firm. Testing shall not commence until the Engineer has approved the proposed forms and procedures.
   2. The Contractor shall keep record of all deficiencies or non-conformance issues and shall be noted and reported to the Engineer and Campus Representative. Any equipment with deficiencies shall be corrected. Contractor shall have Testing Firm retest equipment to confirm that deficiency has been corrected.
3.04 STARTUP TRAINING

A. The Contractor shall coordinate training for Campus Personnel for use of electrical equipment. Contractor shall set up a training session with the manufacturer. Manufacturer shall instruct Personnel train necessary scheduled maintenance and testing, installation of replacement parts, use and programming of customer metering, and proper operation and use of electrical equipment.

B. Provide O&M Manuals for Campus Personnel to use during training session.

C. Training shall be for up to five (5) owner's representative. Startup and training can be conducted on the same day. Include one (1) normal workday at the job site location determined by the owner.

D. Include training for Unit Substation, Air Interrupter Switches, Switchboards, and Panelboards.

END OF SECTION
SECTION 26 08 02
ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.01 OVERVIEW

A. The purpose of these specifications is to assure that all tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are installed in accordance with design specifications.

B. The work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety problems associated with their use. It is the responsibility of the independent testing agency to review all applicable regulatory limitations prior to the use of these specifications.

C. Perform the visual inspections, manual operations and tests on systems and equipment as described in Part 3, "Execution".

D. Tests shall be performed and documented by an independent testing agency.

E. Perform these tests in addition to other electrical tests delineated in other Sections. Testing specified in other Sections shall be considered to be a part of this Section, therefore shall comply with the requirements described herein.

1.02 REFERENCES

A. All inspections and field tests shall be in accordance with the latest edition of the following codes, standards, and specifications except as provided otherwise herein.

1. American National Standards Institute - ANSI
3. Institute of Electrical and Electronic Engineers - IEEE
4. Insulated Cable Engineers Association - ICEA
5. InterNational Electrical Testing Association - NETA
6. National Electrical Manufacturer's Association - NEMA
7. National Fire Protection Association - NFPA
8. Occupational Safety and Health Administration - OSHA
9. State and local codes and ordinances
10. Underwriters Laboratories, Inc. - UL

1.03 SUBMITTAL

A. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with the following. An organization having a "Full Membership" classification issued by the InterNational Electrical Testing Association meets this criteria.

1. The testing organization shall be an independent, third party, testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing organization.

2. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

B. The testing organization shall utilize technicians who are regularly employed for testing services.

C. Each on-site crew leader shall hold a current registered certification in electrical testing applicable to each type of apparatus to be inspected or tested. The certification in electrical testing shall be issued by an independent, nationally-recognized, technician certification agency. The following agencies shall qualify as independent, nationally-recognized, technician certification agencies:

1. InterNational Electrical Testing Association (NETA)
2. Accepted certifications:
3. Certified Technician/Level III
4. Certified Senior Technician/Level IV
1.04 TEST REPORTS

A. Provide written test reports, signed and dated, for all tests prior to acceptance of the tested equipment by the Owner. Test reports on megger, dielectric absorption and high potential tests shall include the ambient temperature and relative humidity existing at the time of the tests. All tests including those listed in other sections shall be submitted in a single bound report. Report shall also demonstrate compliance with Specification, NETA ATS, and industry standards.

B. The Test Documentation shall include a description that identifies the test equipment required for each specified test to be performed. Test Report Forms shall include the following information:
   1. Electrical equipment description.
   2. Electrical equipment identification number.
   3. Electrical equipment nameplate data.
   4. Electrical equipment settings.
   5. Time and date of test.
   6. Ambient conditions at time of test.
   7. Inspection checklist and results.
   8. Test results.
   9. Test equipment used with manufacture, model number, and calibration date.
   10. Remarks about test procedures, results, and suggestions.
   11. Name and signature of testing personnel.
   12. Name and signature of test witness.

1.05 TESTING APPLICATIONS

A. Calibrated test equipment with calibration stickers are required for electrical acceptance tests. The required tests, including correction of defects where found, and subsequent retesting, shall be completed prior to energizing electrical distribution system, utilization systems, and conductors. Tests shall be completed prior to functional testing. The installation of protective devices, breakers, and relay setting shall be completed and verified prior to testing.

PART 2 - PRODUCTS

2.01 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology.

B. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

PART 3 - EXECUTION

3.01 VISUAL INSPECTIONS

A. Prior to any testing, perform visual inspections to verify the following:
   1. The equipment is completely and properly installed
   2. The equipment is free from damage and defects
   3. Shipping blocks and restraints have been removed
   4. Electrical terminations have been properly tightened
   5. The equipment has been properly aligned
   6. The equipment has been properly lubricated
   7. The ventilation louvers are open and unobstructed
   8. The equipment is ready to be tested

3.02 MANUAL OPERATION

A. Prior to any testing, mechanical devices shall be exercised or rotated manually to verify that they operate properly and freely.
3.03 PRIMARY CABLE TESTS
   A. New Primary Cable provided under this contact shall be tested as indicated in Section 26-05-13 after installation and before splicing.
   B. When New Primary Cable (15kV) is provided under this contract and spliced to existing Primary Cable on this project, the complete New Primary Cable and existing Primary Cable shall be given a complete Partial Discharge Test after all splices are completed and tested as indicated below.
   C. After splices are complete they shall be given a DC Hi Pot test before the Partial Discharge Test.
   D. Hi Pot test shall be a 37 kV test in 1kV increments holding for two minutes up to the 37 kV max. At the 37 kV the cable shall be soaked for 10 minutes with no appreciable loss of leakage current. Test results shall be approved by the Engineer in charge before proceeding with the Partial Discharge Testing.
   E. Perform a continuity test, 2,500-volt DC megger test, AC high potential test, and a second 2,500-volt DC megger test on primary cables. The high potential test shall be performed at 45kV for new cable installations, and at 30kV when new cable has been spliced to existing cable.

3.04 POWER CABLE TESTS
   A. Perform a continuity check and a 1,000 volt DC megger test on 500 volt power cables No. 4 AWG and larger.
      1. The megger test shall be performed between each pair of conductors and from each conductor to ground.
      2. The megger test shall be performed for 15 seconds or until the insulation resistance value stabilizes.
      3. The insulation resistance between conductors and from each conductor to ground shall be 100 megohms minimum in one minute or less. In addition, the lowest insulation resistance value shall not differ from the highest value by more than 20 percent.

3.05 CONTROL CABLE TESTS
   A. Perform a continuity check on control and instrumentation wiring.

3.06 SECONDARY SWITCHGEAR AND SWITCHBOARD TESTS
   A. Perform a continuity check and 1,000 volt DC megger test on buses, and on main and feeder breakers.
   B. Perform a primary current injection test and a 'Ducter' (contact resistance) test on main breakers.
   C. Perform a 1,000-volt DC megger test and a turns-ratio test on CT's and PT's.
   D. Calibrate the metering.

3.07 SERVICE, DISTRIBUTION AND MOTOR CONTROL EQUIPMENT TESTS
   A. Perform a 1,000-volt megger test on buses, motor starters and disconnect switches. This test may be combined with the feeder cable megger test by testing the devices and terminated cables together.
   B. Perform a continuity check on motor control circuits and control panel internal wiring.
   C. Perform an operational test on the controls.
   D. Perform a continuity check and a 1,000-volt DC megger test on 3 phase distribution and isolation transformers.

3.08 GROUNDING TESTS
   A. Measure the resistance to ground of each ground rod before connection to the other ground rods. The resistance shall not exceed 25 ohms.
   B. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 5 ohms.

DSA Re-submittal 6/21/2012
C. Tests of the resistance to ground shall be made using either the three point method or the fall-of-potential method.

D. Perform a continuity check from equipment ground bus bars and ground lugs to the ground system.

END OF SECTION
SECTION 26 11 16
SECONDARY UNIT SUBSTATIONS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Unit substation.

1.02 REFERENCE STANDARDS
D. IEEE C37.20.2 - IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear; Institute of Electrical and Electronic Engineers; 1999 (R2005).
E. IEEE C37.20.3 - IEEE Standard for Metal-Enclosed Interrupter Switchgear; Institute of Electrical and Electronic Engineers; 2001.
I. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; Institute of Electrical and Electronic Engineers; 1982 (R2006)
K. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
L. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
M. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2008.
P. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Q. UL Standard 891
R. This unit substation shall be listed by Underwriter's Laboratories. Transformer shall be listed by Factory Mutual.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials. Include nameplate data, schematic diagrams, and bill of materials.
C. Product Data: Provide electrical characteristics and connection requirements, circuit breaker data, fuse data, standard model design tests, and options that are included.

D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

E. Manufacturer's Installation Instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

H. Project Record Documents: Include copy of manufacturer's certified drawings.

I. Operation Data: Include operating instructions for manually and electrically opening and closing circuit breakers.

J. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication; procedures for sampling and maintaining fluid.

K. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. Extra Fuses: Two of each type and size.
   2. Tools: Two each of every special tool required to operate and maintain unit substation.

L. Equipment operation and maintenance instructions shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect products from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; www.eaton.com or approved equal.

2.02 UNIT SUBSTATIONS

A. Description: Secondary unit substation shall consist of primary equipment, transformer and secondary equipment as specified. The manufacturer of the unit substation shall furnish and coordinate all major components of the substations, including incoming primary equipment section, transformer and low-voltage section, as well as circuit breakers, fusible switches, and metering components. Provide a single warranty covering all substation assemblies, transformers and components.

B. Connections between the primary device and transformer shall be copper bussing, and between the transformer and sectionary shall be copper bussing.

C. Outdoor primary and secondary equipment where specified shall be of weatherproof construction, rodent proof and shall contain 277-volt space heaters.

2.03 PRIMARY LOAD INTERRUPTER SWITCH

A. Refer to Section 261321, AIR INTERRUPTER SWITCHES for requirements.
2.04 LIQUID FILLED SUBSTATION TRANSFORMER

A. RATINGS
1. Capacity: as per contract plan drawings.
2. Primary Voltage: 12 kV delta connected.
3. Primary Taps: 2-2 1/2% above and below nominal.
5. Impedance: 5.75 percent.
6. Primary Basic Impulse Level: 95 kV
7. Secondary Basic Impulse Level: 30 kV.
8. Frequency: 60 Hertz.

B. CONSTRUCTION
1. Liquid-Filled Transformers: IEEE C57.12.00, three phase, pad mounted, self-cooled transformer unit, FM Rated.
2. Cooling and Temperature Rise: IEEE C57.12.00; Class OA. 55 degrees C, self-cooled.
3. Insulating Liquid: Less Flammable, biodegradable electrical insulating fluid from high fire point oleic vegetable oil sources and shall be in accordance with the latest edition of NEC. High fire point fluid shall be Factory Mutual and UL listed.
4. Primary Overcurrent Protection: Fuse. Size as per plans
5. High Voltage and Low Voltage Coils: Wound copper.
6. Monitoring Devices:
   a. Temperature Indicator, Dial Type Thermometer
   b. Liquid Level Gauge
   c. Pressure Vacuum Gauge
   d. Cover mounted pressure relief device (Self Sealing with indicator)
7. Transformer Tank: Designed to withstand pressures 25% or greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel plate reinforced with external sidewall breaches. All seams and joints shall be continuously welded.
8. Each radiator assembly shall be individually welded and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before core and coil are tanked. A final six-hour leak test shall be performed after the transformer is tanked, welded and completed to ensure that there are no leaks before shipment.

C. ACCESSORIES
1. Tap Changer with externally operated, Kirk Keyed handle.
2. Combination drain and filter valve and sampling device.
3. Ground Pad - Copper.
4. Stainless Steel Nameplate.
5. Filling plug and filter press connection in cover.

2.05 OUTGOING DISTRIBUTION SWITCHBOARD

A. Ratings
1. Amperage Size: As per contract plan drawings.
2. Voltage: 480/277 volts, 3 Phase, 4 Wire.
3. Amps Interrupting Capacity: As per contract plan drawings.
4. Switchboard shall be fully rated.

B. Construction
1. Description: Switchboard manufactured to NEMA PB 2.
2. Line and Load Terminations: Accessible from the front only, suitable for the conductor materials used.
3. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers.
All edges of front connected covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

4. All sections shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

5. Fully equip spaces for future devices with bussing and bus connections suitable insulated and braced for short circuit currents. Provide continuous current rating as indicated.

C. Bussing
   2. Current Density Rating: 1000 amps per square inch.
   4. Insulated Ground Bus: Copper ground bus extending the length of switchboard. Minimum 1/4 inch thick by 2" height.

D. Wiring and Terminations
   1. Furnish necessary wiring, fuse blocks, and terminal blocks for control components. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked with appropriate designations that correspond to manufacturer's wiring diagrams.
   2. Provide mechanical type terminals for line and load terminations suitable for copper rated for 75 degrees C. Coordinate sizes with conductors.
   3. Provide 2-hole long barrel lugs with inspection window for incoming line section for connection of the main grounding conductors.

E. Insulated Case Circuit breakers:
   1. All switchboard breakers shall be fixed low-voltage air-circuit breakers, Eaton type Magnum DS or approved equal.
   2. Size as indicated on contract plan drawings.
   3. Breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set at the that level.
   4. Provide breaker with a Digitrip 520 RMS-advanced protection trip unit. Trip unit must be provided with adjustable long-time pickup and delay, adjustable short-time pickup and delay, and adjustable instantaneous settings. Provide adjustable ground fault pickup and delay settings where indicated on drawings.
   5. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be 'Connect' (red) and 'Disconnect' (green).
   6. Provide auxiliary contacts, (4) normally open, (4) normally closed.

F. Accessories:
   1. Provide a weatherproof light (fluorescent) and switch and weatherproof GFCI receptacle in each structure. Include all necessary power transformers, wiring and connections.

2.06 PROTECTIVE RELAYS AND INSTRUMENTS
   A. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.
   B. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
   C. Customer Power Meter: Eaton Power XPERT as specified on single line diagram.

2.07 ACCESSORIES
   A. Incoming Cable Terminations: Clamp-type.
   B. Accessories: IEEE C57.12.00 standard accessories.
C. Tap Changer: Externally-operated type.

D. Space Heaters: Provide a control power transformer for space heater in low voltage and medium voltage sections. Power transformer and heater shall be sized by Substation manufacturer.

E. Safety Nameplate: NEMA 260.

2.08 FACTORY FINISHES
A. Clean surfaces before applying paint.
B. Apply corrosion-resisting primer to all surfaces.
C. Apply finish coat of baked enamel paint to 4 mils thick.
D. Finish Color: Manufacturer's standard gray finish.

2.09 SOURCE QUALITY CONTROL
A. Provide factory tests to IEEE C57.12.90 and IEEE C57.12.00. Include the routine tests as defined in the standards and the following other tests:
   1. Impedance voltage and load loss.
   2. Dielectric tests.
   3. Audible sound level.
   4. Short circuit capability.
   5. Telephone influence factor (TIF).
   7. Temperature rise.
B. Test insulating liquid samples in accordance with IEEE C57.111.
C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify District at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION
A. Install in accordance with IEEE C57.94 and manufacturer’s instructions.
B. Install substation plumb and level and with each section aligned properly. Include all necessary shim and grout.
C. Make electrical connections between equipment sections using connectors furnished by manufacturer.

3.03 FIELD QUALITY CONTROL
A. Inspect and test in accordance with NETA STD ATS, except Section 4.
B. Primary Switch: Perform inspections and tests listed in NETA STD ATS, Section 7.5
C. Transformer: Perform inspections and tests listed in NEMA ATS, Section 7.2. Include the following optional tests:
   1. Verify that control and alarm settings on temperature indicators are as specified.
   2. Power factor or dissipation-factor tests in accordance with manufacturer's instructions.
   3. Winding-resistance tests for each winding at nominal tap setting.
   4. Perform an applied voltage test on all high- and low-voltage windings-to-ground.
   5. Individual excitation current tests on each phase.
   6. If ground strap is accessible, remove and measure core insulation resistance at 500 volts dc.
   7. Insulating liquid specific gravity.
   8. Operational test and adjustments on fan and pump controls and alarm functions.
D. Secondary Equipment: Perform inspections and tests listed in NETA STD ATS, Section 7.1 and 7.6.

3.04 STARTUP TRAINING
A: Refer to Commissioning of Electrical Systems - Section 26 08 00

3.05 ADJUSTING
A. Adjust protective relays in accordance with recommendations in the final Power System Study Report.

END OF SECTION
SECTION 26 13 21
AIR INTERMITTER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Medium-voltage air interrupter switches.
B. Medium-voltage fuses.

1.02 REFERENCE STANDARDS
A. IEEE C37.20.3 - IEEE Standard for Metal-Enclosed Interrupter Switchgear; Institute of Electrical and Electronic Engineers; 2001.
B. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. Shop Drawings: Indicate outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, bill of materials, and equipment electrical ratings.
B. Product Data: Provide data for components and accessories including fuse product data.
C. Seismic certification.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements
E. Test Reports: Indicate findings of field quality control procedures.
F. Submit manufacturer's installation instructions.
G. Maintenance Data: Fuse replacement, adjustment and lubrication instructions.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Protect interrupter switches from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Eaton Corporation; www.eaton.com or approved equal.

2.02 AIR INTERRUPTER SWITCHES
A. Description: IEEE C37.20.3, switchgear assembly of individual air interrupter switches in free-standing cubicles, securely bolted together to form an integrated structure, suitable for installation where accessible by general public.
B. Ratings:
1. System Voltage: 12 kV, three phase, three wire, 60 Hz.
2. Maximum Design Voltage: 15 kV.
3. System Grounding: Solid
4. Basic Impulse Level: 95 kV.
5. Main Bus Ampacity: 600 amperes, continuous.
6. Main Cross Bus Momentary Current: 61kA RMS Asymmetrical (10 cycle)
7. 2-Second Current: 38 kA RMS Symmetrical
8. Fused Switched Rating: 15kV Fuse Ampere. Sized as per contract plan documents.
9. Fuse Type: CLE
10. Fuse Interrupting Rating: 63 kA Sym RMS
11. Fused Switch Fault Close Rating: 101kA Asym RMS.

C. Construction
1. Enclosure: Weatherproof, metal-enclosed interrupter switchgear shall consist of deadfront, completely metal-enclosed vertical sections containing load interrupter switches and fuses (where shown) of the number, rating and type noted on the drawings or specified herein.
2. Vertical section construction shall be of universal frame type using die-formed and bolted parts. All enclosing covers and doors shall be fabricated from steel with thickness greater than that specified in ANSI/IEEE C37.20.3.
3. Every vertical section shall contain:
   a. A three-pole, two-position, open-closed switch.
   b. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the position of the three switch blades through the closed door. The window shall not be more that 58" above the switch pad level.
   c. Hinged Inspection Metal Barrier: A hinged grounded metal barrier that is bolted closed in front of switch to prevent inadvertent contact with any live part, yet allows for a full-view inspection on the switch blade position.
   d. Operating Handle: Permanently mounted, padlockable in both positions and interlocked:
      1) To prevent opening fuse compartment door with switch in CLOSED position.
      2) So that door must be in the CLOSED position before the switch can be closed.
   e. Hinged Cover for Operating Handle: Hinged cover with rustproof quarter turn nylon latches over the switch operation mechanism to discourage casual tampering.
   f. Green OPEN, Red CLOSED switch position indicators with the works 'Open' and 'Closed'.
4. Provide sloped drip-proof roof and door in door construction.
5. Include continuous ground bus through switchgear assembly, securely connected to frame of each cubicle.

D. Bussing:
1. Phase bus conductors shall be silver plated Copper.
2. Ground Bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section. Sized sufficiently to carry the rated (2-second) current of the switchgear assembly.
   a. Provide lugs for incoming feeder in cubicle.
      1) Finish: Manufacturer's standard baked enamel paint 4 mils thick.
      2) Clean surfaces before applying paint.
      3) Apply corrosion-resisting primer to all surfaces.
      4) Finish Color: Manufacturer's standard gray finish..

2.03 ACCESSORIES
A. Incoming Cable Terminations: Clamp-type.
B. Space Heaters: Provide space heaters. Include all necessary power transformer and wiring. Heater and power transformers shall be sized by switchgear manufacturer.
2.04 SOURCE QUALITY CONTROL
   A. Provide factory inspection and testing in accordance with IEEE C37.20.3.
   B. Make completed switch assemblies available for inspection at manufacturer's factory prior to packaging for shipment. Notify District at least 7 days before inspection is allowed.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install on concrete pad as indicated on Drawings.

3.02 TRAINING
   A. Provide a training session for up to (5) owner's representatives for one (1) normal workday at the job site location at a time determined by the owner.
   B. Training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly, switches and major components.

3.03 FIELD QUALITY CONTROL
   A. Inspect and test in accordance with NETA STD ATS, except Section 4.
   B. Perform inspections and tests listed in NETA STD ATS, Sections 7.5.1.1., 7.5.1.2., and 7.5.1.3.

END OF SECTION
SECTION 26 24 13
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Switchboards.
B. Switchboard accessories.

1.02 REFERENCE STANDARDS
D. NECA 400 - Standard for Installing and Maintaining Switchboards (ANSI); National Electrical Contractors Association; 2007.
E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
F. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2006.
G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007
I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components, and all options that are included.
C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; electrical characteristics, size and number of bus bars per phase, neutral, and ground; and switchboard instrument details; connection and support points, weight, specified ratings and materials. Include nameplate data, schematic diagrams, and bill of materials.
D. Test Reports: Indicate procedures and results of factory and field testing and inspection. Provide (2) certified copies.
E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation of product, and operating instructions for manually and electrically opening and closing circuit breakers.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
G. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.
H. Project Record Documents: Record actual locations of switchboards. Include a copy of manufacturer's certified drawing.
I. Maintenance Data:
   1. Include maintenance instructions for cleaning methods; cleaning materials; instructions for
circuit breaker removal, replacement, testing and adjustment; and lubrication.
   2. Include spare parts listing; source and current prices of replacement parts and supplies;
and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Campus’s use in maintenance of project.
   1. See Division 1 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.

K. Equipment operation and maintenance instructions shall be provided with each assembly
shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where
applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in
this section with minimum three years documented experience and within 100 miles of the
project.
   C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose
specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and
mounted on shipping skids.
   B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or
heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   C. Handle in accordance with NEMA PB 2.1 and manufacturer’s written instructions. Lift only with
lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal
components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com or approved equal.

2.02 SWITCHBOARDS
   A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and
specified.
   B. Ratings:
   1. Amperage size: As per contract plan drawings.
   3. Amps interrupting Capacity: As per contract plan drawings.
   5. Switchboard shall by fully rated.

2.03 CONSTRUCTION
   A. Description: Switchboard manufactured to NEMA PB 2.
   B. Line and Load Terminations: Accessible from the front only, suitable for the conductor
materials used.
   C. Switchboard shall consist of the required number of vertical sections bolted together to form a
rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of
front connected covers or hinged front panels shall be formed. Provide adequate ventilation
within the enclosure.

DSA Re-submittal 6/21/2012

26 24 13 - 2

SWITCHBOARDS
D. All sections shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible. Rear access shall be provided.

E. Fully equip spaces for future devices with bussing and bus connections suitable insulated and braced for short circuit currents. Provide continuous current rating as indicated.

F. Bussing
   2. Copper bus bars shall be of sufficient size to provide a current density of not more than 1000 amperes per square inch of cross section, and not more than 200 amperes per square inch at bolted connections.
   4. Insulated Ground Bus: Copper ground bus extending the length of the switchboard. Minimum 1/4" thick by 2" height.
   5. Neutral Bus: Full capacity

G. Wiring and Terminations
   1. Furnish necessary wiring, fuse blocks, and terminal blocks for control components. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked with appropriate designations that correspond to manufacturer’s wiring diagrams.
   2. Provide mechanical type terminals for line and load terminations suitable for copper rated for 75 degrees C. Coordinate sizes with conductors.
   3. Provide 2-hole long barrel lugs with inspection windows for incoming line section for connection of the main grounding conductors.

H. Insulated Case Circuit breakers:
   1. Main switchboard breaker shall be fixed low-voltage air-circuit breakers, Eaton type Magnum DS or approved equal.
   2. Size as indicated on contract plan drawings.
   3. Breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set at the that level.
   4. Provide breaker with a Digitrip 520 RMS-advanced protection trip unit. Trip unit must be provided with adjustable long-time pickup and delay, adjustable short-time pickup and delay, and adjustable instantaneous settings. Provide adjustable ground fault pickup and delay settings where indicated on drawings.
   5. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be 'Connect' (red) and 'Disconnect' (green).
   6. Provide auxiliary contacts, (4) normally open, (4) normally closed.

I. Molded Case Circuit Breakers:
   1. All breakers downstream from main circuit breaker shall be molded case circuit breakers with inverse time tripping characteristics.
   2. Circuit breaker shall be operated by toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breakers shall provide a local manual means to exercise the trip mechanism.
   3. Circuit breakers shall be thermal magnetic trip. Ground fault protection shall be provided where indicated.
   4. Provide auxiliary contacts, (2) normally open, (2) normally closed.

J. Pull Section: Size as indicated on drawings.
   1. Size as shown on Drawings.

K. Enclosure: Type 1 for indoor, Type 2 (NEMA 3R) for outdoors.
   1. Align sections at front and rear.
2. Factory Finish: Manufacturer's standard light gray enamel over external surfaces. Clean surfaces before applying paint. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
3. Provide enclosure doors with provisions for padlocking.

2.04 ACCESSORIES
A. Safety Nameplate: NEMA 260

2.05 PROTECTIVE RELAYS AND INSTRUMENTS
A. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.
B. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
C. Customer Power Meter: Eaton Power XPERT as and where specified on single line diagram.

2.06 SOURCE QUALITY CONTROL
A. Shop inspect and test switchboard according to NEMA PB 2.
B. Provide factory tests according the latest version of ANSI and NEMA Standards. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard test for simulated service condition to ensure accuracy of wiring and functionality. Provide main circuits with dielectric test of 2200 volts for (1) minute between live parts and ground and between opposite polarities. Provide wiring and control circuits with dielectric test of 1500 volts for (1) minute between live parts and ground.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION
A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
B. Install in a neat and workmanlike manner, as specified in NECA 400.
C. Install switchboard plumb and level and with each section aligned properly. Include all necessary shim and grout.
D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL AND ACCEPTANCE TESTING
A. Inspect and test in accordance with NETA STD ATS, except Section 4.
B. Perform inspections and tests listed in NETA STD ATS, Section 7.1. and 7.6

3.04 ADJUSTING
A. Adjust all operating mechanisms for free mechanical movement.
B. Tighten bolted bus connections in accordance with manufacturer's instructions.
C. Adjust circuit breaker trip and time delay settings to values indicated in Power System Study.

3.05 CLEANING
A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards. Wall Mounted
B. Lighting and appliance panelboards. Wall Mounted

1.02 REFERENCE STANDARDS

B. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
D. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches; National Electrical Manufacturers Association; 1993.
E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association, 2001 (R2006).
F. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2006.
G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
K. UL 67 - Panelboards; Current Edition, Including All Revisions.
M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and arrangement and sizes.
C. Test Reports. Indicate procedures and results of factory and field testing and inspection. Provide (2) certified copies.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.
F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
H. Maintenance Data:

DSA Re-submittal 6/21/2012
1. Include maintenance instructions for cleaning methods; cleaning materials; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication.
2. Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Campus's use in maintenance of project.
1. See Division 1 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.

J. Equipment operation and maintenance instructions shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 MAINTENANCE MATERIALS
A. See Division 1 - Product Requirements, for additional provisions.
B. Furnish two of each panelboard key.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Eaton Corporation; Cutler-Hammer Products; www.eaton.com or approved equal.

2.02 ALL PANELBOARDS
A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
B. Panels 225A or less shall be lighting style panelboards. Panels above 225A shall be power panelboards. Any distribution board 800A and above shall be a switchboard per 'Switchboard' specifications.
C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
E. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
F. Conductor Terminations: Suitable for use with the conductors to be installed.
G. Enclosures: Surface mounted. Comply with NEMA 250, and list and label as complying with UL 50 and UL 60E.
1. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
2. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

3. Lockable Doors: All locks keyed alike unless otherwise indicated.
4. Door-in-Door construction: The front trim shall have full-length hinged outer door designed to expose the wiring raceways and breakers when open. Another, inner hinged door shall expose breakers only, when open, making this a door-in-door construction. Both doors shall open to the right. When the outer door is open, all gutter space shall be exposed.

H. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
I. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper.
   2. Main and Neutral Lug Type: Compression.

C. Bussing:
   1. Copper, ratings as indicated. Provide full size copper ground and neutral bus in each panelboard.
   2. Copper bus bars shall be of sufficient size to provide a current density of not more than 1000 amperes per square inch of cross section, and not more than 200 amperes per square inch at bolted connections.

D. Minimum integrated short circuit rating: As indicated on drawings.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt on type circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

G. Provide and install all mounting hardware in spaces for future circuit breaker.

H. Each circuit shall be permanently numbered to agree with the panel schedule, using plastic or metal buttons mounted adjacent to the breaker and secured by rivets or grommets with an engraved or depressed number. Adhesive numbering tape, painted numbers, or use of more than one number per breaker is not acceptable.

I. Enclosure: Indoor Units shall be NEMA PB 1.

J. Enclosure: Outdoor Units shall be NEMA 3R suitable for Outdoor Application.

K. A sturdy metal frame, with a clear plastic cover shall be welded to the inside of the panel door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper.
   2. Main and Neutral Lug Type: Compression.

C. Bussing: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

D. Minimum Integrated Short Circuit Rating: As indicated on contract drawings.

E. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Do not use tandem circuit breakers.
F. Enclosure: Indoor Units shall be NEMA PB 1, Type 1, 5-3/4 inches deep, 20 inches wide, cabinet box.

2.05 SOURCE QUALITY CONTROL
A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as shown on the drawings.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
D. Provide filler plates for unused spaces in panelboards.
E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
F. Provide engraved plastic nameplate.
G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.
H. Ground and bond panelboard enclosure according to NEC.
I. Arrange equipment to provide minimum clearances in accordance with manufacturer’s instructions and NFPA 70.
J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.03 FIELD QUALITY CONTROL
A. Perform field inspection and testing in accordance with other sections of these specifications.
B. Inspect and test in accordance with NETA STD ATS, except Section 4.
C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.
D. Ground Fault Protection Systems: Test in accordance with manufacturer’s instructions as required by NFPA 70.
E. Test GFCI circuit breakers to verify proper operation.
F. Test AFCI circuit breakers to verify proper operation.
G. Test shunt trips to verify proper operation.
H. Correct deficiencies and replace damaged or defective panelboards or associated components.

DSA Re-submittal 6/21/2012

26 24 16 - 4
3.04 ADJUSTING

A. Measure steady state load currents at each panelboard feeder, rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

C. Adjust alignment of panelboard fronts.

D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Interior luminaires.
   B. Emergency lighting units.
   C. Exit signs.
   D. Ballasts.
   E. Fluorescent dimming ballasts and controls.
   F. Fluorescent emergency power supply units.
   G. Lamps.
   H. Luminaire accessories.

1.02 REFERENCE STANDARDS
   C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
   F. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
   G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
      2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
      3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
      4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS
   A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.02 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.03 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.
2.04 BALLASTS
A. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.05 FLUORESCENT EMERGENCY POWER SUPPLY UNITS
A. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
B. Compatibility:
   1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.
C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
D. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
E. Fluorescent Ballasts: shall be electronic, high power factor, parallel wired and certified to be designed and constructed by Certified Ballast Manufacturers, Inc..
F. Ballasts shall be suitable for lamp used. Provide certification to Engineer.

2.06 LAMPS
A. Manufacturers shall be GE, Phillip Lighting, Sylvania, or approved equal.
B. Lamp shall all be from the same manufacturer.
   1. Lamps shall manufactured within 60 days of delivery.
   2. Lamps shall come in from the same Lot Number.
   3. Lamps shall be listed with ballasts installed in fixtures.
C. All Lamps:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.
D. Lamps shall at least "3rd generation", "high", or "super" T8, 32W Nominal, 4100K, 85 CRI min.

2.07 OCCUPANCY SENSORS
A. Occupancy Sensors shall be dual technology occupancy sensors.

2.08 ACCESSORIES
END OF SECTION
SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Exterior luminaires.
   B. Lamps.

1.02 REFERENCE STANDARDS
   A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
   C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
   E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 SUBMITTALS
   A. See Division 1 for submittal procedures.
   B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
   E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.04 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
   B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Refer to contract drawings for specific manufacturer.

2.02 LUMINAIRE TYPES
   A. Furnish and install products as indicated on the contract plan drawings.
2.03 LUMINAIRES
   A. Provide products that comply with requirements of NFPA 70.
   B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
   C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
   D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
   E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
   F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
   G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
   H. Exposed Hardware: Stainless steel.

2.04 LAMPS
   A. All Lamps:
      1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
      2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer’s recommendations.
      3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
      4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as shown on the drawings.
   B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
   C. Verify that suitable support frames are installed where required.
   D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
   E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
   A. Provide extension rings to bring outlet boxes flush with finished surface.
   B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION
   A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.
   B. Install products according to manufacturer’s instructions.
   C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
   D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
   E. Pole-Mounted Luminaires:
      1. Grounding:

DSA Re-submittal 6/21/2012    26 56 00 - 2    EXTERIOR LIGHTING
a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

F. Install accessories furnished with each luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Engineer.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION
SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Fire alarm control panels.
   B. Manual fire alarm stations.
   C. Automatic smoke and heat detectors.
   D. Fire alarm signaling appliances.
   E. Auxiliary fire alarm equipment.

1.02 RELATED SECTIONS
   A. Section 15820 - Duct Accessories: Smoke dampers.

1.03 REFERENCES

1.04 SYSTEM DESCRIPTION
   A. Fire Alarm System is Simplex manual, addressable, Class B, Style B system

1.05 SUBMITTALS
   A. Contractor shall within two weeks of Notice to Proceed submit the following for the Electrical Engineer's Review and Approval. Submittal shall be pre-reviewed by certified installer.
      1. Product Data: Provide data cut sheets showing electrical characteristics and connection requirements of fire alarm devices
      3. Fire Alarm Wiring
      4. Installer National Institute for Certification in Engineering Technologies (NICET) Level II Certification
      5. Shop Drawings showing the following:
         a. Fire Alarm Riser Diagram showing each device, conduits, and wiring connection required.
         b. Fire Alarm Devices Zones and Addresses.
      6. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of products.

   B. Contractor shall submit progress inspection reports signed by a Simplex Certified Installer. Inspection report shall indicate satisfactory installation of raceways, wiring, fire alarm devices, and equipment per Simplex installation standards. Inspection shall be submitted on a bi-weekly basis, or as requested by IOR, the District, or the Electrical Engineer. Contractor shall within 3 working days correct deficiencies noted on the inspection report. No additional contract time will be allotted for correction of deficiencies.

   C. Contractor shall within two weeks of testing submit the following for the Electrical Engineer's Review and Approval.
      1. Test Reports: Indicate satisfactory completion of required tests and inspections.

   D. Upon final acceptance of fire alarm system, Contractor shall submit the following documents to the District.
      1. Operation Data: Operating instructions.
3. As-built drawings: Drawings shall reflect actual locations of fire alarm devices, equipment, wire gauge, conduit, and routing. Voltages at EOL resistor shall also be reflected.

E. See Special Materials for additional submittals.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 72, NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Installer Qualifications: Company specializing in installing the products specified in this section.
   1. NICET Certification: The installing contractor shall employ at least one individual at the jobsite supporting this project that has attained NICET Level II Certification in Fire Alarm Systems. All submittals and drawings shall be approved, initialed and show the NICET Certification Number of the individual maintaining the certification and taking responsibility for the documentation.
   2. With minimum three years documented experience.
   3. Certified in the State in which the Project is located as fire alarm installer.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

E. Utilize companies regularly engaged in fire alarm system installation; RFI, Sound and Signal, or equal.

1.07 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.

1.08 SPECIAL TRAINING AND MATERIALS

A. Contractor shall arrange a special training (minimum of 8 hours) conducted to familiarize school maintenance personnel with the new fire alarm system. Training shall at a minimum cover the following:
   1. Familiarization with the new fire alarm system, devices, identifying zones, coverage, and routing.
   2. Provide general guidelines on the proper maintenance and operation of the fire alarm system (i.e. battery, voltage check, alarm, and trouble mode, etc.)
   3. Provide instructions on how to operate fire alarm for fire drill purposes.

B. Fire Alarm Installer shall provide Owner with 8.5" x 11" sheets of floor plans showing all the fire alarm equipment and devices. Device addresses shall be reflected in these floor plans. Device addresses shall correspond with preprogrammed addresses in the fire alarm control panel.

C. Fire Alarm Installer shall provide and install a permanently engrave 8.5" x 11" metal plate showing fire alarm site plan. Install in front of the fire alarm panel. Submit fire alarm site plan to engineer for approval.

1.09 EXTRA MATERIALS

A. Provide ten manual station break-glass rods.

B. Provide six keys of each type.

C. Provide three of each type of automatic detectors with base.
PART 2 PRODUCTS

2.01 MANUFACTURERS: SIMPLEX

2.02 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

A. Control Panel: Modular construction with flush wall-mounted enclosure.

B. Power supply: Adequate to serve control panel modules, remote detectors, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

C. System Supervision: Component or power supply failure places system in trouble mode.

D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.

E. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.

F. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

H. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.

I. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
   1. Visual and audible trouble alarm indicated by zone at fire alarm control panel.
   2. Visual and audible trouble alarm indicated at remote annunciator panel.

J. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
   1. Sound and display local fire alarm signaling devices with temporal signal.
   2. Transmit non-coded signal to central station.

K. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.

2.03 INITIATING DEVICES


B. Spot Heat Detector: Fixed temperature, rated 135 degrees F and temperature rate of rise of 15 degrees F.

C. Ceiling Mounted Smoke Detector: NFPA 72, ionization type with adjustable sensitivity and visual indication of detector actuation, suitable for mounting on 4 inch outlet box. Provide two-wire detector with common with separate power supply and signal circuits.

D. Duct Mounted Smoke Detector: NFPA 72, ionization type with auxiliary SPDT relay contact key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common with separate power supply and signal circuits.

2.04 SIGNALING APPLIANCES

A. Alarm Lights: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens. Strobe rating as indicated in the drawings.

B. Alarm Horn: NFPA 72, surface type fire alarm horn.
   1. Sound Rating: 75 dB at 10 feet.
C. Remote Annunciator: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush wall-mounted enclosure.

2.05 FIRE ALARM WIRE AND CABLE
A. Fire Alarm Power Branch Circuits: Building wire as specified in Division 16000.
B. Initiating Device Appliance Circuits: Twisted Pair #12, minimum. Refer to Manufacturer for additional requirements.
C. Signaling Device Appliance Circuits: THWN #12 AWG minimum. Refer to Manufacturer for additional requirements.
D. Color code
   1. Provide fire alarm circuit conductors with insulation color coded as follows, or using colored tape at each conductor termination and in each junction box.
   2. Power Branch Circuit Conductors: Black, red, white.
   3. Initiating Device Circuit: Black, red.
   5. Signal Device Circuit: Blue (positive), white (negative).

PART 3 EXECUTION
3.01 EXAMINATION
A. For existing systems that will be modified, contractor shall perform a pre-test. Pre-test shall indicative of extent of fire alarm system and test results shall verify following:
   1. Number of initiation and signaling zones, addresses, etc.
   2. Interconnection of equipment and devices to fire alarm control panel.
   3. EOL device locations and voltage drop measurements.
   4. General routing of fire alarm wiring
   5. Other information that may be necessary to modify existing system
B. Coordinate location of fire alarm devices with Architect prior to rough-in. Device locations in floor plans has bee designed to meet strobe and sound coverage. Deviations from locations in floor plans must be approved prior to installation. Contractor shall be responsible for providing additional devices if strobe and sound coverage requirements are not met due to changes in device locations.
C. All fire alarm conduits shall be concealed. If site conditions do not allow for concealment of conduits, installer shall coordinate routing of exposed conduits with Architect prior to rough in.

3.02 INSTALLATION
A. Install products in accordance with NEC, NFPA 72, CBC, and manufacturer’s instructions.
B. Install manual stations with 48 inches to centerline of device above finished floor.
C. Install audible devices 90 inches to top of device above finished floor, not less than 6 inches from ceiling
D. Install visual or audible/visual devices 80 inches to bottom of device, not greater than 96 inches above finished floor but not less than 6 inches from ceiling.
E. Install fire alarm wiring in 3/4 inch minimum conduit.
F. Mount outlet box for electric door holder/release to withstand 80 pounds pulling force.
G. Automatic Detector Installation: Conform to NFPA 72.
H. Junction boxes shall be installed and painted Red.

3.03 FIELD QUALITY CONTROL
A. Perform field inspection and testing in as specified in the contract specifications and drawings.
B. Testing shall include the testing of the following:
   1. New Fire Alarm System
2. Sound Levels
3. Strobe Flash Rate for Multiple Strobes in Single Location
5. Testing of connection and communication with remote unit, and central station.

C. Test in accordance with NFPA 72, Chapter 7.

D. Conduct tests in the presence of the owner’s representative, the local fire authority, and the DSA Inspector of Record.

E. Provide a signed and completed certificate of completion to DSA upon completion of project in accordance with NFPA 72, Chapter 4. This form shall be signed by DSA IOR.

3.04 DEMONSTRATION

A. Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION
SECTION 28 35 00
REFRIGERANT MONITORING SYSTEM

PART 1  GENERAL
1.01  SECTION INCLUDES
A. Refrigerant Monitoring Systems (RMS).

1.02  REFERENCES
A. ASHRAE Standard 15/34 - 2007
B. EPA Standard 608 CFR
C. NFPA 70 - National Electrical Code.
D. NFPA 72 - National Fire Alarm Code
E. 2010 California Mechanical Code, Chapter 11
F. 2010 California Fire Code, Section 606
G. California Air Resources Board Section 95385

1.03  SUBMITTALS
A. Provide catalog cut sheets describing system, indicating accuracies, minimum detectable quantities of various refrigerants, data outputs, dimensions, contact ratings, capabilities.
B. Provide catalog cut sheets of components for use in the RMS, UPS, General Alarm Panel and EF Emergency Control Panel. These would include the enclosures, pushbuttons, indicating lamps, relays and terminal strips. Clearly indicate all optional or 'extra' items/features to be included (expansion modules, communication modules, battery modules, etc.)
C. Provide complete shop drawings for the RMS, UPS, General Alarm Panel, Batteries, and EF Emergency Control Panel, indicating point to point wiring diagrams, component layout and lettering to be provided. Include in shop drawings all interface connections to building control system (EMS, BAS, etc.), as well as all connections to building Fire Alarm panel.
D. Provide Electrical Specification for RMS Panel, General Alarm Panel, UPS and batteries, and EF Emergency Control Panels. At a minimum, provide input power, voltage, and loads under standby and alarm conditions. Provide sizing calculations for UPS, UPS supplemental batteries and General Alarm Panel batteries.
E. Provide cutsheets for horns, strobes, and breakglass pullstations. Submit nameplate list and breakglass pullstation labeling for review.

1.04  QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.05  DELIVERY, STORAGE, AND PROTECTION
A. In accordance with SECTION 01 60 00, PRODUCT REQUIREMENTS.
B. Deliver All products under this Section to project site in sealed protective packaging.
C. Store all products under this Section to under cover and elevated above grade.

1.06  WARRANTY
A. Correct defective Work within a one year period after Date of Substantial Completion.

1.07  EXTRA MATERIALS
A. Supply three zero air filters and pickup filter (for each location) elements for Owner's use in maintenance of project.
B. Supply six replacement breakglass rods for each pullstation installed.
1.08 INSTRUCTION

A. Contractor shall furnish and coordinate instruction for the Owner's Maintenance personnel. Provide a minimum of 4 hours training for 5 operators. Provide instruction on normal operation and maintenance, including zero filter replacement. Provide instruction for alarm functions, silence, reset and fault sequences. Provide instruction on EF emergency control panel. Provide instructions for fault diagnostics. Provide instructions for periodic testing requirements as required by the manufacturer and code.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Substitutions: See Section 01 60 00 - Product Requirments.

2.02 MATERIALS

A. ALARM HORN: Remote signaling devices shall be suitable for flush or surface mounting to standard outlet or junction boxes. Provide nameplate " R-134a - REFRIGERANT ALARM". Engraved lamicoid signs shall be posted at all horn locations. " - REFRIGERANT ALARM". Outside chiller room: "DO NOT ENTER WHEN HORN IS SOUNDING"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN HORN IS SOUNDING". Letters shall be a minimum of 1 inches high, white, with red background. Horns shall be have variable tone settings. Device color shall not be red. Provide weatherproof backbox for exterior installation. Horns shall have silenceable feature or be wired so that horns may be silenced. As specified on drawings.

B. ALARM STROBE: Remote signaling devices shall be suitable for flush or surface mounting to standard outlet or junction boxes. Engraved lamicoid signs shall be posted at all strobe locations. " - REFRIGERANT ALARM". Outside chiller room: "DO NOT ENTER WHEN LIGHT IS ON"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN LIGHT IS ON". Letters shall be a minimum of 1 inches high, white, with red background. Device color shall not be red. Provide weatherproof backbox for exterior installation. As specified on drawings.

C. ALARM HORN STROBE: Remote signaling devices shall be weatherproof and suitable for flush or surface mounting to standard outlet or junction boxes. Provide nameplate "REFRIGERANT ALARM". Engraved lamicoid signs shall be posted at all horn/strobe alarm locations. Outside chiller room: "DO NOT ENTER WHEN LIGHT IS ON"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN LIGHT IS ON". Letters shall be a minimum of 1 inches high, white, with red background. Horns and horn/strobes shall be as further specified on Drawings. Color shall not be red and shall be distinct from facility fire alarm horn/strobes.

D. BREAKGLASS PUSHBUTTONS: For manual initialization of emergency shutdown of equipment and for manual initiation of fan purge sequence. Pushbuttons shall be as specified on the Drawings. Color shall not be red and shall be distinct from facility fire alarm pull stations.

E. REFRIGERANT MONITORING SYSTEM GENERAL ALARM PANEL: General alarm panel shall be utilized to power horns and strobes and shall have battery backup 24 VDC, with accessories and modules as specified on the drawings. Panel shall provide full supervision of signaling devices and refrigerant monitoring system and shall provide "trouble" inputs to the facility fire alarm system for remote monitoring. Units specified on drawings are typical small fire alarm panels and shall be repainted a color other than red prior to installation.

F. UPS and BATTERIES: APC or approved equal, shall provide continuous AC power to the refrigerant monitor. Provide the unit with the capacity and extra batteries as specified on the drawings. Batteries & UPS sized for 24 hours of monitoring, and 5 minutes of alarming. Mount equipment off of the floor.

G. FAN EMERGENCY CONTROL: Contractor fabricated NEMA IV, painted enclosure with break glass front and locking hinged cover. Provide oil tight pushbuttons for emergency control of exhaust fans. Provide indicating lights as shown and mount in panel. Label all components.

H. SAMPLE TUBING: The tubing shall be refrigerant-grade copper, ¼" O.D. seamless Type ACR (hard or annealed) complying with ASTM-B280 or seamless Type K, L, or M (drawn or
annealed) in accordance with ASTM-B88, with compression fittings. Soldered or brazed connections are not acceptable due to foreign gases and contaminants. Poly tubing and other gas absorbing/leaching types are unacceptable due to sample corruption. Nylon nonplasticized ¼" O.D. tubing, similar to Parker Hannifin, may be used if preapproved, and installed or bundled in ¾" EMT conduit, or larger, 80% free area. The tubing shall be shipped sealed to the site.

PART 3 EXECUTION

3.01 CALIBRATION

A. Unit shall be factory calibrated. This includes a zero calibration, as well as a minimum of two additional points using calibration gases of known concentrations.

3.02 MANUFACTURERS DIRECTIONS

A. Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown. Equipment which is required to be field assembled shall be assembled under the direct supervision of the manufacturer.

3.03 EQUIPMENT

A. Accurately set and leveled with supports neatly placed and properly fastened. Properly fasten equipment in place with bolts or clips as shown on drawings to prevent movement in earthquake. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in or installing equipment into position in or on the building and for adequate anchoring of equipment.

B. Mount monitor panel and refrigerant monitoring pick ups outside of any directed airstream from air outlets or inlets, motor vents, etc.

C. Refrigerant Sensing Piping: Install ¾" O.D. tubing to each monitored zone. Connections shall be mechanical compression fittings. Pressure test installed tubing with 15 psig air. Tubing shall be worked into a complete, integrated arrangement with like elements to make work neat appearing, and finished. Where exposed, parallel with walls or structural elements; vertical runs plumb; horizontal runs level, parallel with structure or uniformly pitched as appropriate. Terminate in utility box and provide particulate filter on end of line. Mount pick ups within 10" of floor. Provide support at less than six foot intervals and at all bends.

D. Zero and Pick Up Filters: Assemble and install zero and pick up filters as per manufacturer's instructions.

E. Exhaust port: Field route exhaust port a minimum of five feet from zero filter.

F. UPS: Mount UPS System and Batteries on concrete housekeeping pad (4" min) or mount to wall with appropriate shelves and seismic restraints.

G. Horns: Set horn tone to be distinct from fire alarm horns. Set 15 dBA above ambient sound levels. Install horns as shown on drawings.

H. Strobes: Coordinate flash rate of refrigerant strobes with fire alarm strobes if any. Total flash rate shall not exceed 300 flashes per minute. Install strobes as shown on drawings.

I. Horn/Strobes: Combination units shall be as per individual units described above. Install as shown on drawings.

J. Breakglass: Install breakglass at 48" above finish floor to the centerline of the device.

K. EF Emergency Control Panel: Wall or pedestal mount securely to resist seismic forces. Mount at 48" above floor to centerline of panel, unless otherwise noted.

3.04 SYSTEM SET UP AND PROGRAMMING

A. Coordinate with Controls Contractor for scaling and setpoints programming, relay contact normal position and interconnections to reset pushbuttons, horn silence, EF Emergency Control Panel, BAS and building Fire Alarm Control Panel. Provide latching alarm action, normally open relay contact positions, 0 2000 ppm scaling for analog outputs, and alarm levels as described in this section and as shown on the drawings. Provide written start up report.
verifying that all sequences and operations are as specified and required for proper operation of complete system.

3.05 SIGNS, LABELS AND IDENTIFICATION OF EQUIPMENT
A. Post warning signs at each alarm horn/strobe location. Properly identify each piece of equipment and its controls using engraved laminated plastic descriptive nameplates, black on white, fastened to equipment and controls using round head brass machine screws, pop rivets, contact cement or chain to equipment. Cardholders in any form are not acceptable.

B. Provide and post code required sign indicating installing contractor, and type and quantity of refrigerant in system as described on the drawings.

3.06 TESTING AND DEMONSTRATION:
A. Complete Refrigerant Monitoring System shall be tested and demonstrated in the presence of the Owner and Engineer to verify correct operation for all aspects of the installed system to meet the sequences and operation as specified herein and on the drawings and as required to meet code requirements.

B. Installing Contractor shall provide test gases for use in demonstration operation of all alarm functions (lo, med and high, each refrigerant required). Installing Contractor shall provide replacement breakglass rods for replacement at the end of testing and demonstration. Demonstration shall include, but not necessarily limited to, the following:
1. Purge fan pullstation operation.
2. Emergency Power Off pullstation operation.
3. Low, Medium and High Level alarm operation
4. Horn Silence (local and remote from EF Emergency Control Panel).
5. System reset
6. Communication of alarms to Fire Alarm System and BAS system printer
7. Disconnecting alarm devices to verify annunciation to Fire Alarm
8. Disconnect power to verify battery backup operation
10. Operation of room temperature sensor/thermostat.

C. Controls Contractor representative shall also be present during demonstration.

END OF SECTION
10200 - Merritt College CHW Infrastructure

SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 DEFINITIONS
A. Finish Grade Elevations: Indicated on drawings.
B. Subgrade Elevations: 6 inches below finish grade elevations indicated on drawings, unless otherwise indicated.

1.03 REFERENCES
A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010
B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³)); 2007.
D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2,700 kN m/m³)); 2009.
F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005
G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 SUBMITTALS
A. See Section Division 1 for submittal procedures.
B. Materials Sources: Submit name of imported materials source.
C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING
A. When necessary, store materials on site in advance of need.
B. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.
   4. Protect stockpiles from excessive moisture that would negatively impact compaction requirements.

PART 2 PRODUCTS

2.01 FILL MATERIALS
A. General Fill: Subsoil excavated on-site.
   1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
B. Concrete for Fill: Lean concrete.
C. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter. Quarry fines also acceptable in lieu of sand.
D. Topsoil: Topsoil excavated on-site.
   1. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL
   A. See Division 01 - Quality Requirements, for general requirements for testing and analysis of soil material.
   B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION
   A. Identify required lines, levels, contours, and datum locations.
   B. Locate, identify, and protect utilities that remain and protect from damage.
   C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
   D. Protect plants, lawns, rock outcroppings, and other features to remain.

3.03 TRENCHING
   A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
   B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
   C. Do not interfere with 45 degree bearing splay of foundations.
   D. Cut trenches wide enough to allow inspection of installed utilities.
   E. Hand trim excavations. Remove loose matter.
   F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
   G. Remove excavated material that is unsuitable for re-use from site.
   H. Stockpile excavated material to be re-used in area designated on site.
   I. Remove excess excavated material from site.

3.04 REMOVAL OF SPOILS
   A. Contractor shall be responsible for proper disposal of all excess spoils not required for backfilling operations.
   B. Contractor shall be responsible to provide any testing required on spoils prior to delivery to disposal site. Remediation, if any shall be performed by the Campus.

3.05 PREPARATION FOR UTILITY PLACEMENT
   A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
   B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
   C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.06 BACKFILLING
   A. Backfill to contours and elevations indicated using unfrozen materials.
   B. Fill up to subgrade elevations unless otherwise indicated.
   C. Employ a placement method that does not disturb or damage other work.
   D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
   E. Maintain optimum moisture content of fill materials to attain required compaction density.
F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At landscaping: 90 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.07 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Utility Piping, Conduits, and Duct Bank:
   2. Cover with sand.
   3. Backfill with general fill.
   4. Compact in maximum 6 inch lifts to 95 percent of maximum dry density under paving, roads and sidewalks, 6 inch lifts to 90 percent of maximum dry density under landscaping.

3.08 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.09 FIELD QUALITY CONTROL

A. See Division 01 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D3017, or ASTM D2922.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: one test for every 100 feet of trench.

3.10 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Removal of discovered rock during excavation.

1.02 PRICE AND PAYMENT PROCEDURES
   A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
   B. Trench Rock Removal: By the cubic yard measured before disintegration. Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials. Rock Removal pricing also includes all necessary backfill and compaction where rock has been removed to provide a solid trench bottom and bearing surface for subsequent utility placement.

1.03 DEFINITIONS
   A. Trench Rock: Solid mineral material with a volume in excess of 1/6 cubic yard or solid material that cannot be removed with a 1/3 cubic yard capacity power shovel without drilling.
   B. Rock: Solid mineral material of a size that cannot be removed with a 1/2 cubic yard capacity power shovel.

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Submit proposed method of rock removal and any products proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Mechanical Disintegration Compound: Grout mix of non-toxic materials that expand on curing. Bustar Expansive Grout by Demolition Technologies Inc., or equal.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION
   A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL
   A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.
   B. Mechanical Methods: Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
   C. Form level bearing at bottom of excavations. Provide additional backfill as required to bring bottom up to required elevation.
   D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
   E. Remove excavated materials from site.
   F. Correct unauthorized rock removal to directions of Engineer.

3.04 FIELD QUALITY CONTROL
   A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

END OF SECTION
SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Aggregate base course.
B. Single course bituminous concrete paving.
C. Double course bituminous concrete paving.
D. Surface sealer.

1.02 REFERENCE STANDARDS
A. Al MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.

1.03 QUALITY ASSURANCE
A. Perform Work in accordance with State of California Highways standard.
B. Mixing Plant: Conform to State of California Highways standard.
C. Obtain materials from same source throughout.

1.04 REGULATORY REQUIREMENTS
A. Conform to applicable code for paving work on public property.

1.05 FIELD CONDITIONS
A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS
A. Asphalt Cement: ASTM D 946.
B. Aggregate for Base Course: In accordance with State of California Highways standards.
C. Aggregate for Binder Course: In accordance with State of California Highways standards.
D. Aggregate for Wearing Course: In accordance with State of California Highways standards.
E. Fine Aggregate: In accordance with State of California Highways standards.
F. Primer: In accordance with State of California Highways standards.
G. Tack Coat: Homogeneous, medium curing, liquid asphalt.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN
A. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with Al MS-2.
B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with Al MS-2.
C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with Al MS-2.

2.03 SOURCE QUALITY CONTROL
A. Test mix design and samples in accordance with Al MS-2.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
   B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE
   A. Place and compact base course.

3.03 PREPARATION - PRIMER
   A. Apply primer in accordance with manufacturer's instructions.
   B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.
   C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT
   A. Apply tack coat in accordance with manufacturer's instructions.
   B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE
   A. Install Work in accordance with State of California Highways standards.
   B. Place asphalt within 24 hours of applying primer or tack coat.
   C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
   D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE
   A. Place asphalt binder course within 24 hours of applying primer or tack coat.
   B. Place wearing course within two hours of placing and compacting binder course.
   C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
   D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 SEAL COAT
   A. Apply seal coat to surface course and asphalt curbs in accordance with Al MS-19.

3.08 TOLERANCES
   A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
   B. Variation from True Elevation: Within 1/2 inch.

3.09 FIELD QUALITY CONTROL
   A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.
   B. Provide field inspection and testing. Take samples and perform tests in accordance with Al MS-2.

3.10 PROTECTION
   A. Immediately after placement, protect pavement from mechanical injury for 4 days or until surface temperature is less than 140 degrees F.

END OF SECTION
SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, roads, and inclined ramps.

1.02 REFERENCE STANDARDS
A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
F. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on joint filler, admixtures, and curing compound.
C. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES
A. Comply with applicable requirements of ACI 301.
B. Design paving for parking and residential streets.
C. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, buff color Portland cement, exposed aggregate finish.
D. Parking Area Pavement: 4,000 psi 28 day concrete, 5 inches thick, 6/6 - 6 x 6 inch mesh reinforcement, wood float finish.

2.02 FORM MATERIALS
A. Form Materials: Conform to ACI 301.
B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).
2.03 REINFORCEMENT
   A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.
   B. Dowels: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.04 CONCRETE MATERIALS
   A. Obtain cementitious materials from same source throughout.
   B. Concrete Materials: Provide in accordance with State of California Highways standards.

2.05 CONCRETE MIX DESIGN
   A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
   B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
      1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

2.06 MIXING
   A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
   B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
   B. Verify gradients and elevations of base are correct.

3.02 SUBBASE
   A. Prepare subbase in accordance with State of California Highways standards.

3.03 PREPARATION
   A. Moist base to minimize absorption of water from fresh concrete.

3.04 FORMING
   A. Place and secure forms to correct location, dimension, profile, and gradient.
   B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
   C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT
   A. Place reinforcement as indicated.
   B. Place dowels to achieve pavement and curb alignment as detailed.

3.06 COLD AND HOT WEATHER CONCRETING
   A. Follow recommendations of ACI 305R when concreting during hot weather.
   B. Follow recommendations of ACI 306R when concreting during cold weather.
   C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE
   A. Place concrete in accordance with ACI 304R.
   B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
   C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
3.08 JOINTS
   A. Align curb, gutter, and sidewalk joints.
   B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
      1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
      2. Secure to resist movement by wet concrete.

3.09 FINISHING
   A. Area Paving: Light broom, texture perpendicular to pavement direction.
   B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
   C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
   D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

3.10 TOLERANCES
   A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

3.11 FIELD QUALITY CONTROL
   A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
      1. Provide free access to concrete operations at project site and cooperate with appointed firm.

3.12 PROTECTION
   A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION
SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Fence framework, fabric, and accessories.
B. Excavation for post bases; concrete foundation for posts.
C. Manual gates and related hardware.

1.02 REFERENCE STANDARDS
C. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.

1.03 SUBMITTALS
A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Chain Link Fences and Gates:

2.02 MATERIALS AND COMPONENTS
A. Materials and Components: Conform to CLFMI Product Manual Unless otherwise noted.
B. Fabric Size: CLFMI Heavy Industrial service PVC coated over Zinc coated wire.
C. Intermediate Posts: Type I round. PVC coated over Zinc coated post.
D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round PVC coated or Zinc coated post and rails.
E. Gates: to match Fence, unless noted otherwise.

2.03 ACCESSORIES
A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
B. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
C. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

2.04 FINISHES
A. Components and Fabric: Vinyl coated over coating of 1.8 oz/sq ft galvanizing.
B. Accessories: Same finish as framing.
C. Color: Black.
PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F 567 unless noted otherwise.

B. Place fabric on outside of posts and rails.

C. Set all posts posts plumb, in concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff.

D. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

E. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

F. Install center brace rail on corner gate leaves.

G. Do not stretch fabric until concrete foundation has cured 28 days.

H. Position bottom of fabric 2 inches above finished grade.

I. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

J. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

K. Install bottom tension wire stretched taut between terminal posts, unless noted otherwise.

L. Do not attach the hinged side of gate to building wall; provide gate posts.

M. Install gate with fabric to match fence. Install hardware.

N. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

O. Ground fence in accordance with electrical drawings.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

END OF SECTION
SECTION 33 05 13
MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry
      transition to lid frame, covers, anchorage, and accessories.

1.02 SUBMITTALS
   A. See Division 1 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and
      accessory locations for precast manholes. Shop drawings shall include calculations,
      reinforcements for pipe openings, and shall be stamped by a registered structural engineer.
   C. Product Data: Provide manhole covers, component construction, features, configuration, and
      dimensions.

1.03 QUALITY ASSURANCE
   A. Manufacturer: Company specializing in manufacturing products specified in this section with
      minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C476 (ASTM
      C476M), with resilient connectors complying with ASTM C923 (ASTM C923M).

2.02 PRECAST CONCRETE MANHOLES
   A. Manufacturer:
      1. Utility Vault, a division of Oldcastle Precast;
      2. Jensen Precast;
      3. Substitutions: See Division 1 - Product Requirements.
   B. Vault shall have flat sides, Sidewall flanges not acceptable.
   C. Description: Precast manhole designed in accordance with ASTM C 858, comprising modular,
      interlocking sections complete with accessories.
   D. Loading: ASTM C 857, Class [H-20].
   E. Shape: As indicated.
   F. Nominal Inside Dimensions: See drawings for dimensions.
   G. Inside Depth: See drawing for dimension.
   H. Wall Thickness: As indicated.
   I. Outside Wall: Provide waterproofing.
   J. Riser Casting: 12 inch, with manhole step cast into frame.
   K. Frames and Covers: ASTM A 48; Class 30B gray cast iron, 27 inch size, machine finished with
      flat bearing surfaces. Provide cover marked [according to service "CHW" or HHW"] to indicate
      utility.
   L. Entry Provisions: [as indicated on the drawings].
   M. Lid:
      1. Size: 36" Diamters
      2. Lid shall be water tight
      3. Provide welded ID#. See drawings for exact ID number.
   N. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement.
   O. Ladder: OSHA approved, aluminum, full length, with top hook to engage manhole step in riser
      casting. Provide one ladder for each manhole.
P. Pipe Entry: Provide openings as indicated. All openings shall be field coordinated.
Q. Sump Covers: ASTM A 48; Class 30B gray cast iron.
R. Source Quality Control: Inspect manholes in accordance with ASTM C 1037.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.
B. Verify that built-in items are in proper location, and ready for roughing into Work.
C. Verify excavation for manholes is correct.

3.02 MANHOLES

A. Place concrete base pad, minimum 6" Class II aggregate.
B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
C. Cut and fit for pipe.
D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
E. Set cover frames and covers level without tipping, to correct elevations.
F. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION
SECTION 33 61 13
UNDERGROUND HYDRONIC ENERGY DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe and pipe fittings for:
   1. Chilled water piping system.
B. Valves:
   1. Ball valves.
   2. Butterfly valves.
   4. Strainers.

1.02 REFERENCE STANDARDS
A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
C. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Submit complete shop drawings for piping system showing all fittings, elevations, pipe accessories, hanger locations and all connected equipment. Submit on reproducible film, and compact disk. Drawings shall be produced in AutoCad 2008 or later release.
C. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
D. Project Record Documents: Record actual locations of pipe routing, valve locations and unforeseen utilities.
E. Piping Pressure Test Reports: Provide piping pressure test reports indicating:
   1. District
   2. Project Address
   3. Project Name
   4. Testing Contractor
   5. Pipe Segment Tested
   6. Pipe Size, Service and material (including wall thickness information (schedule, SDR, etc.)
   7. Test Medium
   8. Date and Time of Test Start
   9. Starting Pressure and Temperature of Test Medium
   10. Starting Ambient Temperature
   11. Date and Time of Test End
   12. Ending Pressure and Temperature of Test Medium
   13. Ending Ambient Temperature
   14. Observations and Conclusions
F. Prefabricated Piping Systems: Provide manufacturer's shop drawings with dimensioned piping layout and details of all expansion loops, elbows, anchor points, building and/or manhole entry points and all other pertinent information needed to verify that the type of materials being offered are in accordance with these specifications. Prefabricated pipe units are to be subsequently dimensioned and numbered to fit actual job conditions as field verified by the installing contractor prior to the start of factory fabrication work.

G. As-Built Drawings: At project closeout, provide as-built drawings of the piping systems installed. Drawings shall be prepared using AutoCad 2008 or later release. Where Contract Drawings were created in 3D, prepare as-builds using Autodesk Revit 2011 or later release. Submit two reproducible copies and two complete sets of drawing files on a compact disc.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS
2.01 HYDRONIC SYSTEM REQUIREMENTS
A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, bolsters, anchors and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized. Common anchors for chilled water and heating hot water are not allowed.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide temporary flanges/blinds, test connections as required to perform hydro testing of piping system, in segments as required to meet project requirements and time constraints. Remove flanges from all direct buried portions of piping at completion of testing.

C. Pipe-to-Valve Connections: Use flanges to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections. Flanges, unions or grooved couplings shall be used in accessible manholes or tunnels only, unless otherwise indicated or shown on contract drawings. Grooved fittings and couplings are not acceptable for use on systems conveying fluids in excess of 95 degrees F.

D. Valves: Provide valves where indicated.
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, and base of vertical risers. Use 1 inch valves with cap; pipe to nearest drain.

2.02 CHILLED WATER PIPING, BURIED
A. STEEL CARRIER, HDPE JACKET: Underground piping for lines shall consist of a factory prefabricated, pre insulated system suitable for direct burial, consisting of a carrier pipe, insulation, and a corrosion resistant outer casing. Prefabricated piping system shall be XtruTherm as manufactured by Perma Pipe, Ferro-Therm as manufactured by Thermacor Process, L.P., or approved equal. All straight sections, expansion loops, fittings, anchors and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds.
1. Carrier Pipe: ASTM A 53, Grade A or B, Schedule 40 for pipe sizes under 12", 0.375" wall for 12" and over, black, seamless or electric resistance welded.
4. Insulation: Polyurethane, spray applied, nominal density 2 pounds per cubic foot foam for straight sections and preformed foam for fittings - 1-1/2" thick. \( K = .16 \) BTU-in/hr-SF-F.
5. Casing: Jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12", 150 mils for jacket sizes larger than 12" to 24", and 175 mils for jacket sizes greater than 24".
6. Fittings: Fittings shall be factory fabricated and provide sufficient straight lengths of pipe on each end to allow for field joints in straight piping only. Insulation and casing shall be the same as for the straight piping system.
7. End Seals: Moisture barrier end seals shall be factory applied, sealed to the jacket and carrier pipe. Field applied end seals shall be installed at any field cut to the piping before continuing with the installation. End seals shall be:
8. Field Joints: Straight run joints shall be field-insulated per the manufacturer’s instructions, using polyurethane foam poured in an HDPE sleeve and sealed with a heat shrink sleeve. (At the Engineer’s option, a pressure testable joint closure may be specified.) All joint closures and insulation shall occur at straight sections of pipe. All insulation and jacketing materials shall be furnished by piping system manufacturer.
9. Piping system shall be capable of field modifications (cutting and joining), to allow for rerouting to avoid unforeseen obstructions without affecting system warranty.

B. STEEL PIPING IN MANHOLES: Steel piping inside manholes shall conform to the following:
1. Pipe: ASTM A 53, Grade A or B, Schedule 40 for pipe sizes under 12", 0.375" wall for 12" and over, black, electric resistance welded.
2. Fittings: ASTM A 234/A 234M, forged steel welding type, 150 lb flanged or 150 factory fabricated grooved joint.
3. Joints: Welded, or 150 lb flanged or 150 factory fabricated grooved joint.
4. Insulation: Polyurethane, nominal density 2 pounds per cubic foot foam and preformed foam for fittings - 1-1/2" thick or Cellular Glass, FOAMGLAS® by Pittsburgh Corning, preformed, 1-1/2" thick.
5. Jacketing: Pittsburgh Corning Pittwrap®, heat sealable, 125 mil modified bitumen jacketing for straight sections. Pittsburgh Corning Pittwrap® cut to shape, or Pittcote® 300 finish and PC® Fabric 79.

2.03 UNIONS, FLANGES, AND COUPLINGS - IN MANHOLES ONLY
A. Unions for Pipe 2 Inches and Under:
1. Ferrous Piping: 150 psig malleable iron, threaded.
B. Flanges for Pipe Over 2 Inches:
1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Gaskets: 1/16 inch thick preformed neoprene.

2.04 BALL VALVES
A. Manufacturers:
5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Up To and Including 2 Inches:
1. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends.
2.05 BUTTERFLY VALVES - IN MANHOLES AND DIRECT BURIED

A. Manufacturers
1. DeZurik Water Controls; Model AWWA Butterfly Valves (BAW): www.dezurikwater.com or equal, no known equal.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. General: Butterfly valves shall meet the requirements of AWWA C504 standards. Butterfly Valve shall have offset disc design, corrosion resistant shaft, stainless steel disc edge, and self-compensating shaft seals. Moulded-in body seat with disc locators provides positive sealing and longer seat life on sizes 3 - 20". Large valves, 24" and larger shall have adjustable, replaceable seat, non-hollow disc structure, and rubber seat retained within a dovetail groove in the valve body and locked in place by an epoxy wedge.
1. Temperature Range: to 290°F
2. AWWA Class: 150B
3. Body Material: Cast iron ASTM A126 Class B
4. Disc Material: 316 Stainless Steel ASTM A743 Type CF8M
5. Shaft Material: 316 Stainless Steel ASTM A276 Type 316
6. Seat Material: EPDM Terpolymer of Ethylene Propylene & a Diene (-20 to 290 F)
7. Packing Material: EPDM Self adjusting (-20 to 290 F)
8. Valve Style: Flanged joint
9. Coating: Epoxy coated, minimum 8 mils dry finish

C. Actuator Type: Valves between 3"-36" shall have a scotch yoke mechanism that allows the actuators to provide a torque curve matching the torque required by the valve. The actuator shall have a steel threaded input shaft and ductile iron yoke nuts (traveling nut actuator). Valves between 30"-72" shall have a link-arm mechanism that will allow the actuator to provide characterized closure which slows valve travel as the disc comes into the seat. Provide handwheel for use in manholes and standard operating nut for buried service.

2.06 BALANCING VALVES

A. Manufacturers:

B. Construction:
1. 2-1/2" to 12" Pipe Size
   a. Cast iron, flanged construction with 125 psig flanged connections suitable up to 175 psig working pressure at 250 F. Valves 2-1/2" - 3" shall have a brass ball with glass and carbon filled TFE seat rings. Valves 4" - 12" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves shall have memory stop feature and calibrated nameplate with position indication.

2.07 STRAINERS

A. Size 2-1/2 inch to 4 inch:
1. Manufacturers:
   b. Substitutions: See Section 01 60 00 - Product Requirements.
2. Flanged carbon steel or cast iron body for 150 psig (WOG) working pressure, Y pattern with 1/16" stainless steel perforated screen.

2.08 PRECAST MANHOLES

A. See Section 330513 - Manholes and Structures.

PART 3 EXECUTION

3.01 PREPARATION

3.02 PREFABRICATED PIPING SYSTEM INSTALLATION

A. Follow manufacturer's written instructions for all installation procedures.
B. Coordinate with manufacturer for field inspection prior to testing or backfilling. To assure proper installation of the piping materials, a manufacturer's field service instructor who is technically qualified to determine whether or not the installation is being made in accordance with the manufacturer's recommendations shall be present during critical periods of the materials installation and testing.

C. Polyurethane insulation shall be poured in place into the field weld area. All field applied insulation shall be placed only on straight sections. The mold for the insulation shall be made of clear adhesive backed polyester film. Joint area shall be sealed with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory applied resin.

D. All insulation and coating materials for making the field joint shall be furnished by the prefabricated piping manufacturer.

E. Bedding and Backfilling:
1. See also Section 31 23 16.13 Trenching for Site Utilities.
2. Backfilling shall not begin until the heat shrink wrap has cooled, or until the FRP lay-up has fully cured.
3. Install external bolstering material of the type and dimensions as recommended/required by the manufacturer for external expansion compensation.
4. Provide 4 inch layer of sand or fine gravel, tamped in the trench for a uniform bedding.
5. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 12 inches above the top of the piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil.

F. Field Modifications for rerouting
1. Line and grade shall be modified in the field to avoid existing obstructions as required. Field modifications to slope and grade shall be as delineated on the Drawings. No increase in contract price will be permitted for piping installed within the defined tolerance.
2. Modifications to pre-fabbed pipe shall be accomplished with pipe and fittings as specified for manhole applications, with preformed insulation and PittWrap® jacketing.
3. Mitred joints will be allowed up to 22-1/2 degrees to avoid existing obstructions.

3.03 TESTING
A. Unless otherwise noted, hydrostatically test all piping installed under this contract to 1-1/2 times the normal working pressure or 150 psig, whichever is higher for a period of not less than 4 hours with no visible signs of leakage.

B. Provide necessary caps or blinds to protect equipment not rated for test pressure (safety valves, regulators, etc.).

C. Pressure test all buried piping prior to backfilling, unless otherwise noted.

D. Prefabricated/Preinsulated Piping Systems:
1. Carrier piping shall be hydrostatically tested at 225 psig for a minimum of 4 hours. Test prior to backfilling/insulating/wrapping field joints.

E. Pneumatic Testing:
1. Pneumatic testing is expressly prohibited on any non-metallic piping.
2. Other than as excepted above, pneumatic testing will not be considered without written consent from District or Engineer, and substantiation as to why hydrotesting is inapplicable. Additional testing requirements and measures may be required for a pneumatic test and will be considered on a case-by-case basis.

F. Reports: Submit test reports for all pipeline sections tested per Submittals requirements in Part 1 of this specification.

END OF SECTION
SECTION 33 71 19
ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Nonmetallic duct.

1.02 REFERENCE STANDARDS
B. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for nonmetallic conduit.
C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.
D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
E. Field Samples: Provide sample of actual conduit delivered to site, two each 2 feet long.
F. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT
A. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.02 ACCESSORIES
A. Underground Warning Tape: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
C. Verify locations of manholes prior to excavating for installation.
D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

F. Contractor shall locate pullboxes, vaults, and manholes away from drainage path.

3.02 DUCT BANK INSTALLATION

A. Install duct to locate top of ductbank at depths as indicated on drawings.

B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.

C. Cut duct square using saw or pipe cutter; de-burr cut ends.

D. Insert duct to shoulder of fittings; fasten securely.

E. Join nonmetallic duct using adhesive as recommended by manufacturer.

F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Provide suitable fittings to accommodate expansion and deflection where required.

I. Terminate duct at manhole entries using end bell.

J. Stagger duct joints vertically in concrete encasement 6 inches minimum.

K. Use suitable separators and chairs installed not greater than 4 feet on centers.

L. Band ducts together before backfilling.

M. Securely anchor duct to prevent movement during concrete placement.

N. Concrete backfill: Use mineral pigment to color concrete red.

O. Provide minimum 4 inch concrete cover at bottom, top, and sides of ductbank.

P. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

Q. Provide suitable pull string in each empty duct except sleeves and nipples.

R. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

S. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

END OF SECTION
SECTION 33 71 19
UNDERGROUND ELECTRICAL STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. PVC Non-metallic Conduit and Ducts
B. Underground pull boxes
C. Underground vaults
D. Manholes.
E. Accessories

1.02 REFERENCES
A. ASTM C 858 - Underground Precast Concrete Utility Structures.
D. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.
E. NEMA TC 9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
G. NEMA TC 14 - Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings.
H. UL 651A - Type EB and A PVC Conduit and HDPE Conduit.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for nonmetallic conduit and manhole accessories.
C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes, vaults, and pullboxes. Shop drawings shall include reinforcements for conduit openings and stamped by a registered structural engineer.
D. Field Samples: Provide sample of actual plastic duct delivered to site, two each 2 feet long.
E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.
F. Shop drawings of manhole, vault, and pullbox covers complete with nameplate schedule.

1.04 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT
A. PVC Coated Rigid Steel Conduit: ANSI C80.1.
   1. Product: Rigid Steel Conduit, corrosion-resistant, pvc coated. Shall be hot dip galvanized, to which a minimum 40-mil thick PVC coating has been bonded to the outside of the conduit. A 2-mil coat of urethane coating shall be bonded to the inside. Coating shall be free of pinholes. Elbows shall be factory made and coated.

B. Plastic Utilities Duct: NEMA TC 2; Polyvinyl Chloride (PVC) Schedule 80.
   1. Duct Fittings: NEMA TC 3.
   2. Product: Carlon or approved equal.
   3. Plug fittings with pull tab.
   4. Nominal size: As shown in drawings.
5. Conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could damage conductors or cables.

C. Reinforced Resin Conduit and Fittings: NEMA TC 14, Type SW.

D. Concrete - Concrete for conduit encasement shall be Class C with 3/8" maximum aggregate and shall be red concrete (iron oxide) with 28-days compressive strength of 2,500 psi.

E. Concrete - Concrete for buried ducts shall be Class C with 1" maximum aggregate and shall be red concrete "slurry fill".

2.02 UNDERGROUND PULLBOXES

A. Manufacturers: Jensen Pre-cast, Christy Concrete Products, BES Concrete Products

B. Sizes: See Schedule on drawings.

C. Pullboxes shall be precast concrete as indicated on plans.
   1. Traffic Box - High density reinforced concrete box with non-setting shoulders positioned to maintain grade and facilitate back filling. Utility boxes shall be used where shown on the drawings. Use steel checker plate, H/20 loading, bolt down. Provide 12" extension pieces.
   2. General Utility Box - High density reinforced concrete box with non-setting shoulders positioned to maintain grade and facilitate back filling. Utility boxes shall be used where shown on the drawings. Use reinforced concrete lids on unfinished grades (i.e. grass, dirt, etc.), and steel checker plate lids on finished grades (i.e. concrete, asphalt, etc.) Provide 12" extension pieces.

2.03 UNDERGROUND VAULTS

A. Manufacturers: Utility Vault, or approved equal.

B. Sizes: 17" (width) x 30" (length) and 3' (width) x 5' (length), 2'-0" up to 4'-6" (Depth), (Maximum Dimensions)

C. Vaults shall be precast concrete as indicated on plans. Electrical vaults shall be without base. Telecommunication vaults shall be with base.

D. Telecommunication Vaults - High density reinforced concrete with 7/8" dia. pull irons, 12" dia. x 2" sump, 1/2" dia. plastic inserts. Utility Vault Company, Inc., Model #PTS-3660, or approved equal.
   1. Cover: Traffic rated (H/20 minimum) with guard bars, height adjustment brackets and torsion assisted opening.
   2. Ducts: 4" dia. "term-a-ducts" for minimum number of conduits, as shown on drawings.
   3. Racks: package per most current Pac Bell specifications
   4. Accessories: provide grade rings as appropriate to maintain grade and facilitate back filling.

E. Electrical Vaults - High density reinforced concrete with 7/8" diameter lifting inserts or pulling irons.
   1. Covers
      a. Traffic - full traffic rated, with H/20 loading.
      b. Pedestrian - pedestrian, slip resistant
   2. Types
      a. Nominal 17" x 30" Vaults - without base, minimum depth 24", mastic sealant for joints, and a term-a-duct per PG&E specifications. Utility Vault Model #04-3513
      b. Nominal 3' x 5' Vaults - with base, 14" diameter x 4" sump (2 each), 1" diameter ground rod knock-outs (2 each), term-a-ducts and knock-outs per conduit sizes in site plans, and per PG&E specifications Utility Vault Model #04-3588.
      c. Cover - full traffic covers with H/20 loading
         1) Splice Vaults Utility Vault Model #04-1616
         2) Transformer Vaults - Utility Vault Model #04-1614
2.04 PRECAST CONCRETE MANHOLES
A. Manufacturers: Forni Corporation, Utility Vault, Associated Concrete Products.
B. Description: Precast manhole designed in accordance with ASTM C 858, comprising modular, interlocking sections complete with accessories.
C. Size and Shape: As indicated on plans. At least seven (7) feet high interior clearance.
D. Frames and Covers: ASTM A 48; Class B30 gray cast iron, 36 inch size, machine finished with flat bearing surfaces. Provide cover marked as scheduled to indicate utility. Cover and frame shall have provisions for bolting cover to manhole.
E. Duct Entry Provisions: Reinforced opening/windows with plastic duct terminators and diaphragms as indicated on plans.
F. Duct Entry Locations: As indicated.
G. Duct Entry Size: 4 inch for telecommunication manholes; 5 inch for electrical manholes.
H. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.
I. Cable Rack Inserts: Fiberglass. Minimum load rating of 800 pounds (365 kg). Locate at 3 feet on center.
J. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch steel channel, 48 inch length. Provide cable rack arm mounting slots on 1-1/2 inch centers.
K. Cable Supports: Porcelain clamps and saddles.
L. Ladder: Fiberglass, [12"+/- O.C.] rungs, with top hooks to engage manhole step in riser casting. Provide one ladder for each manhole.
M. Sump Covers: ASTM A 48; Class 30B gray cast iron.
N. Source Quality Control: Inspect manholes in accordance with ASTM C 1037.

2.05 ACCESSORIES
A. Underground Warning Tape: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines. Orange colored tape with suitable warning legend will describe buried telecommunications lines.
B. Duct spacers shall be Wunpeece, Carlon Snap-Loc or equal. Spacers shall be provided with rebar holder.
C. Ground Rod - 3/4" x 10' minimum, copper clad. Blackburn, Erico, or equal.
D. Grounding Electrode Conductor - 4/0 bare copper conductor
E. Pullrope - 3/16" dia. min., 150 lbs test, yellow nylon
F. Detectable muletape - All telecommunications conduits shall be equipped with 5/8" dia. min., 1800 lbs strength, flat woven polyester detectable muletape. Muletape shall be printed with sequential footage or meter markings and contain an corrosion-resistant 22awg conductor compatible with any standard transmitting/receiving equipment.
G. Duct Plugs - removable, reusable, plastic plugs. Watertight, airtight, and gastight with provisions for pullrope attachments.

PART 3 EXECUTION
3.01 EXAMINATION
A. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system. Verify routing and termination locations of duct bank prior to excavation for rough-in.
B. Pullboxes, Vaults and Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system. Verify locations of pullboxes, vaults and manholes prior to excavating for installation.
C. Contractor shall locate pullboxes, vaults, and manholes away from drainage path.

3.02 DUCT BANK INSTALLATION

A. Underground conduits shall be as specified PVC for electrical and telecommunications. PVC Coated rigid steel conduit shall be used in areas crossing steam piping, minimum 10 feet length on either side of steam piping. Do not run new conduits parallel to steam piping. Maintain a minimum of 5 feet clearance between steam or hot water piping and electrical conduits.

B. Layout
1. Duct bank routing shown in the drawings is approximate. Exact duct banks routing shall be determined with close coordination with Project Manager. Account for existing field conditions, and new field conditions in coordinating the final routing of duct banks.
2. Conduct exploratory excavation sufficiently ahead so that any obstacles can be determined pre-hand, and mediated sooner to make necessary offsets and bends around existing obstacles.

C. Depth and Clearances
1. Install power and communications duct to locate top of ductbank minimum 30 inches below finished grade.
2. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances and to manholes where possible.
3. Underground conduits shall be as specified PVC for electrical and telecommunications. PVC Coated rigid steel conduit shall be used in areas crossing steam piping, minimum 3 feet length on either side of steam piping. Maintain a minimum of 3 feet clearance between steam or hot water piping and electrical conduits.
4. Maintain the following clearances (minimum) between High Voltage (over 600 Volts) and a. Power Conduit - two (2) inches b. Gas Pipe - twelve (12) inches c. Telephone, Cable Conduit - twelve (12) inches d. Wet Utilities - 3’ minimum from concrete encased High Voltage Lines

D. All underground conduits not indicated otherwise on the drawings shall be concrete encased.

E. Installation
1. Install conduits as recommended by manufacturer using approved couplings, fittings, and cement.
2. Cut duct square using saw or pipe cutter; de-burr cut ends.
3. Insert duct to shoulder of fittings; fasten securely.
4. Join nonmetallic duct using adhesive as recommended by manufacturer.
5. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
6. Install no more than equivalent of four 90-degree bends between pull points for power.
7. Install no more than equivalent of two 90-degree bends between pull points for tel/com.
8. Provide suitable fittings to accommodate expansion and deflection where required.
9. Terminate duct at manhole entries using end bell.
10. Stagger duct joints vertically in concrete encasement 6 inches minimum.
11. Use suitable separators and chairs installed not greater than 4 feet on centers.
13. Securely anchor duct to prevent movement during concrete placement.
14. Provide minimum 4 inch concrete cover at bottom, top, and sides of ductbank.
15. Connect to existing concrete encasement using dowels.
16. Connect to manhole wall using dowels.
17. Provide suitable pull string in each empty duct except sleeves and nipples.
18. Provide detectable muletape in all empty telecommunications conduits.
19. Immediate after backfilling and compaction swab ducts. Draw a testing mandrel not less than 12 inches long with a diameter 1/4" less than the interior diameter of the conduit through each conduit. Then draw a stiff wire bristle brush and size to match conduit.
diameter until conduit is clear of all particles of earth, sand, and gravel. Use suitable duct plugs to protect installed duct against entrance of dirt and moisture.


3.03 PRE-CAST MANHOLE, VAULTS, AND UNDERGROUND PULLBOX INSTALLATION

A. Install and seal precast sections in accordance with ASTM C 891.
B. Install manholes plumb.
C. Use precast neck and shaft sections to bring manhole cover to finished elevation. Refer to grading plans for finished elevations.
D. Attach cable racks to inserts after manhole installation is complete.
E. Provide crushed rocks min 6" in bottom of manholes for proper drainage or install drains and connect to closest site drainage system.
F. Install two ground rods, one on each opposite corners. Ground rods shall project 6" above manhole floor.
G. Knock-out a 2" diameter hole in sump area of manhole.
H. Clean manhole of any debris prior to substantial completion. Drain manhole of water.

END OF SECTION
**USING OLDCASTLE PRECAST BLOCKS**

1. All blocks are property of Oldcastle Precast and are provided for general use in customer drawings.
2. The Oldcastle Precast logo should not be altered.
3. Plans and elevations are dynamic blocks flat feature rendering installation. Simply click on this block and revolve to view all available standard sizes using the link menu.
4. The Vizibility State of each dynamic block can be changed to allow for more or fewer on a given model.
5. Custom sizes are available. Contact Oldcastle Precast for more details.

**SPECIFICATIONS**

1. Concrete: Design Strength of 4000 psi at 28 days
2. Steel Reinforcement: ASTM A 416 Grade 60 tubing, ASTM A 193 Grade D5 welded wire fabric
3. Live Load: AASHTO HS 20
4. Unit Weight: 120 psf
5. Depth of Fill: 6" to 12"
6. Lateral Soil Pressure: 40 psf
7. Water Table: 5' below grade

**STANDARD COMPONENTS**

1. 12" Drainage Sump
2. Embossed Ribbed & Pulling Frames
3. Manhole Cover & Frame

**OPTIONS**

1. Vault can be customized with these options in locations requested by the customer:
   - Cover Options - Galvanized cover, hatch, concrete,
   - Fill with Ring & Cover, concrete lid
   - 2/5 Grade Rings & Rings - Round or Rectangular
   - Knockouts & Blockouts - Round or Rectangular
   - Torus & Ducts
   - Vault & Hardware - Unistrut, inserts

---

**WATER VAULT**
ELECTRICAL
6'-0" x 8'-0" x 7'-0" I.D.
Vault Roseville Electric
Model: V687RVE

V687RVE Top
Weight: 13,950 lbs.
Item #: xxxxxxxxxxx

V687RVE Base
Weight: 12,850 lbs.
Item #: xxxxxxxxxxx

SPECIFICATIONS:
1. Concrete shall be 5000 PSI at 28 day compressive strength.
2. Steel reinforcement: Rebar, ASTM A-415
   Grade 60 or Mesh, A-185 Grade 55.

Oldcastle Precast
Northern California
© 2011 Oldcastle Precast, Inc.
DESIGN LOAD: H-20 TRAFFIC LOADING WITH 1 TO 5 FEET SOIL COVER.
WATER TABLE ASSUMED TO BE 6 FEET BELOW FINISHED GRADE.
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.
DESIGN LOAD: H-20 TRAFFIC LOADING WITH 1 TO 5 FEET SOIL COVER.
WATER TABLE ASSUMED TO BE 6 FEET BELOW FINISHED GRADE.
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.
JENSEN PRECAST COMPANY
FLOTATION CALCULATION PROGRAM VERSION 2.10
8'-0"x10'-0"x8'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

STRUCTURE LENGTH 10.00 FEET
STRUCTURE WIDTH 8.00 FEET
TOP SLAB THICKNESS 9.00 INCHES
WALL HEIGHT 8.00 FEET
WALL THICKNESS 8.00 INCHES
BOTTOM THICKNESS 8.00 INCHES
EXTERIOR HEIGHT 9.42 FEET
EXTERIOR PERIMETER 41.33 FEET
DEPTH TO TOP 1.00 FEET
DEPTH TO WATER 6.00 FEET

SOIL WT. DRY 100.00 LBS/CU.FT.
SOIL WT. SUBMERGED 57.60 LBS/CU.FT.
SOIL COHESION 0.00 LBS/SQ.FT.
INTER. FRICTION ANGLE 20.00 DEGREES
SOIL PRESS. COEFFICIENT -K_a- 0.36

DISPLACED VOLUME = 11.33 x 9.33 x 4.42 = 467.19 CUBIC FT.
UPLIFT FORCE = 62.4 LBS/CU.FT.x DISPLACED VOLUME = 29152.36 LBS.

TOP SLAB = 11.33x 9.33x 9.00/12.00 x 150 = 11900.00 LBS.
WALLS = 38.67x 8.00x 8.00/12.00 x 150 = 30933.33 LBS.
BOTTOM = 11.33x 9.33x 8.00/12.00 x 150 = 10577.78 LBS.
TOTAL STRUCTURE WEIGHT 53411.11 LBS.

SOIL WT. DRY = 11.33x 9.33x 1.00x100.00 = 10577.78 LBS.
SOIL WT. WET = 11.33x 9.33x 0.00x 57.60 = 0.00 LBS.

SOIL WEIGHT ABOVE STRUCTURE 10577.78 LBS.

**********************************************************************
SOIL FRICTIONAL RESISTANCE

NORMAL STRESS = Ka x SUBMERGED WT. x AVG. DEPTH = 118.37 LBS/SQ.FT.
RESIST. = COHESION + (STRESS x TANGENT INT. ANG) = 43.08 LBS/SQ.FT.
SOIL FRICTION = 43.08 x 41.33 x 9.42 = 16768.64 LBS.

53411.11 + 10577.78 + 16768.64
SAFETY FACTOR = ------------------------------------- = 2.77√
29152.36

******************************************************************
PRECAST COMPANY
FLATOLEN CALCULATION PROGRAM VERSION 2.10

8'-0"x10'-0"x3'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

******************************************************************
**JENSEN PRECAST COMPANY**

**FLOTATION CALCULATION PROGRAM VERSION 2.10**

8'-0"x10'-0"x8'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

<table>
<thead>
<tr>
<th>Structure Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Length</td>
<td>10.00 FEET</td>
</tr>
<tr>
<td>Structure Width</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>Top Slab Thickness</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>Wall Height</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>Bottom Thickness</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>Exterior Height</td>
<td>9.42 FEET</td>
</tr>
<tr>
<td>Exterior Perimeter</td>
<td>41.33 FEET</td>
</tr>
<tr>
<td>Depth to Top</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>Depth to Water</td>
<td>6.00 FEET</td>
</tr>
</tbody>
</table>

**Soil Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Wt. Dry</td>
<td>100.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>Soil Wt. Submerged</td>
<td>57.60 LBS/CU.FT.</td>
</tr>
<tr>
<td>Cohesion</td>
<td>0.00 LBS/SQ.FT.</td>
</tr>
<tr>
<td>Inter. Friction Angle</td>
<td>20.00 DEGREES</td>
</tr>
<tr>
<td>Soil Press. Coefficient (K_a)</td>
<td>0.36</td>
</tr>
</tbody>
</table>

**Displaced Volume**

\[
\text{DISPLACED VOLUME} = 11.33 \times 9.33 \times 8.42 = 890.30 \text{ CUBIC FT.}
\]

**Uplift Force**

\[
\text{UPLIFT FORCE} = 62.4 \text{ LBS/CU.FT.} \times \text{DISPLACED VOLUME} = 55554.49 \text{ LBS.}
\]

**Total Structure Weight**

- **Top Slab**
  \[
  11.33 \times 9.33 \times 9.00/12.00 \times 150 = 11900.00 \text{ LBS.}
  \]
- **Walls**
  \[
  38.67 \times 8.00 \times 8.00/12.00 \times 150 = 30933.33 \text{ LBS.}
  \]
- **Bottom**
  \[
  11.33 \times 9.33 \times 8.00/12.00 \times 150 = 10577.78 \text{ LBS.}
  \]

\[
\text{TOTAL STRUCTURE WEIGHT} = 53411.11 \text{ LBS.}
\]

**Soil Weight**

- **Soil Wt. Dry**
  \[
  11.33 \times 9.33 \times 5.00 \times 100.00 = 52888.89 \text{ LBS.}
  \]
- **Soil Wt. Wet**
  \[
  11.33 \times 9.33 \times 0.00 \times 57.60 = 0.00 \text{ LBS.}
  \]

**Soil Weight Above Structure**

\[
\text{52888.89 LBS.}
\]

**-----------------------------------------------**
JENSEN PRECAST COMPANY
FLOTATION CALCULATION PROGRAM VERSION 2.10

8'-0"x10'-0"x8'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

SOIL FRICTIONAL RESISTANCE

NORMAL STRESS = Ka x SUBMERGED WT. x AVG. DEPTH = 201.31 LBS/SQ.FT.
RESIST. = COHESION + (STRESS x TANGENT INT. ANG) = 73.27 LBS/SQ.FT.
SOIL FRICTION = 73.27 x 41.33 x 9.42 = 28518.93 LBS.

53411.11 + 52888.89 + 28518.93
SAFETY FACTOR = ----------------------------------------------- = 2.43
55554.49

***************************************************************************
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C957 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FT</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 IN</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FT</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FT</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FT</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FT</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FT</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FT</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 IN</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P(t) = \frac{16000.00 \times 1.70 \times 1.3}{4.16} = 8500.00 \text{ LBS.}
\]

\[
W_d = (0.750 \times 150 \times 1.4) + (1.00 \times 110.00 \times 1.4) = 311.50 \text{ LBS/SQ.FT.}
\]

\[
W_d = W_d \times \text{LOAD WIDTH/BEAM WIDTH} = 374.40 \text{ LBS/SQ.FT.}
\]

\[
M_u = \frac{P(t) \times L}{4} + \frac{W_d \times L^2}{8} = 21941.65 \text{ FT.LBS.}
\]

\[
M_u/\phi = M_u / 0.90 = 292555.27 \text{ IN.LBS.}
\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C957 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

F_{c}=4500.0, \quad b=0.825, \quad F_{y}=60000.

\sigma_{b} = 0.85 \frac{F_{c}}{b} \frac{87000}{F_{y}} = 0.0311 \frac{87000}{F_{y}+F_{y}}

\sigma_{max} = 0.75 \sigma_{b} = 0.02335

\sigma_{min} = \frac{200}{F_{y}} = 0.00333

d = 9.00 - 2.00 - 0.3125 = 6.6875 INCHES

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

\sigma = \frac{A_{s}}{bd} = 0.01030 \quad STEEL \ RATIO \ OK

\omega = \frac{\sigma_{y}}{F_{c}} = 0.13735

M_{n} = F_{c} b d^{2} (1 - 0.59 \omega) = 304820.47 IN.LBS.

304820.47 > 292555.27 IN.LBS. \quad \text{MOMENT CAP. OK} \checkmark
COVER SLAB FOR 8x10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ Vu = \frac{W \times (L-2d)}{2} + P_{11} = 9914.37 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \times b \times d} = 145.345 \text{ LBS./SQ.IN.} \]

SHEAR AT SLAB EDGE NOTCH

\[ Vu = \frac{W \times L}{2} + P_{11} = 10123.02 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \times b \times (t\text{-notch})} = 124.057 \text{ LBS./SQ.IN.} \]

\[ Vc = 1.9 \sqrt{f_c} + 2500 \sigma \frac{Vu \times d}{Mu} = 153.209 \text{ LBS./SQ.IN.} \]

153.209 > 145.345 LBS./SQ.IN. SHEAR CAP. OK ✔

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1944 SQ.IN.

USE NO. 5 BARS AT 18" ON CENTER As = 0.207 SQ.IN.
**JENSEN PRECAST CONCRETE**

**TOP SLAB BEAM PROGRAM VERSION 3.00**

**CRACK CONTROL CHECK**

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50' WIDE BEAM WITH 60' WIDE LOAD - SPANNING 104'
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P11 = \frac{16000.00 \times 1.3}{\text{BEAM WIDTH}} = 5000.00 \text{ LBS.}
\]

\[
Wd1 = (0.750 \times 150) + (1.00 \times 110.00) = 222.50 \text{ LBS/SQ.FT.}
\]

\[
Wd1 = Wd1 \times \text{LOAD WIDTH/BEAM WIDTH} = 267.43 \text{ LBS/SQ.FT.}
\]

\[
M = \frac{P11 \times L + Wd1 \times L^2}{4 - 8} = \frac{1335928.28 \text{ FT.LBS.}}{160203.39 \text{ IN.LBS.}}
\]

Fy = 60000.
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
CRACK CONTROL CHECK

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C657 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[ d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \]

TRY NO. 5 BARS AT 4 1/2" ON CENTER
\[ \sigma = \frac{A_s}{bd} = 0.01030 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2\alpha_n + (\alpha_n)^2)^{0.5} - \alpha_n = 0.325 \]

\[ j = 1 - \left(\frac{k}{3}\right) = 0.892 \]

\[ M = \frac{fs}{\alpha_jd} = 32497.060 \]

\[ D_c \text{ (FOR CRACK CONTROL)} = 2.3125 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 20.8125 \text{ SQ.IN.} \]

\[ \text{MAX. } fs = \frac{130000.00}{(D_c\text{AREA})^{0.33}} = 35738.919 \text{ psi} \]

\[ \text{MAX. } fs = 0.60 \times F_y = 36000.000 \text{ psi} \]

\[ 35738.919 > 32497.060 \text{ LBS/SQ.IN. CRACK CONTROL OK} \checkmark \]
**JENSEN PRECAST CONCRETE**  
**TOP SLAB BEAM PROGRAM VERSION 3.00**  
**DEFLECTION CALCULATION**

COVER SLAB FOR 8x10 VAULT (SLBBEAM.DAT)  
ASTM C857 A-16 (AASHTO HS-20-44) LOADING  
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"  
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P_{II} = \frac{16000 \times 1.3}{\text{BEAM WIDTH}} = \frac{5000.00 \text{ LBS}}{} \]

\[
Wd1 = (0.750 \times 150) \times (1.00 \times 110.00) = 222.50 \text{ LBS/SQ.FT.} \]

\[
Wd1 = Wd1 \times \text{LOAD WIDTH/BEAM WIDTH} = 267.43 \text{ LBS/SQ.FT.} \]

\[
F_{lc} = 4500. \quad F_y = 60000. \]

\[
d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \]

**NO. 5 BARS AT 4 1/2" ON CENTER \( \bar{A_s} = 0.827 \text{ SQ.IN.} \)**

\[
n = \frac{E_s}{E_c} = 7.584 \]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[
\frac{\text{WIDTH} \times \text{THICK}^3}{12} = 729.000 \text{ IN.}^4
\]

\[
\frac{\text{WIDTH} \times \text{THICK}^2}{6} = 162.000 \text{ IN.}^3
\]

CRACKING STRESS = \(7.5 \times F!c^{0.50}\) 503.115 psi
CRACKING MOMENT = STRESS \times Sg = 81504.68 IN.LBS.

DEAD LOAD IMMEDIATE DEFLECTIONS:

\[
\frac{Wd1xL^2}{8} = 2512.78 \text{ FT.LBS.}
\]

30153.39 IN.LBS.

C CRACKED SECTION = 2.172 INCHES

\[
Y_t = d - C \text{ CRACKED SECTION} = 4.515 \text{ INCHES}
\]

\[
I_{crk} = \frac{b \text{ } C^3}{12} + C b (C /2)^2 + N \text{ As } Y_t^2 = 168.824 \text{ IN.}^4
\]

\[
I_{eff} = (Mcrk/M)^3 I_g + (1-(Mcrk/M)^3) I_{crk} = 729.000 \text{ IN.}^4
\]

IF \(I_{eff} > I_g\) \(I_{eff} = I_g\)

\[
\frac{5 \text{ Wd1 } L^4}{384 \text{ EI}} = 0.0122 \text{ INCHES}
\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SL.BEAM.DAT)
ASTM C857 A-16 (AASHO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

LIVE LOAD IMMEDIATE DEFLECTIONS:

\[
\begin{align*}
M_{tot} &= \frac{P_{11}xL}{4} + \frac{Wd}{8} = 13350.28 \text{ FT.LBS.} \\
&= 160203.39 \text{ IN.LBS.} \\
C \text{ CRACKED SECTION} &= 2.172 \text{ INCHES} \\
Y_t &= d - C \text{ CRACKED SECTION} = 4.515 \text{ INCHES} \\
I_{crk} &= \frac{b \cdot C^3}{12} + C \frac{b}{(C/2)^2} + N \cdot A_s \cdot Y_t^2 = 168.824 \text{ IN.}^4 \\
I_{eff} &= (M_{crk}/M)^3 I_g + (1-(M_{crk}/M)^3) I_{crk} = 242.590 \text{ IN.}^4 \\
\text{IF } I_{eff} > I_g \quad I_{eff} = I_g \\
\text{LL def} &= \frac{P_{11}L^3}{48EI} = 0.1265 \text{ INCHES}
\end{align*}
\]
### JENSEN PRECAST CONCRETE
### TOP SLAB BEAM PROGRAM VERSION 3.00
### ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8x10 VAULT (SLBBEAM.DAT)
ASTM C357 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
W_{11} = \frac{32000 \times 1.70}{(1.75 \times 5.00)^2} = 710.53 \text{ LBS/SQ.FT.}
\]

\[
W_{11} = W_{11} \times \text{LOAD WIDTH/BEAM WIDTH} = 854.00 \text{ LBS/SQ.FT.}
\]

\[
W_d = (0.750 \times 150 \times 1.4) + (5.00 \times 110 \times 0.00 \times 1.4) = 927.50 \text{ LBS/SQ.FT.}
\]

\[
W_d = W_d \times \text{LOAD WIDTH/BEAM WIDTH} = 1114.78 \text{ LBS/SQ.FT.}
\]

\[
W_{lx} = \frac{W_d}{L_x^2}
\]

\[
M_u = \frac{18498.94}{8} = 221987.31 \text{ IN.LBS.}
\]

\[
M_u/\phi = M_u/0.90 = 246652.56 \text{ IN.LBS.}
\]
COVER SLAB FOR 8X10 VAULT (SLB.CEM.AAT.DAT)
ASTM C357 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[ F_c = 4500, \quad b = 0.825, \quad F_y = 60000 \]

\[ \sigma_b = 0.85 \frac{F_c}{F_y} \frac{87000}{87000 + F_y} = 0.0311 \]

\( \sigma_{max} = 0.75 \sigma_b = 0.02335 \)

\( \sigma_{min} = 200/F_y = 0.00333 \)

\( d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \)

TRY NO. 5 BARS AT 5" ON CENTER \( A_s = 0.744 \text{ SQ. IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.00927 \quad \text{STEEL RATIO OK} \checkmark \]

\[ \varepsilon = \frac{oF_y}{F_c} = 0.12361 \]

\[ M_n = F_c b d^2 (1-0.59\varepsilon) = 276757.58 \text{ IN.LBS.} \]

\[ 276757.58 > 246652.56 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK} \checkmark \]
COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT
\[ Vu = \frac{W \times (L-2d)}{2} + P_{11} = 7437.50 \text{ LBS.} \]
\[ Vu/\phi = \frac{Vu}{0.85 \times b \times d} = 109.034 \text{ LBS./SQ. IN.} \]

SHEAR AT SLAB EDGE NOTCH
\[ Vu = \frac{W \times L}{2} + P_{11} = 8534.69 \text{ LBS.} \]
\[ Vu/\phi = \frac{Vu}{0.85 \times b \times (t\text{-notch})} = 104.592 \text{ LBS./SQ. IN.} \]
\[ Vc = 1.9\sqrt{f'c} + 2500.0 \frac{Vu \times d}{M_u} = 150.633 \text{ LBS/SQ. IN.} \]
\[ 150.633 > 109.034 \text{ LBS./SQ. IN. SHEAR CAP. OK} \]

MINIMUM REINFORCING
As min. = 0.0018 bt = 0.1944 SQ. IN.

USE NO. 5 BARS AT 18" ON CENTER As = 0.207 SQ. IN.
### Jensen Precast Concrete

**Top Slab Beam Program Version 3.00**

**Crack Control Check**

Cover slab for 8x10 vault (SLBBEAM.DAT)  
ASTM C357 A-16 (AASHTO HS-20-44) Loading  
50" Wide Beam with 60" Wide Load - Spanning 104"  
Top slab at 1.00 to 5.00 feet below finished grade

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab Span</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Slab Thickness</td>
<td>9.00 Inches</td>
</tr>
<tr>
<td>Loaded Width</td>
<td>5.00 Feet</td>
</tr>
<tr>
<td>Beam Width</td>
<td>4.16 Feet</td>
</tr>
<tr>
<td>Depth to Slab Top</td>
<td>5.00 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 Lbs/cu.ft.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 Lbs/cu.ft.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 Lbs.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 Feet</td>
</tr>
<tr>
<td>Slab Edge Notch Depth</td>
<td>1.00 Inches</td>
</tr>
<tr>
<td>Crack Limit - z -</td>
<td>130000.00 Lbs/in.</td>
</tr>
</tbody>
</table>

\[
W_{II} = \frac{32000.}{(1.75 \times 5.00)^2} = 417.96 \text{ Lbs/Sq.Ft.}
\]

\[
W_{II} = W_{II} \times \text{LOAD WIDTH/BEAM WIDTH} = 502.35 \text{ Lbs/Sq.Ft.}
\]

\[
W_{dI} = (0.750 \times 150) + (5.00 \times 110.00) = 662.50 \text{ Lbs/Sq.Ft.}
\]

\[
W_{dI} = W_{dI} \times \text{LOAD WIDTH/BEAM WIDTH} = 796.27 \text{ Lbs/Sq.Ft.}
\]

\[
M = \frac{W \times L^2}{8} = \frac{12202.06}{146424.75} \text{ Ft.Lbs.} \quad \text{In.Lbs.}
\]

F:\(c=4500\), Fy=60000.
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
CRACK CONTROL CHECK

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[ d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \]

TRY NO. 5 BARS AT 5" ON CENTER \( A_s = 0.744 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{b d} = 0.00927 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2\sigma + (\sigma n)^2)^{0.5} - \sigma n = 0.311 \]

\[ j = 1 - \frac{k}{3} = 0.896 \]

\[ M = \frac{fs}{Asjd} = 32835.581 \]

\[ D_c \text{ (FOR CRACK CONTROL)} = 2.3125 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 23.1250 \text{ SQ.IN.} \]

\[ \text{MAX.} \frac{fs}{(\text{FOR CRACK CONTROL}) (D_c \text{AREA})^{0.33}} = 34505.547 \text{ psi} \]

\[ \text{MAX.} \frac{fs}{F_y} = 36000.000 \text{ psi} \]

\[ 34505.547 > 32835.581 \text{ LBS/SQ.IN. CRACK CONTROL OK} \]
### JENSEN PRECAST CONCRETE
### TOP SLAB BEAM PROGRAM VERSION 3.00
### DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLBBeam.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CT.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CT.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

$$ W_{II} = \frac{32000.}{(1.75 \times 5.00)^2} = 417.96 \text{ LBS/SQ.FT.} $$

$$ W_{II} = W_{II} \times LOAD\ WIDHT/BEAM\ WIDHT = 502.35 \text{ LBS/SQ.FT.} $$

$$ W_{II} = (0.750 \times 150) + (5.00 \times 110.00) = 662.50 \text{ LBS/SQ.FT.} $$

$$ W_{II} = W_{II} \times LOAD\ WIDHT/BEAM\ WIDHT = 796.27 \text{ LBS/SQ.FT.} $$

F!c=4500.  \hspace{2cm} Fy=60000.

$$ d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} $$

NO. 5 \hspace{0.5cm} BARS AT 5" ON CENTER \hspace{0.5cm} As = 0.744 \text{ SQ.IN.} $$

$$ n = \frac{Es}{Ec} = 7.584 $$
JENSEN PRECAST CONCRETE  
TOP SLAB BEAM PROGRAM VERSION 3.00  
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)  
ASTM C857 A-16 (AASHTO HS-20-44) LOADING  
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"  
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[
\frac{\text{WIDTH} \times \text{THICK}^3}{12} = 729.000 \text{ IN.}^4
\]

\[
\frac{\text{WIDTH} \times \text{THICK}^2}{6} = 162.000 \text{ IN.}^3
\]

CRACKING STRESS = 7.5 x F\!\!c^{0.50} = 503.115 psi

CRACKING MOMENT = STRESS x Sg = 81504.68 IN.LBS.

DEAD LOAD IMMEDIATE DEFLECTIONS:

\[
\frac{Wd1 \times L^2}{8} = 7481.88 \text{ FT.LBS.}
\]

\[
\frac{89782.57 \text{ IN.LBS.}}{C \text{ CRACKED SECTION}} = 2.081 \text{ INCHES}
\]

\[
y_t = d - C \text{ CRACKED SECTION} = 4.606 \text{ INCHES}
\]

\[
I_{crk} = \frac{b \text{ C}^3}{12} + C b \left(\frac{C}{2}\right)^2 + N As \ y_t^2 = 155.786 \text{ IN.}^4
\]

\[
I_{eff} = (Mcrk/M)^3 I_{crk} + (1-(Mcrk/M)^3)I_{crk} = 584.619 \text{ IN.}^4
\]

IF \( I_{eff} > I_{g} \) \( I_{eff} = I_{g} \)

\[
\frac{5 \text{ Wd1 L}^4}{384 \text{ EI}} = 0.0453 \text{ INCHES}
\]
LIVE LOAD IMMEDIATE DEFLECTIONS:

\[ M_{\text{tot}} = \frac{W x L^2}{8} = 12202.06 \text{ FT.LBS.} \]

\[ = 146424.75 \text{ IN.LBS.} \]

C CRACKED SECTION = 2.081 INCHES

\[ Y_t = d - C \text{ CRACKED SECTION} = 4.606 \text{ INCHES} \]

\[ b \frac{C^3}{12} + C b \left(\frac{C}{2}\right)^2 + N A S Y_t^2 = 155.786 \text{ IN}^4 \]

\[ I_{\text{crk}} = (M_{\text{crk}}/M)^3 I_g + (1-(M_{\text{crk}}/M)^3)I_{\text{crk}} = 254.646 \text{ IN}^4 \]

IF \( I_{\text{eff}} > I_g \) \( I_{\text{eff}} = I_g \)

\[ LL_{\text{def}} = \left(\frac{5 W}{114} L^4\right) = 0.0656 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

WALL WIDTH 8.67 FEET
WALL LENGTH 10.67 FEET
SECTION HEIGHT 8.00 FEET
BEAM HEIGHT 5.83 FEET
DIST CENTERLINE TO OPENING FAR EDGE 0.00 FEET
WALL THICKNESS 8.00 INCHES
DEPTH TO TOP 1.67 FEET
DEPTH TO GROUND WATER 6.00 FEET
LATERAL PRESS. -WET- 81.00 LBS/CU.FT.
LATERAL PRESS. -DRY- 40.00 LBS/CU.FT.
LIVE LOAD SURCHARGE 80.00 LBS.
CRACK CONTROL -z- 130,000.00 LBS/IN.

P1 = LATERAL PRESSURE AT GRADE ELEVATION
P2 = LATERAL PRESSURE AT WATER ELEVATION
P3 = LATERAL PRESSURE AT TOP OF WALL
P4 = LATERAL PRESSURE AT BASE OF WALL

P1 = 80.00 x 1.70
P2 = P1 + 6.00 x 40.00 x 1.70
P3 = P1 + 1.67 x 40.00 x 1.70
P4 = P2 +( 9.67 - 6.00) x 81.00 x 1.70
Pavg = P3 + P4 / 2
Pbm = Pavg x SECTION HEIGHT
BEAM HEIGHT

Ft,c=4500.
θ=0.825
Fy=60000.

THIS DOCUMENT AND THE DATA DERIVED THEREIN OR HEREWITH IS NOT TO BE REPRODUCED, USED OR DISCLOSED IN ANY FORM IN PART BY ANY ONE WITHOUT THE WRITTEN PERMISSION OF JENSEN PRECAST
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[
\frac{F_{lc}}{87000} = \frac{0.85 \times b}{F_y} = 0.0311
\]
\[
\alpha_{max} = 0.75 \times b = 0.02335 \quad \alpha_{min} = \frac{200}{F_y} = 0.00333
\]

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068

DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
P_{bm} \times \text{LENGTH} \times \text{LENGTH}
\]
\[
\text{FEM long wall} = \frac{8455.15 \text{ FT.LBS.}}{12}
\]
\[
P_{bm} \times \text{WIDTH} \times \text{WIDTH}
\]
\[
\text{FEM short wall} = \frac{5882.52 \text{ FT.LBS.}}{12}
\]

MOMENT DIST. long wall = 1287.78 FT.LBS.
MOMENT DIST. short wall = 1584.84 FT.LBS.

\[-M_u = \text{FEM long wall} - \text{DIST long wall} = 7167.37 \text{ FT.LBS.} \]
\[
86008.40 \text{ IN.LBS.}
\]

\[-M_u/\phi = -M_u/0.90 = 9556.89 \text{ IN.LBS.}
\]

\[
P_{bm} \times \text{LENGTH} \times \text{LENGTH}
\]
\[
+M_u = -M_u + \frac{5515.35 \text{ FT.LBS.}}{8} = 66184.22 \text{ IN.LBS.}
\]
\[
+M_u/\phi = +M_u/0.90 = 73538.03 \text{ IN.LBS.}
\]
NEGATIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5 BARS AT 5 1/2" ON CENTER \( A_s = 0.676 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01409 \quad \text{STEEL RATIO OK} \]

\[ F_c \]

\[ M_n = F_c b d^2 = (1-0.59w) = 144333.54 \text{ IN.LBS.} \]

\[ 144333.54 > 95564.89 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK} \]

SHEAR CAPACITY CHECK

\[ \frac{P_{avg} \times (\text{LENGTH}-2d)}{2} = 3248.38 \text{ LBS.} \quad \text{-AT d FROM CORNER-} \]

\[ \frac{V_u}{\phi} = \frac{V_u}{0.85 b d} = 79.617 \text{ LBS./SQ.IN.} \quad \text{-AT d FROM CORNER-} \]

\[ V_u = P_{bm} \times \text{DIST TO OPEN} = 0.00 \text{ LBS.} \quad \text{-AT OPENING-} \]

\[ \frac{V_u}{\phi} = \frac{V_u}{0.85 b d} = 0.000 \text{ LBS./SQ.IN.} \quad \text{-AT OPENING-} \]

\[ V_c = 2.00 \sqrt{F_c} = 134.164 \text{ LBS./SQ.IN.} \]

\[ 134.164 > 79.617 \text{ LBS./SQ.IN.} \quad \text{SHEAR CAP. OK} \]
POSITIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

**TRY NO. 5 BARS AT 7" ON CENTER**

\[ \sigma = \frac{A_s}{bd} = 0.01107 \quad \text{STEEL RATIO OK} \checkmark \]

\[ \alpha = \frac{\sigma f_y}{F!c} = 0.14762 \]

\[ M_n = F!c b d^2 (1 - 0.59\alpha) = 116434.48 \text{ IN.LBS.} \]

\[ 116434.48 > 73538.03 \text{ IN.LBS. \quad MOMENT CAP. OK} \checkmark \]

**MINIMUM REINFORCING**

\[ A_s \text{ min.} = 0.0018 \times b t = 0.1728 \text{ SQ.IN.} \]

**USE NO. 4 BARS AT 13 1/2" ON CENTER**

\[ A_s = 0.178 \text{ SQ.IN.} \]
### JENSEN PRECAST CONCRETE
### CENTER SECTION DESIGN PROGRAM VERSION 3.00
### CRACK CONTROL CHECK

8'0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C390 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL WIDTH</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>1.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS</td>
</tr>
<tr>
<td>CRACK CONTROL -z -</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

P1 = LATERAL PRESSURE AT GRADE ELEVATION
P2 = LATERAL PRESSURE AT WATER ELEVATION
P3 = LATERAL PRESSURE AT TOP OF WALL
P4 = LATERAL PRESSURE AT BASE OF WALL

- \( P1 = 80.00 \) = 80.00 LBS/SQ.FT.
- \( P2 = P1 + 6.00 \times 40.00 \) = 320.00 LBS/SQ.FT.
- \( P3 = P1 + 1.67 \times 40.00 \) = 146.80 LBS/SQ.FT.
- \( P4 = P2 +( 9.67- 6.00)\times 81.00 \) = 617.27 LBS/SQ.FT.
- \( P_{avg} = P3 + P4 / 2 \) = 382.03 LBS/SQ.FT.

\[
P_{min} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = \frac{524.23 \text{ LBS/SQ.FT.}}{1.67 \text{ FEET}}
\]

\( F!c=4500. \)
\( F_{y}=60000. \)
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
FEM \text{ long wall} = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} = 4973.62 \text{ FT.LBS.}
\]

\[
FEM \text{ short wall} = \frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} = 3283.84 \text{ FT.LBS.}
\]

MOMENT DIST. long wall = 757.52 FT.LBS.
MOMENT DIST. short wall = 932.26 FT.LBS.

\[-M = FEM \text{ long wall} - \text{DIST long wall} = 4216.10 \text{ FT.LBS.} \]
\[50593.18 \text{ IN.LBS.}\]

\[Mu = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{8} = 3244.32 \text{ FT.LBS.} \]
\[38931.90 \text{ IN.LBS.}\]
NEGATIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5 BARS AT 5 1/2" ON CENTER \( A_s = 0.676 \text{ SQ. IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01409 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2n + (an)^2)^{0.5} - an = 0.368 \]

\[ j = 1 - \left(\frac{k}{3}\right) = 0.877 \]

\[ M \]

\[ f_s = \frac{21312.183}{A_{sdj}} \]

\[ D_c \text{ (FOR CRACK CONTROL)} = 4.0000 \text{ INCHES} \]

AREA (FOR CRACK CONTROL) = 44.0000 SQ. IN.

MAX. \( f_s = \frac{130000.00}{(D_c \text{ AREA})^{0.33}} = 23197.394 \text{ psi} \)

MAX. \( f_s = 0.60 \times F_y = 36000.000 \text{ psi} \)

\[ 23197.394 > 21312.183 \text{ LBS/SQ. IN. CRACK CONTROL OK} \]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 7" ON CENTER As = 0.531 SQ.IN.

σ = As/bd = 0.01107

n = Es / Ec = 7.584

k = (2an + (an)^2)^0.5 - an = 0.334

j = 1 - (k/3) = 0.889

M = f / Asjd

fs = ---- = 20611.922
    Asjd

Dc (FOR CRACK CONTROL) = 4.0000 INCHES

AREA (FOR CRACK CONTROL) = 56.0000 SQ.IN.

MAX. fs = 130000.00
         (FOR CRACK CONTROL) (DcAREA)^0.33

MAX. fs = 0.60 x Fy = 36000.000 psi

21405.601 > 20611.922 LBS/SQ.IN. CRACK CONTROL OK /
### JENSEN PRECAST CONCRETE

**CENTER SECTION DESIGN PROGRAM VERSION 3.00**

**DEFLECTION CALCULATION**

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C899 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL WIDTH</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>1.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS.</td>
</tr>
<tr>
<td>CRACK CONTROL -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

**LATERAL PRESSURE AT GRADE ELEVATION**

**LATERAL PRESSURE AT WATER ELEVATION**

**LATERAL PRESSURE AT TOP OF WALL**

**LATERAL PRESSURE AT BASE OF WALL**

\[
P_1 = \text{LATERAL PRESSURE AT GRADE ELEVATION}
P_2 = \text{LATERAL PRESSURE AT WATER ELEVATION}
P_3 = \text{LATERAL PRESSURE AT TOP OF WALL}
P_4 = \text{LATERAL PRESSURE AT BASE OF WALL}
\]

\[
P_1 = 80.00 = 80.00 \text{ LBS/SQ.FT.}
P_2 = P_1 + 6.00 \times 40.00 = 320.00 \text{ LBS/SQ.FT.}
P_3 = P_1 + 1.67 \times 40.00 = 146.80 \text{ LBS/SQ.FT.}
P_4 = P_2 + (9.67 - 6.00) \times 81.00 = 617.27 \text{ LBS/SQ.FT.}
P_{avg} = P_3 + P_4 / 2 = 382.03 \text{ LBS/SQ.FT.}
\]

\[
P_{bm} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = 524.23 \text{ LBS/SQ.FT.}
\]

\[
F'c = 4500, \quad F_y = 60000.
\]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

FEM long wall = \( \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} \) = 4973.62 FT.LBS.
FEM short wall = \( \frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} \) = 3283.84 FT.LBS.

MOMENT DIST. long wall = 757.52 FT.LBS.
MOMENT DIST. short wall = 932.26 FT.LBS.

\(-M = \text{FEM long wall} - \text{DIST long wall} = 4216.10 \text{ FT.LBS.} \)
\(50593.18 \text{ IN.LBS.} \)

\(+M = -M + \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{8} \) = 3244.32 FT.LBS.
\(38931.90 \text{ IN.LBS.} \)
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

NO. 5 BARS AT 7" ON CENTER As = 0.531 SQ.IN.

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 \times 0.125 = 0.50 psi

CRACKING MOMENT = STRESS x Sg = 64398.76 IN.LBS.

C CRACKED SECTION = 1.337 INCHES

Yt = d - C CRACKED SECTION = 2.663 INCHES

\[ I_{crk} = \frac{b \cdot C^3}{12} + b \cdot C \left( \frac{C}{2} \right)^2 + N \cdot A_s \cdot Yt^2 = 38.143 \text{ IN.}^4 \]

\[ I_{eff} = (M_{crk}/M)^3 \cdot Ig + (1-(M_{crk}/M)^3)I_{crk} = 512.000 \text{ IN.}^4 \]

IF \[ I_{eff} > Ig \]
\[ I_{eff} = Ig \]

Deflect = \[ \frac{P_{BEAM} \cdot L^4}{384 \cdot EI} = 0.0156 \text{ INCHES} \]
# JENSEN PRECAST CONCRETE

## CENTER SECTION DESIGN PROGRAM VERSION 3.00

**ULTIMATE STRENGTH DESIGN**

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)

ASTM C890 A-16 (AASHTO HS-20-44) LOADING

96" SECTION HEIGHT WITH 70" BEAM

TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL WIDTH</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>5.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU. FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU. FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS.</td>
</tr>
<tr>
<td>CRACK CONTROL -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

### Calculations

- **P1** = LATERAL PRESSURE AT GRADE ELEVATION
- **P2** = LATERAL PRESSURE AT WATER ELEVATION
- **P3** = LATERAL PRESSURE AT TOP OF WALL
- **P4** = LATERAL PRESSURE AT BASE OF WALL

\[
P1 = 80.00 \times 1.70 = 136.00 \text{ LBS/SQ.FT.}
\]

\[
P2 = P1 + 6.00 \times 40.00 \times 1.70 = 544.00 \text{ LBS/SQ.FT.}
\]

\[
P3 = P1 + 5.67 \times 40.00 \times 1.70 = 521.56 \text{ LBS/SQ.FT.}
\]

\[
P4 = P2 + (13.67 \times 6.00) \times 81.00 \times 1.70 = 1600.16 \text{ LBS/SQ.FT.}
\]

\[
P_{avg} = \frac{P3 + P4}{2} = 1060.86 \text{ LBS/SQ.FT.}
\]

\[
P_{bm} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = 1455.72 \text{ LBS/SQ.FT.}
\]

\[F/c = 4500, \quad B = 0.825, \quad F_y = 60000.\]
**JENSEN PRECAST CONCRETE**  
CENTER SECTION DESIGN PROGRAM VERSION 3.00  
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)  
ASTM C690 A-16 (AASHTO HS-20-44) LOADING  
96" SECTION HEIGHT WITH 70" BEAM  
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[
\frac{F_{c}}{F_{y}} = \frac{87000}{87000 + F_{y}} = 0.0311
\]

\[
\sigma_{\text{max}} = 0.75 \times \frac{F_{c}}{F_{y}} = 0.02335 \quad \sigma_{\text{min}} = \frac{200}{F_{y}} = 0.00333
\]

\[K_{\text{long wall}} = 1.00/\text{LENGTH} = 1.00000\]

\[K_{\text{short wall}} = 1.00/\text{WIDTH} = 1.23068\]

\[\text{DEF. FACTOR long wall} = 0.44829\]

\[\text{DEF. FACTOR short wall} = 0.55171\]

\[
F_{\text{EM long wall}} = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} = 13811.06 \text{ FT.LBS.}
\]

\[
F_{\text{EM short wall}} = \frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} = 9118.77 \text{ FT.LBS.}
\]

\[\text{MOMENT DIST. long wall} = 2103.52 \text{ FT.LBS.}\]

\[\text{MOMENT DIST. short wall} = 2588.76 \text{ FT.LBS.}\]

\[-\mu = F_{\text{EM long wall}} - \text{DIST long wall} = 11707.53 \text{ FT.LBS.} - 140490.41 \text{ IN.LBS.}\]

\[-\mu/\phi = -\mu/0.90 = 156100.45 \text{ IN.LBS.}\]

\[P_{bm} = \frac{\mu \times \text{LENGTH} \times \text{LENGTH}}{8} = 9009.05 \text{ FT.LBS.} - 108108.61 \text{ IN.LBS.}\]

\[+\mu/\phi = +\mu/0.90 = 120120.67 \text{ IN.LBS.}\]
NEGATIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 4" ON CENTER As = 0.930 SQ.IN.

σ = As/bd = 0.01937 STEEL RATIO OK

σ = f_y = 0.25833

Mn = F!c b d^2 = (1 - 0.59φ) = 189180.60 IN.LBS.

189180.60 > 156100.45 IN.LBS. MOMENT CAP. OK

SHEAR CAPACITY CHECK

\[ Vu = \frac{Pavg \times (LENGTH - 2d)}{2} = 5306.07 \text{ LBS.} \text{ AT d FROM CORNER} \]

\[ \frac{Vu}{\phi} = \frac{130.051 \text{ LBS.}/\text{SQ.IN.} \text{ AT d FROM CORNER}}{0.85 b d} \]

\[ Vu = \text{Pbm} \times \text{DIST TO OPEN} = 0.00 \text{ LBS.} \text{ AT OPENING} \]

\[ \frac{Vu}{\phi} = \frac{0.00 \text{ LBS.}/\text{SQ.IN.} \text{ AT OPENING}}{0.85 b d} \]

\[ Vc = 2.00 \sqrt{F!c} = 134.164 \text{ LBS}/\text{SQ.IN.} \]

134.164 > 130.051 LBS./SQ.IN. SHEAR CAP. OK
JENSEN PRECAST CONCRETE  
CENTER SECTION DESIGN PROGRAM VERSION 3.00  
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)  
ASTM C690 A-16 (AASHTO HS-20-44) LOADING  
96" SECTION HEIGHT WITH 70" BEAM  
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

POSITIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5  
BARS AT 4 1/2" ON CENTER \( A_s = 0.827 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01722 \quad \text{STEEL RATIO OK \checkmark} \]

\[ \phi = \frac{\sigma_f}{F_t} = 0.22963 \]

\[ M_n = \frac{F_t c b d^2}{1 - 0.59\phi} = 171520.47 \text{ IN.LBS.} \]

\[ 171520.47 > 120120.67 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK \checkmark} \]

MINIMUM REINFORCING

\[ A_s \text{ min.} = 0.0018 b t = 0.1728 \text{ SQ.IN.} \]

USE NO. 4 BARS AT 13 1/2" ON CENTER \( A_s = 0.178 \text{ SQ.IN.} \)
**JENSEN PRECAST CONCRETE**

**CENTER SECTION DESIGN PROGRAM VERSION 3.00**

**CRACK CONTROL CHECK**

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Width</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Length</td>
<td>10.67 Feet</td>
</tr>
<tr>
<td>Section Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Beam Height</td>
<td>5.83 Feet</td>
</tr>
<tr>
<td>Dist Centerline to Opening Far Edge</td>
<td>0.00 Feet</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top</td>
<td>5.67 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Lateral Press. -Wet-</td>
<td>81.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Lateral Press. -Dry-</td>
<td>40.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Live Load Surcharge</td>
<td>80.00 Lbs.</td>
</tr>
<tr>
<td>Crack Control -z-</td>
<td>130000.00 Lbs/In.</td>
</tr>
</tbody>
</table>

P1 = Lateral Pressure at Grade Elevation
P2 = Lateral Pressure at Water Elevation
P3 = Lateral Pressure at Top of Wall
P4 = Lateral Pressure at Base of Wall

P1 = 80.00
P2 = P1 + 6.00 x 40.00 = 320.00 Lbs/Sq.Ft.
P3 = P1 + 5.67 x 40.00 = 306.80 Lbs/Sq.Ft.
P4 = P2 +(13.67- 6.00)x 81.00 = 941.27 Lbs/Sq.Ft.
Pavg = P3 + P4 / 2 = 624.03 Lbs/Sq.Ft.
Pbm = Pavg x Section Height / Beam Height = 856.31 Lbs/Sq.Ft.

Fic=45000.00
Fy=60000.00
JESEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTBDAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
P_{\text{FEM long wall}} = \frac{P_{\text{pm}} \times \text{LENGTH} \times \text{LENGTH}}{12} = 8124.15 \text{ FT.LBS.}
\]

\[
P_{\text{FEM short wall}} = \frac{P_{\text{pm}} \times \text{WIDTH} \times \text{WIDTH}}{12} = 5363.98 \text{ FT.LBS.}
\]

MOMENT DIST. long wall = 1237.37 FT.LBS.
MOMENT DIST. short wall = 1522.80 FT.LBS.

\[
-M = \text{FEM long wall} - \text{DIST long wall} = 6806.78 \text{ FT.LBS.}
\]

\[
+M = -M + \frac{P_{\text{pm}} \times \text{LENGTH} \times \text{LENGTH}}{8} = 5299.44 \text{ FT.LBS.}
\]

\[
= 63593.30 \text{ IN.LBS.}
\]
NEGATIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5 BARS AT 4" ON CENTER \( A_s = 0.930 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01937 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2\alpha n + (\alpha n)^2)^{0.5} - \alpha n = 0.415 \]

\[ j = 1 - \left(\frac{k}{3}\right) = 0.862 \]

\[ M = \frac{fs}{Asjd} = 25779.292 \]

\[ D_c (\text{FOR CRACK CONTROL}) = 4.0000 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 32.0000 \text{ SQ.IN.} \]

\[ \text{MAX. } f_s = \frac{130000.00}{(D_c \text{AREA})^{0.33}} = 25795.271 \text{ psi} \]

\[ \text{MAX. } f_s = 0.60 \times F_y = 36000.000 \text{ psi} \]

25795.271 > 25779.292 LBS/SQ.IN. CRACK CONTROL OK
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C990 A-16 (AASHTO HS-20-44) LOADING
96' SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

σ = As/bd = 0.01722

n = Es / Ec = 7.584

k = (2n + (an)^2)^0.5 - 0.5 - an = 0.397

j = 1 - (k/3) = 0.868

M
fs = ---- = 22164.348
Asjd

Dc (FOR CRACK CONTROL) = 4.0000 INCHES

AREA (FOR CRACK CONTROL) = 36.0000 SQ.IN.

MAX. fs = \frac{130000.00}{(Dc(\text{AREA})^0.33)} = 24802.146 psi

MAX. fs = 0.60 \times F_y = 36000.000 psi

24802.146 > 22164.348 LBS/SQ.IN. CRACK CONTROL OK
**JENSEN PRECAST CONCRETE**

**CENTER SECTION DESIGN PROGRAM VERSION 3.00**

**DEFLECTION CALCULATION**

8'-0" x 10'-0" x 8'-0" TANK BOTTOM SECTION (REKCTB.DAT)

ASTM C930 A-16 (AASHTO HS-20-44) LOADING

96" SECTION HEIGHT WITH 70" BEAM

TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>WALL WIDTH</th>
<th>8.67 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>5.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS.</td>
</tr>
<tr>
<td>CRACK CONTROL -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

**P1 =** LATERAL PRESSURE AT GRADE ELEVATION

**P2 =** LATERAL PRESSURE AT WATER ELEVATION

**P3 =** LATERAL PRESSURE AT TOP OF WALL

**P4 =** LATERAL PRESSURE AT BASE OF WALL

\[
P1 = 80.00 = 80.00 \text{ LBS/SQ.FT.}
\]

\[
P2 = P1 + 6.00 \times 40.00 = 320.00 \text{ LBS/SQ.FT.}
\]

\[
P3 = P1 + 5.67 \times 40.00 = 306.80 \text{ LBS/SQ.FT.}
\]

\[
P4 = P2 + (13.67 - 6.00) \times 81.00 = 941.27 \text{ LBS/SQ.FT.}
\]

\[
P_{avg} = P3 + P4 / 2 = 624.03 \text{ LBS/SQ.FT.}
\]

\[
P_{bm} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = 856.31 \text{ LBS/SQ.FT.}
\]

\[F_{c} = 4500.
\]

\[F_{y} = 60000.
\]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0" x 10'-0" x 8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[ FEM \text{ long wall} = \frac{Pbm \times \text{LENGTH} \times \text{LENGTH}}{12} = 8124.15 \text{ FT.LBS.} \]

\[ FEM \text{ short wall} = \frac{Pbm \times \text{WIDTH} \times \text{WIDTH}}{12} = 5363.98 \text{ FT.LBS.} \]

MOMENT DIST. long wall = 1237.37 FT.LBS.
MOMENT DIST. short wall = 1522.80 FT.LBS.

\[ -M = \text{FEM long wall} - \text{DIST long wall} = 6886.78 \text{ FT.LBS.} \]
\[ = \frac{82641.42 \text{ IN.LBS.}}{8} \]

\[ +M = -M + \frac{Pbm \times \text{LENGTH} \times \text{LENGTH}}{8} = 5299.44 \text{ FT.LBS.} \]
\[ = 63593.30 \text{ IN.LBS.} \]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING.
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

n = Es / Ec = 7.584

\[ Ig = \frac{\text{WIDTH x THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH x THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 x F/c^0.50 = 503.115 psi

CRACKING MOMENT = STRESS x Sg = 64398.76 IN.LBS.

C CRACKED SECTION = 1.588 INCHES

Yt = d - C CRACKED SECTION = 2.412 INCHES

\[ I_{crk} = \frac{b \cdot C^3}{12} + b \cdot C \cdot (C/2)^2 + N \cdot As \cdot Yt^2 = 52.494 \text{ IN.}^4 \]

\[ I_{eff} = (Mc_{rk}/M)^3 \cdot Ig + (1-(Mc_{rk}/M)^3)I_{crk} = 512.000 \text{ IN.}^4 \]

IF I_{eff} > Ig \quad I_{eff} = Ig

\[ \text{Deflect} = \frac{P_{BEAM} \cdot L^4}{384 \cdot EI} = 0.0255 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSL.B.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

| STRUCTURE LENGTH | 10.00 FEET |
| STRUCTURE WIDTH  | 8.00 FEET  |
| BOTTOM SLAB SPAN  | 8.67 FEET  |
| WALL HEIGHT       | 8.00 FEET  |
| TOP SLAB THICKNESS| 9.00 INCHES|
| BOTTOM SLAB THICKNESS| 8.00 INCHES|
| WALL THICKNESS    | 8.00 INCHES|
| DEPTH TO TOP SLAB | 1.00 FEET  |
| DEPTH TO GROUND WATER | 6.00 FEET |
| SOIL DENSITY -WET- | 120.00 LBS/CU.FT. |
| SOIL DENSITY -DRY- | 110.00 LBS/CU.FT. |
| WHEEL LOADING     | 16000.00 LBS. |
| WHEEL SPACING     | 6.00 FEET  |
| AXLE SPACING      | 14.00 FEET  |
| CRACK LIMIT -z-   | 130000.00 LBS/IN. |

LIVE LOAD = 32000. x 1.70 = 54400.00 LBS.

DRY EARTH = 1.00x11.33x 9.33x110.00x1.4= 16289.78 LBS.
TOP SLAB =11.33x 9.33x 9.00/12.00 x 150 x1.4= 16660.00 LBS.
WALLS =38.67x 8.00x 8.00/12.00 x 150 x1.4= 43306.67 LBS.
TOTAL WEIGHT = 130656.44 LBS.

WEIGHT/SQ.FT. = 130656.44
               11.33 x 9.33
               = 1235.20 LBS/SQ.FT.
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
\frac{W \times L^2}{8} = 11606.05 \text{ FT.LBS.}
\]

\[
\mu = \frac{\mu}{\phi} = 139272.65 \text{ IN.LBS.}
\]

\[
\mu/\phi = \mu/0.90 = 154747.39 \text{ IN.LBS.}
\]

\[F'c=4500, \quad B=0.825, \quad Fy=60000,\]

\[
\sigma_b = 0.65 \frac{F'c}{Fy} = 87000 \quad 87000+1 = 0.0311
\]

\[
\sigma_{max} = 0.75 \sigma_b = 0.02335
\]

\[
\sigma_{min} = \frac{200}{Fy} = 0.00333
\]

\[
d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES}
\]

TRY NO. 5 BARS AT 7 1/2" ON CENTER As = 0.496 SQ.IN.

\[
\sigma = \frac{A_s}{b d} = 0.00668 \quad \text{STEEL RATIO OK ✓}
\]

\[
\psi = \frac{\sigma Fy}{F'c} = 0.08907
\]

\[
M_n = \frac{F'c b d^2 \sigma}{(1-0.59\psi)} = 174463.37 \text{ IN.LBS.}
\]

\[
174463.37 \geq 154747.39 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK ✓}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ \frac{W \times (L-2d)}{2} = \frac{Vu}{2} = 4717.68 \text{ LBS.} \]

\[ \frac{Vu}{\phi} = \frac{74.750 \text{ LBS./SQ.IN.}}{0.85 b \ d} \]

SHEAR AT SLAB EDGE NOTCH

\[ \frac{W \times L}{2} = \frac{Vu}{2} = 5354.58 \text{ LBS.} \]

\[ \frac{Vu}{\phi} = \frac{74.994 \text{ LBS./SQ.IN.}}{0.85 b (t-notch)} \]

\[ V_c = 1.9\sqrt{f'_c} + 2500.\sigma = 141.536 \text{ LBS/SQ.IN.} \]

\[ 141.536 > 74.994 \text{ LBS./SQ.IN. SHEAR CAP. OK} \]

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ.IN.

USE NO. 4 RARS AT 13 1/2" ON CENTER As = 0.178 SQ.IN.
### Jensen Precast Concrete

**Bottom Slab Design Program Version 3.00**

**Crack Control Check**

8'-0" x 10'-0" x 8'-0" Panel Vault (BtmSlab.Dat)

ASTM C890 A-16 (AASHTO HS-20-44) Loading

8" Floor Thickness

Inside Floor at 9.67 to 13.67 Feet Below Finished Grade

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Length</td>
<td>10.00 Feet</td>
</tr>
<tr>
<td>Structure Width</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Bottom Slab Span</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Top Slab Thickness</td>
<td>9.00 Inches</td>
</tr>
<tr>
<td>Bottom Slab Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top Slab</td>
<td>1.00 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 Lbs.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 Feet</td>
</tr>
<tr>
<td>Slab Edge Notch Depth</td>
<td>1.00 Inches</td>
</tr>
<tr>
<td>Crack Limit -z-</td>
<td>130000.00 Lbs/In.</td>
</tr>
</tbody>
</table>

**Live Load = 32000. =**

32000.00 Lbs.

**Dry Earth = 1.00x11.33x9.33x110.00 =**

11635.56 Lbs.

**Top Slab = 11.33x9.33x9.00/12.00 x 150 =**

11900.00 Lbs.

**Walls = 38.67x8.00x8.00/12.00 x 150 =**

30933.33 Lbs.

**Total Weight =**

86468.89 Lbs.

**Weight/Sq.Ft. = \frac{86468.89}{11.33 \times 9.33} =**

817.46 Lbs/Sq.Ft.
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
M = \frac{W \times L^2}{8} = \frac{7680.93 \text{ FT.LBS.}}{92171.13 \text{ IN.LBS.}}
\]

\[F/c = 4500, \quad F_y = 60000\]

\[d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES}\]

TRY NO. 5 BARS AT 7 1/2" ON CENTER \(A_s = 0.496 \text{ SQ.IN.}\)

\[\sigma = \frac{A_s}{b_d} = 0.00668\]

\[n = \frac{E_s}{E_c} = 7.584\]

\[k = (2\alpha_n + (\alpha_n)^2)^{0.5} - \alpha_n = 0.272\]

\[j = 1 - \frac{k}{3} = 0.909\]

\[M = \frac{fs}{A_s \sqrt{jd}} = 33023.370\]

\[D_c \quad \text{(FOR CRACK CONTROL)} = 1.8125 \text{ INCHES}\]

\[\text{AREA \quad \text{(FOR CRACK CONTROL)} = 27.1875 \text{ SQ.IN.}}\]

\[\text{MAX. } fs = \frac{130000.00}{(D_c \times \text{AREA})^{0.33}} = 35459.095 \text{ psi}\]

\[\text{MAX. } fs = 0.60 \times F_y = 36000.000 \text{ psi}\]

35459.095 > 33023.370 LBS/SQ.IN. CRACK CONTROL OK \(\checkmark\)
### Jensen Precast Concrete

**Bottom Slab Design Program Version 3.00**

**Deflection Calculation**

8'-0" x 10'-0" x 8'-0" Panel Vault (BTMSLB.DAT)

ASTM C890 A-16 (AASHTO HS-20-44) Loading

8" Floor Thickness

Inside floor at 9.67 to 13.67 feet below finished grade

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Length</td>
<td>10.00 Feet</td>
</tr>
<tr>
<td>Structure Width</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Bottom Slab Span</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Top Slab Thickness</td>
<td>9.00 Inches</td>
</tr>
<tr>
<td>Bottom Slab Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top Slab</td>
<td>1.00 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 Lbs/ft.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 Lbs/ft.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 Lbs.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 Feet</td>
</tr>
<tr>
<td>Slab Edge Notch Depth</td>
<td>1.00 Inches</td>
</tr>
<tr>
<td>Crack Limit -z-</td>
<td>13000.00 Lbs/in.</td>
</tr>
</tbody>
</table>

**Live Load**

\[ \text{Live Load} = 32000 \times 32000 \times 0.01 \text{ Lbs.} \]

**Dry Earth**

\[ \text{Dry Earth} = 1.00 \times 11.33 \times 9.33 \times 110.00 \text{ Lbs.} \]

**Top Slab**

\[ \text{Top Slab} = 11.33 \times 9.33 \times 9.00 / 12.00 \times 150 \text{ Lbs.} \]

**Walls**

\[ \text{Walls} = 38.67 \times 8.00 \times 8.00 / 12.00 \times 150 \text{ Lbs.} \]

**Total Load**

\[ \text{Total Load} = 86468.89 \text{ Lbs.} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

TOTAL LOAD/SQ.FT. = \frac{86468.89}{11.33 \times 9.33} = 817.46 LBS/SQ.FT.

TOTAL DEAD LOAD = 54468.89 LBS.

DEAD LOAD/SQ.FT. = \frac{54468.89}{11.33 \times 9.33} = 514.94 LBS/SQ.FT.

F'c=4500. \quad Fy=60000.

M_{dl} = \frac{W \times L^2}{8} = 4838.41 FT.LBS. \quad 58060.87 IN.LBS.

M_{tot} = \frac{W \times L^2}{8} = 7680.93 FT.LBS. \quad 92171.13 IN.LBS.
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8' - 0" x 10' - 0" x 8' - 0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

DEAD LOAD IMMEDIATE DEFLECTIONS:

d = 8.00 - 1.50 - 0.3125 = 6.1875 INCHES

No. 5 BARS AT 7 1/2" ON CENTER As = 0.496 SQ.IN.
n = Es / Ec = 7.584

\[ \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 x F!c^0.50 = 503.115 psi
CRACKING MOMENT = STRESS x Sg = 64398.76 IN.LBS.
C CRACKED SECTION = 1.681 INCHES
Yt = d - C CRACKED SECTION = 4.507 INCHES

\[ \frac{b \times C^3}{12} + C b \times (C/2)^2 + N As \times Yt^2 = 95.398 \text{ IN.}^4 \]

Ieff = (Mcrk/M)\(^3\) Ig + (1-(Mcrk/M)\(^3\))Icrk = 512.000 \text{ IN.}^4

IF Ieff > Ig Ieff = Ig

\[ \frac{5 \times Wd1 \times L^4}{384 \times EI} = 0.0334 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

LIVE LOAD IMMEDIATE DEFLECTIONS:

\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

NO. 5 BARS AT 7 1/2" ON CENTER \( A_s = 0.496 \text{ SQ.IN.} \)

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ \text{WIDTH} \times \text{THICK}^3 \]
\[ I_G = \frac{12}{12} = 512.000 \text{ IN}^4 \]

\[ \text{WIDTH} \times \text{THICK}^2 \]
\[ S_G = \frac{6}{6} = 128.000 \text{ IN}^3 \]

CRACKING STRESS = \( 7.5 \times f'_c \cdot 0.50 = 503.115 \text{ psi} \)

CRACKING MOMENT = STRESS \times S_G = 64398.76 \text{ IN} \cdot \text{LBS.} \)

C CRACKED SECTION = 1.681 INCHES

\[ Y_t = d - C \text{ CRACKED SECTION} = 4.507 \text{ INCHES} \]

\[ \text{I}_{crk} = \frac{b \ C^3}{12} + C \ b (C / 2)^2 + N \ As \ Y_t^2 = 95.398 \text{ IN}^4 \]

\[ \text{I}_{eff} = \left( \frac{M_{crk}}{M} \right)^3 I_g + (1 - \left( \frac{M_{crk}}{M} \right)^3) \text{I}_{crk} = 237.490 \text{ IN}^4 \]

IF \( \text{I}_{eff} > I_g \) \( \text{I}_{eff} = I_g \)

\[ \text{LL def} = \frac{5 W H L^4}{384 E I} = 0.0424 \text{ INCHES} \]
**JENSEN PRECAST CONCRETE**  
**BOTTOM SLAB DESIGN PROGRAM VERSION 3.00**  
**ULTIMATE STRENGTH DESIGN**

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)  
ASTM C930 A-16 (AASHTO HS-20-44) LOADING  
8" FLOOR THICKNESS  
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Length</td>
<td>10.00 FEET</td>
</tr>
<tr>
<td>Structure Width</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>Bottom Slab Span</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>Wall Height</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>Top Slab Thickness</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>Bottom Slab Thickness</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>Depth to Top Slab</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>Crack Limit -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

**LIVE LOAD**

\[
\text{LIVE LOAD} = \frac{32000.00 \times 1.70 \times 11.33 \times 9.33}{(5.00 \times 1.75)^2} = 75158.35 \text{ LBS.}
\]

**DRY EARTH**

\[
\text{DRY EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 \times 1.4 = 81448.89 \text{ LBS.}
\]

**TOP SLAB**

\[
\text{TOP SLAB} = 11.33 \times 9.33 \times 9.00 / 12.00 \times 150 \times 1.4 = 16660.00 \text{ LBS.}
\]

**WALLS**

\[
\text{WALLS} = 38.67 \times 8.00 \times 8.00 / 12.00 \times 150 \times 1.4 = 43306.67 \text{ LBS.}
\]

**TOTAL WEIGHT**

\[
\text{TOTAL WEIGHT} = 216573.90 \text{ LBS.}
\]

**WEIGHT/SQ.FT.**

\[
\text{WEIGHT/SQ.FT.} = \frac{216573.90}{11.33 \times 9.33} = 2047.44 \text{ LBS/SQ.FT.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C390 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[ \frac{W \times L^2}{8} = \frac{19238.00}{230855.99} \text{ FT.LBS.} \]

\[ \frac{Mu}{\phi} = \frac{Mu}{0.90} = \frac{256506.65}{IN.LBS.} \]

\[ Fc=4500. \quad b=0.825 \quad Fy=60000. \]

\[ \sigma = 0.85 \frac{Fc}{87000} = 0.0311 \]

\[ \sigma_{max} = 0.75 \sigma_b = 0.02335 \]

\[ \sigma_{min} = \frac{200}{Fy} = 0.00333 \]

\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

\[ \sigma = \frac{As}{bd} = 0.01113 \quad \text{STEEL RATIO OK} \]

\[ \infty = \frac{\sigma Fy}{Fc} = 0.14845 \]

\[ Mn = Fc b^2 d^2 \approx (1-0.59\infty) = 280020.47 \text{ IN.LBS.} \]

\[ 280020.47 > 256506.65 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ V_{u} = \frac{W \times (L-2d)}{2} = 7819.95 \text{ LBS.} \]
\[ V_{u}/\phi = \frac{V_{u}}{0.85 \times b \times d} = 123.905 \text{ LBS./SQ.IN.} \]

SHEAR AT SLAB EDGE NOTCH

\[ V_{u} = \frac{W \times L}{2} = 8875.66 \text{ LBS.} \]
\[ V_{u}/\phi = \frac{V_{u}}{0.85 \times b \times (t\text{-notch})} = 124.309 \text{ LBS./SQ.IN.} \]

\[ V_{c} = 1.9V_{u}/c + 2500.\sigma \frac{V_{u}}{M_{u}} = 150.922 \text{ LBS./SQ. IN.} \]
\[ 150.922 > 124.309 \text{ LBS./SQ. IN. SHEAR CAP. OK} \]

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ.IN.

USE NO. 4 BARS AT 13 1/2" ON CENTER As = 0.178 SQ.IN.
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C690 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BOTTOM SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM SLAB THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP SLAB</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -2-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
32000.00 \times 11.33 \times 9.33 = 44210.79 \text{ LBS.}
\]

\[
(L.00 \times 1.75)^2 = 58177.78 \text{ LBS.}
\]

\[
\text{DRAE EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 = 58177.78 \text{ LBS.}
\]

\[
\text{TOP SLAB} = 11.33 \times 9.33 \times 9.00/12.00 \times 150 = 11900.00 \text{ LBS.}
\]

\[
\text{WALLS} = 38.67 \times 8.00 \times 8.00/12.00 \times 150 = 30933.33 \text{ LBS.}
\]

\[
\text{TOTAL WEIGHT} = 145221.90 \text{ LBS.}
\]

\[
\text{WEIGHT/SQ.FT.} = \frac{145221.90}{11.33 \times 9.33} = 1372.90 \text{ LBS/SQ.FT.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0" x 10'-0" x 8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
\frac{W \times L^2}{8} = 12899.89 \text{ FT.LBS.} \quad \frac{154798.64 \text{ IN.LBS.}}{}
\]

F/c=4500. \quad Fy=60000.

d = 8.00 - 1.50 - 0.3125 = 6.1875 INCHES

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

\[
\sigma = \frac{As}{bd} = 0.01113
\]

\[
n = \frac{Es}{Ec} = 7.584
\]

\[
k = \frac{(2\alpha n + (\alpha n)^2)^{0.5}}{\alpha n} = 0.335
\]

\[
j = 1 - \frac{k}{3} = 0.888
\]

\[
M = \frac{fs}{Asjd} = 34069.147
\]

Dc (FOR CRACK CONTROL) = 1.8125 INCHES

AREA (FOR CRACK CONTROL) = 16.3125 SQ.IN.

MAX. \, fs = \frac{130000.00}{(\text{FOR CRACK CONTROL}) \, (Dc \, \text{AREA})^{0.33}} = 42041.405 \text{ psi}

MAX. \, fs = 0.60 \times Fy = 36000.000 \text{ psi}

36000.000 > 34069.147 \text{ LBS/SQ.IN. CRACK CONTROL OK}
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE LENGTH</td>
<td>10.00 FEET</td>
</tr>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BOTTOM SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM SLAB THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP SLAB</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[ \text{LIVE LOAD} = \frac{32000 \times 11.33 \times 9.33}{(5.00 \times 1.75)^2} = 44210.79 \text{ LBS.} \]

\[ \text{DRY EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 = 58177.78 \text{ LBS.} \]

\[ \text{TOP SLAB} = 11.33 \times 9.33 \times 9.00/12.00 \times 150 = 11900.00 \text{ LBS.} \]

\[ \text{WALLS} = 38.67 \times 8.00 \times 8.00/12.00 \times 150 = 30933.33 \text{ LBS.} \]

\[ \text{TOTAL LOAD} = 145221.90 \text{ LBS.} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
\text{TOTAL LOAD/SQ.FT.} = \frac{145221.90}{11.33 \times 9.33} = 1372.90 \text{ LBS/SQ.FT.}
\]

\[
\text{TOTAL DEAD LOAD} = 101011.11 \text{ LBS.}
\]

\[
\text{DEAD LOAD/SQ.FT.} = \frac{101011.11}{11.33 \times 9.33} = 954.94 \text{ LBS/SQ.FT.}
\]

\[
F_{c}=4500. \quad F_{y}=60000.
\]

\[
M_{d1} = \frac{W \times L^{2}}{8} = 8972.70 \text{ FT.LBS.}
\]

\[
107672.34 \text{ IN.LBS.}
\]

\[
M_{\text{tot}} = \frac{W \times L^{2}}{8} = 12899.89 \text{ FT.LBS.}
\]

\[
154798.64 \text{ IN.LBS.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

DEAD LOAD IMMEDIATE DEFLECTIONS:

\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

NO. 5 BARS AT 4 1/2" ON CENTER \[ A_s = 0.827 \text{ SQ.IN.} \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN."}^4 \]

\[ S_g = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN."}^3 \]

CRACKING STRESS = 7.5 x F_c\times0.50 = 503.115 \text{ psi}

CRACKING MOMENT = STRESS \times S_g = 64398.76 \text{ IN.LBS.}

C CRACKED SECTION = 2.073 \text{ INCHES}

\[ Y_t = d - C \text{ CRACKED SECTION} = 4.114 \text{ INCHES} \]

\[ b C^3 \]

\[ I_{crk} = \frac{b C^3}{12} + C b \left( \frac{C}{2} \right)^2 + N A_s Y_t^2 = 141.774 \text{ IN."}^4 \]

\[ I_{eff} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M))^3 I_{crk} = 220.985 \text{ IN."}^4 \]

IF \[ I_{eff} > I_g \quad I_{eff} = I_g \]

\[ DL_{def} = \frac{5 Wd^3 L^4}{384 E I} = 0.1437 \text{ INCHES} \]
8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

LIVE LOAD IMMEDIATE DEFLECTIONS:
d = 8.00 - 1.50 - 0.3125 = 6.1875 INCHES

NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.
n = Es / Ec = 7.584

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 x Fc^0.50 = 503.115 psi
CRACKING MOMENT = STRESS x Sg = 64398.76 IN.LBS.
C CRACKED SECTION = 2.073 INCHES

\[ Yt = d - C \text{ CRACKED SECTION} = 4.114 \text{ INCHES} \]

\[ Icrk = \frac{\text{b C}^3}{12} + C b (C/2)^2 + N As Yt^2 = 141.774 \text{ IN.}^4 \]

\[ Ieff = (Mcrk/M)^3 Ig + (1-(Mcrk/M)^3)Icrk = 168.430 \text{ IN.}^4 \]

IF \( Ieff > Ig \) \( Ieff = Ig \)

\[ ll_{def} = \frac{5 \text{ WIL L}^4}{384 \text{ EI}} = 0.0825 \text{ INCHES} \]
SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.
D. As-Built Drawings

1.02 SUBMITTALS
A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by District, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with District’s permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. As-Built Drawings:
   1. Submit two compact disks with electronic as-built drawings in AutoCad 2008 or newer. Include all pen settings.
   2. Submit two opaque copies and one reproducible original of drawings to Engineer.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION
3.01 PROJECT RECORD DOCUMENTS
A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer’s instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling future reference by District.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA
A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES
A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.
B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
D. Additional information as specified in individual product specification sections.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS
A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.
B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
C. Include color coded wiring diagrams as installed.
D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
F. Provide servicing and lubrication schedule, and list of lubricants required.
G. Include manufacturer's printed operation and maintenance instructions.
H. Include sequence of operation by controls manufacturer.
I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide control diagrams by controls manufacturer as installed.
K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
M. Include test and balancing reports.
N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
B. Prepare data in the form of an instructional manual.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with District's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
B. Verify that documents are in proper form, contain full information, and are notarized.

DSA Re-submittal 6/21/2012

01 78 00 - 3
CLOSEOUT SUBMITTALS
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 AS BUILT DRAWINGS
A. Prepare as-built drawings utilizing AutoCad 2008 or later. Use nationally recognized drawing standards, including layer management and organization.
B. Engineer will provide original design drawing files for starting point of as-builts.
C. Drawings shall indicate actual installed location, elevation, orientation, size and features of all equipment and materials installed under this contract.
D. Revise all sheets from the design drawings as required to reflect actual construction. This includes but is not limited to all diagrams, panel schedules, equipment schedules, controls points lists, floor plans, elevations, profiles and sequences.
E. As Built drawings for underground utilities shall include showing and marking of all utilities crossed, whether shown on Contract Drawings or not. Information for existing utilities shall include utility type, size, depth or elevation, and station number or location to permanent, fixed above grade features.

END OF SECTION
SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY
A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
B. Training of District personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.

1.02 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Contractor's Commissioning Authority.
   2. Submit one copy to the Contractor's Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Contractor’s Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Contractor's Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: District will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Contractor's Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training, include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such as slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE
A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by District.

B. Demonstrations conducted during Functional Testing need not be repeated unless District personnel training is specified.

C. Demonstration may be combined with District personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Contractor's Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. District will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the District.

E. Provide training in minimum two hour segments.

F. The District or District's Representative is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of District's personnel to be trained; re-schedule training sessions as required by District; once schedule has been approved by District failure to conduct sessions according to schedule will be cause for District to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.
J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION
Specifications
For
Merritt College -
CHW Infrastructure
SOBE No. 10200
6/21/2012
SPECIFICATIONS

Merritt Community College – CHW Infrastructure
Project #10200

Merritt Community College
12500 Campus Drive
Oakland, CA 94619

PERALTA COMMUNITY COLLEGE DISTRICT
OAKLAND, CA. 94619

Approval Stamps

ARCHITECT
Joseph Gonzalez
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

ELECTRICAL ENGINEER
Jeffry Gosal
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

MECHANICAL ENGINEER
John Salas
Salas O’Brien Engineers, Inc.
305 South 11th Street
San Jose, Ca. 95112

STRUCTURAL ENGINEER
Stephen Ward
AKH Structural Engineers
1505 Meridian Ave., Ste. B
San Jose, Ca. 95125

APPLICATIONS FOR LICENSED PROFESSIONAL ENGINEERS
STATE OF CALIFORNIA
No. C 19795
REN. 11-30-13

STATE OF CALIFORNIA
No. 18084

STATE OF CALIFORNIA
No. 5099

STATE OF CALIFORNIA
No. 84987
EXP. 6/28/16

DIVISION OF THE STATE ARCHITECT
APPLICATION 11 25 34
AG 11 29 12
DIVISION OF THE STATE ARCHITECT
# Statement of Structural Tests and Special Inspections

## 2010 CBC

**School Name:** Merritt College  
**District:** Peralta Community College  
**Application No.:**  
**Date Submitted:** 1/23/2012

**IMPORTANT:** This form is only a summary list of structural tests and special inspections required for the project. The actual tests and inspections must be performed as detailed on the DSA approved documents. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A.

**NOTE:** This form is also available for projects submitted for review under the 2007 CBC.

**INSTRUCTIONS:** Click a plus sign (+) before any category or subcategory to reveal additional tests and special inspections. An "X" before a listed test or inspection indicates it is a mandatory requirement. A shaded box indicates a test or special inspection that may be required, depending on the scope of the construction and other issues. A shaded box can be clicked indicating your selection of that test. 

**Note:** All references to the California Building Code (CBC) are to the 2010 edition.

<table>
<thead>
<tr>
<th>REQUIRED TEST OR SPECIAL INSPECTION</th>
<th>TYPE</th>
<th>PERFORMED BY</th>
<th>CODE REFERENCE AND NOTES</th>
</tr>
</thead>
</table>

## SOILS

### 1. GENERAL:

- **Table 1704A.7**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Periodic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Verify that:</td>
<td>GE*</td>
<td>By geotechnical engineer or his or her qualified representative.</td>
</tr>
</tbody>
</table>
  - site has been prepared properly prior to placement of controlled fill and/or excavations for foundations. |
  - foundation excavations are extended to proper depth and have reached proper material, and |
  - materials below footings are adequate to achieve the design bearing capacity. |

### 2. COMPACTED FILLS:

- **Table 1704A.7**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Test</th>
<th>Lab*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Perform qualification testing of fill materials.</td>
<td></td>
<td>Under the supervision of the geotechnical engineer.</td>
</tr>
<tr>
<td>X</td>
<td>b. Verify use of proper materials and inspect lift thicknesses, placement, and compaction during placement of fill.</td>
<td>Continuous</td>
<td>GE*</td>
</tr>
<tr>
<td>X</td>
<td>c. Test compaction of fill.</td>
<td>Test</td>
<td>Lab*</td>
</tr>
</tbody>
</table>

### 4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):

- **Table 1704A.9**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Continuous</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Inspect drilling operations and maintain complete and accurate records for each pier.</td>
<td>GE*</td>
<td>By geotechnical engineer or his or her qualified representative.</td>
</tr>
<tr>
<td>X</td>
<td>b. Verify locations of piers.</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>c. Confirm pier diameters, plumness, bell diameters (if applicable), lengths, and embedment into bedrock (if applicable). Record concrete or grout volumes.</td>
<td>Continuous</td>
<td>GE*</td>
</tr>
<tr>
<td>X</td>
<td>e. Concrete piers.</td>
<td>Provide tests and inspections per CONCRETE section below.</td>
<td></td>
</tr>
</tbody>
</table>

### 5. RETAINING WALLS:

- **Continuous**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>GE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Placement of soil reinforcement, drainage devices, and backfill.</td>
<td>Placement, compaction and inspection of backfill per Section 1704A.7.1 for fills supporting foundations (see Section 2 above).</td>
</tr>
</tbody>
</table>

---

**In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.**

---

**DSA-103**  
*(rev 11-07-11)*
### Concrete

#### 7. Cast in Place Concrete

**Material Verification and Testing:**

<table>
<thead>
<tr>
<th>X</th>
<th>a.</th>
<th>Verify use of required design mix.</th>
<th>Periodic</th>
<th>SI &amp; PI*</th>
<th>* To be performed by batch-plant special inspector and project inspector.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>b.</td>
<td>Test reinforcing steel.</td>
<td>Test</td>
<td>Lab</td>
<td>1916A.2 (1916.1.8*). ASTM A370. See IR 17-10</td>
</tr>
<tr>
<td>X</td>
<td>c.</td>
<td>Perform slump, temperature, and (where required) air content tests.</td>
<td>Test</td>
<td>Lab</td>
<td>ASTM C172, ASTM C31.</td>
</tr>
</tbody>
</table>

**Inspection:**

| X | e. | Inspect batching of concrete. | Continuous | SI | 1704A.4.2; (see 1704A.4.3, option 2 for waiver based on design parameters). |
| X | f. | Inspect placement of formwork, reinforcing steel, embedded items and concrete. Inspect curing and form removal. | Continuous | PI* | * May be performed by a special inspector when specifically approved by DSA. |

#### 10. Shotcrete (in addition to Cast in Place Concrete tests and inspections):

| X | b. | Test shotcrete (compression). | Test | Lab | 1913A.5, 1913A.10 and 1916A.5 (1913.5*, 1913.10* and 1916.1.9*). ASTM C42, ASTM C1140 |

#### 11. Post-Installed Anchors:

| X | a. | Inspect installation of post-installed anchors | Continuous | PI | Table 1704A.4 |
| X | b. | Test post-installed anchors. | Test | Lab | 1916A.7 (1916.1.11*). |

### Masonry

#### Table 1704A.5.3

### Steel

#### 17. Structural Steel and Cold-Formed Steel Used for Structural Purposes

**Material Verification:**

| X | a. | Verify that all materials are appropriately marked and that: | Periodic | * | * By special inspector when performed off-site; by project inspector for steel shipped directly to project site without welding or fabrication. |
| X | b. | Test unidentified materials | Test | Lab | 2203A.1 (2203.1*). ASTM A370. |
| X | c. | Examine seam welds of structural tubes and pipes | Periodic | SI* | * See DSA IR 17-3. |

**Inspection:**

| X | d. | Verify member locations, bracing and all details constructed in the field. | Continuous | PI |
| X | e. | Verify stiffener locations, connection tab locations and all construction details fabricated in the shop. | Periodic | SI |

#### 19. Welding:

**Verification of Materials, Equipment, Welders, etc.:**

DSA IR 17-3, AWS D1.1 and AWS D1.8 (AWS D1.3 for cold-formed steel).

| X | a. | Verify weld filler material identification markings per AWS designation listed on the DSA approved documents and the WPS. | Periodic | SI |

*In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.*
# Statement of Structural Tests and Special Inspections

**2010 CBC**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19.1 SHOP WELDING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Inspect groove, multi-pass, and fillet welds &gt; 5/16&quot;</td>
<td>Continuous</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td>b. Inspect single-pass fillet welds ≤ 5/16&quot;</td>
<td>Periodic</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td>c. Inspect welding of stairs and railing systems.</td>
<td>Periodic</td>
<td>SI</td>
<td>1704A.3.1 Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td><strong>19.2 FIELD WELDING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Inspect groove, multi-pass, and fillet welds &gt; 5/16&quot;</td>
<td>Continuous</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td>b. Inspect single-pass fillet welds ≤ 5/16&quot;</td>
<td>Periodic</td>
<td>SI</td>
<td>Per AISC 360 (and AISC 341 as applicable). See DSA IR 17-3.</td>
</tr>
<tr>
<td>f. Inspect welding of stairs and railing systems</td>
<td>Periodic</td>
<td>SI*</td>
<td>* May be performed by the project inspector when approved by DSA. See DSA IR 17-3.</td>
</tr>
<tr>
<td><strong>WOOD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OTHER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section 1704A.15

---

*In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2.*
### Statement of Structural Tests and Special Inspections

2010 CBC

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soils testing and Inspection: Geotechnical Verified Report</td>
<td>Form DSA-293</td>
</tr>
<tr>
<td>2</td>
<td>All Structural Testing: Laboratory Verified Report</td>
<td>Form DSA-291</td>
</tr>
<tr>
<td>3</td>
<td>Concrete Batch Plant Inspection: Special Inspection Verified Report</td>
<td>Form DSA-292</td>
</tr>
<tr>
<td>4</td>
<td>Shotcrete Inspection: Special Inspection Verified Report</td>
<td>Form DSA-292</td>
</tr>
<tr>
<td>5</td>
<td>Shop Welding Inspection: Special Inspection Verified Report</td>
<td>Form DSA-292</td>
</tr>
<tr>
<td>6</td>
<td>Field Welding Inspection: Special Inspection Verified Report</td>
<td>Form DSA-292</td>
</tr>
</tbody>
</table>

#### KEY to Columns

<table>
<thead>
<tr>
<th>1 Type</th>
<th>2 Performed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous – Indicates that a continuous special inspection is required</td>
<td>GE – Indicates that the special inspection is to be performed by a registered geotechnical engineer or his or her authorized representative</td>
</tr>
<tr>
<td>Periodic – Indicates that a periodic special inspection is required</td>
<td>Lab – Indicates that the test is to be performed by a testing laboratory accepted in the DSA laboratory Evaluation and Acceptance (LEA) Program</td>
</tr>
<tr>
<td>Test – Indicates that a test is required</td>
<td>PI – Indicates that the special inspection is to be performed by the project inspector</td>
</tr>
<tr>
<td>SI – Indicates that the special inspection is to be performed by a special inspector</td>
<td></td>
</tr>
</tbody>
</table>

(Note: The difference between “tests” and “special inspections” is addressed in IR 17-4)

**Signed**

Name of Architect or Engineer, General Responsible Charge: Joseph Brown 4/23/12

Name of Structural Engineer (when structural design has been delegated): Stephen R. Ward 4/23/12

Identification Stamp: DIV OF THE STATE ARCHITECT
APP. # 01-112534

AC N/A  F/LS N/A  SS C B

DATE 6/23/12

~ In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that can be used by community colleges, per 2010 CBC Sec. 1.9.2.2. ~
## DOCUMENTS REQUIRED FOR PROJECT CERTIFICATION- ORS-6

**Project Name:** MERRIT COLLEGE

**File No.:** I-CL  
**Application No.:** 01-112534  
**Name of A/E:** SALASOBRIEN

### Project Information

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Item</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-5 (Project/Site)</td>
<td>For Project/Site Inspector(s)</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Form DSA-5 (In-Plant)</td>
<td>For Relocatable Buildings Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form DSA-102</td>
<td>Contract Information</td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6/AE)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports (Form DSA-6/AE)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Architect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Structural Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mechanical Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Engineer</td>
<td></td>
</tr>
</tbody>
</table>

### Final Verified Report (Form DSA-6)

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports (Form DSA-6)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Project/Site Inspector(s)</td>
<td>From Each Contractor</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Contractor</td>
<td>For Relocatable Building Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In-Plant Inspector(s)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Special Inspector(s)</td>
<td></td>
</tr>
</tbody>
</table>

### Other Final Verified Reports/Affidavits

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Final Verified Reports/Affidavits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Laboratory (Form DSA-291)</td>
<td>Signed by LEA Lab Professional Engineer</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Shop Welding &amp; Fabrication (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Field Welding (Form DSA-292)</td>
<td>Signed by AWS/CWI Welding Inspector</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>High Strength Bolt Installation (Form DSA-262)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Glulam Fabrication (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manufactured Trusses</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Masonry Inspection (Form DSA-292)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Engineered Fill (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Drilled Pier Soil Inspection (Form DSA-293)</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beacher Fabrication</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Retaining Walls</td>
<td>Signed by Geotechnical Engineer</td>
</tr>
</tbody>
</table>

### Other Documents

<table>
<thead>
<tr>
<th>Req'd</th>
<th>Received</th>
<th>Not Received</th>
<th>Items</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Further Fees</td>
<td>See Attached Invoice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Notice of Completion</td>
<td>Signed by School District/Owner</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Automatic Sprinkler System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fire Suppression System D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skylights D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beachers D.A.</td>
<td>Deferred Approval Item</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change Orders:</td>
<td>For all fees and/or reimbursable charges paid to the Construction Managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Reports:</td>
<td>X Expansion Anchors, ☐ Grouted Anchors, ☒ Adhesive Anchors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electrical Grounding Test Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Checklist for Site Inspector of Relocatable Bldgs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Record Set of Drawings and Specifications approved by DSA during plan check but were not copied to DSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

**Signature of A/E:**  

**Date:** 06/29/12

**For 90 Day Letter Preparation By:**  

**Date:** 06/29/12

(Rev. 5/07)
# TABLE OF CONTENTS

## DIVISION 01 - GENERAL REQUIREMENTS

- 01 10 00 SUMMARY
- 01 13 00 PROJECT COORDINATION
- 01 14 00 WORK RESTRICTIONS
- 01 21 12 ALLOWANCES
- 01 22 00 UNIT PRICES
- 01 23 00 ALTERNATES
- 01 30 00 ADMINISTRATIVE REQUIREMENTS
- 01 30 55 SAMPLE FORMS
- 01 40 00 QUALITY REQUIREMENTS
- 01 50 00 TEMPORARY FACILITIES AND CONTROLS
- 01 60 00 PRODUCT REQUIREMENTS
- 01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS
- 01 78 00 CLOSEOUT SUBMITTALS
- 01 79 00 DEMONSTRATION AND TRAINING

## DIVISION 05 - METALS

- 05 51 00 METAL STAIRS
- 05 52 13 PIPE AND TUBE RAILINGS

## DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 07 46 46 FIBER CEMENT SIDING
- 07 90 05 JOINT SEALERS

## DIVISION 08 - OPENINGS

- 08 11 13 HOLLOW METAL DOORS AND FRAMES
- 08 33 23 OVERHEAD COILING DOORS
- 08 71 00 DOOR HARDWARE
- 08 91 00 LOUVERS

## DIVISION 09 - FINISHES

- 09 21 16 GYPSUM BOARD ASSEMBLIES
- 09 90 00 PAINTING AND COATING

## DIVISION 10 - SPECIALTIES

- 10 14 00 SIGNAGE
- 10 44 00 FIRE PROTECTION SPECIALTIES

## DIVISION 22 - PLUMBING

- 22 10 05 PLUMBING PIPING
- 22 10 06 PLUMBING PIPING SPECIALTIES

## DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
23 05 19 METERS AND GAGES FOR HVAC PIPING
23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 19 HVAC PIPING INSULATION
23 08 00 COMMISSIONING OF HVAC
23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
23 09 30 ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS
23 21 13 HYDRONIC PIPING
23 21 14 HYDRONIC SPECIALTIES
23 21 23 HYDRONIC PUMPS
23 25 00 HVAC WATER TREATMENT
23 31 00 HVAC DUCTS AND CASINGS
23 34 23 HVAC POWER VENTILATORS
23 64 16 CENTRIFUGAL WATER CHILLERS
23 65 13 INDUCED DRAFT COOLING TOWERS

DIVISION 26 - ELECTRICAL

26 05 01 MINOR ELECTRICAL DEMOLITION
26 05 10 ELECTRICAL GENERAL PROVISIONS
26 05 12 BASIC MATERIAL AND METHODS
26 05 13 MEDIUM-VOLTAGE CABLE
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 73 POWER SYSTEM STUDY
26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 02 ELECTRICAL ACCEPTANCE TESTING
26 11 16 SECONDARY UNIT SUBSTATIONS
26 13 21 AIR INTERRUPTER SWITCHES
26 24 13 SWITCHBOARDS
26 24 16 PANELBOARDS
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 00 FIRE ALARM SYSTEM
28 35 00 REFRIGERANT MONITORING SYSTEM

DIVISION 31 - EARTHWORK

31 23 16.13 TRENCHING
31 23 16.25 ROCK REMOVAL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING
32 13 13 CONCRETE PAVING
32 31 13 CHAIN LINK FENCES AND GATES

DIVISION 33 - UTILITIES

33 05 13 MANHOLES
33 61 13 UNDERGROUND HYDRONIC ENERGY DISTRIBUTION
33 71 19 ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

DSA Re-submittal 6/21/2012
SECTION 01 10 00
SUMMARY

PART 1 GENERAL
1.01 PROJECT
A. Project Name: Chilled Water Infrastructure.
B. District’s Name: Peralta Community College District
C. Engineer’s Name: Salas O’Brien Engineers, Inc.
D. The Project consists of the alteration of Building F, and underground chilled water infrastructure with connections to Building L, and Building Q. Work includes the installation of a chilled water plant in Building F, with cooling tower yard, including new electrical service. Also included is stubout service to future Science Building. Building F alterations include converting the existing entrance into a chiller room, installing second floor stair exiting and lower room addition with acoustical louvers, a cooling tower yard with site screen chain link fences & gates, pumps and new electrical substation to serve the new central chilled water plant equipment. Exposed pipes to have outdoor box enclosures on exterior walls and low roofs. See 01 23 00 Alternates for Concrete Cooling Tower Yard Enclosure and third chiller.

1.02 CONTRACT DESCRIPTION
A. Contract Type: A single prime contract based on a Stipulated Price as described in the Invitation to Bid.

1.03 DESCRIPTION OF ALTERATIONS WORK
A. Scope of demolition and removal work is shown on drawings.
B. Scope of alterations work is shown on drawings.
C. HVAC: Alter existing system and add new construction, keeping existing in operation.
D. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
E. Relocation of storage container currently located in future cooling tower area at Bldg F to an on site area designated by the District.
F. District will remove the following items before start of work:
   2. Contents of storage container for the installation of the cooling tower pad and piping near Building F.
   3. All stored/loose items currently inside the future chiller room in Building F.

1.04 FUTURE WORK
A. Project is designed for future chilled water connection to future Science Building. Proposed building outline is shown on Contract Drawings.

1.05 OWNER OCCUPANCY
A. District intends to continue to occupy portions of the existing buildings during the entire construction period.
B. District intends to occupy the Project upon Substantial Completion.
C. Cooperate with District to minimize conflict and to facilitate District’s operations.
D. Schedule the Work to accommodate District occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES
A. Construction Operations: Limited to areas noted on Drawings.
B. Arrange use of site and premises to allow:
   1. District occupancy.
   2. Work by Others.
   3. Work by District.

DSA Re-submittal 6/21/2012
4. Use of site and premises by the public.
5. Use of site by Students, Staff and Employees.

C. Provide access to and from site as required by law and by District.

D. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

E. Existing building spaces may not be used for storage.

F. Limit shutdown of utility services to 4 hours at a time, arranged at least two weeks in advance with District.
   1. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE
   A. Coordinate construction schedule and operations with District.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
PART 1 GENERAL

1.01 GENERAL COORDINATION

A. The requirements of this Section relate to various requirements of the Agreement, General and Special Conditions, specifications, drawings, and all modifying documents which are part of the construction contract. Responsibility for coordination of all such applicable requirements shall be that of the Contractor.

B. The Contractor shall coordinate and cooperate with the District and other Contractors, and shall execute the work of this contract in a timely manner so as to cause no delay in the work of other contracts.

C. The Contractor shall be responsible for the coordination of all Work, including but not limited to, all trades including specialized trades to accomplish all aspects of the Work.

D. The Contractor shall coordinate scheduling, submittals, and work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items to be installed later.

E. Contractor shall verify that utility requirement characteristics of operating equipment are compatible with building utilities. Contractor shall coordinate work of various Sections having interdependent functions and be responsible for installing, connecting to, and placing in service, related equipment.

F. Contractor shall coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. This shall include, but not be limited to: following routing shown for pipes, ducts, and conduit, as closely as practicable; placing runs parallel with line of building, and utilizing spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

G. In finished areas except as otherwise indicated, Contractor shall ensure that pipes, ducts, and wiring are concealed within the construction.

H. Contractor shall coordinate locations of fixtures and outlets with finish elements.

I. Contractor shall coordinate daily clean up of Work in each area of work and at the end of each work shift.

J. Contractor shall coordinate completion and clean up of Work of separate Sections in preparation for substantial completion and for portions of Work designated for District's occupancy.

K. Contractor shall coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of District activities.

L. In addition to the above requirements and requirements of the General Conditions, Contractor shall be responsible for the coordination of the following:
   1. Provisions for future installation of work not included in the contract as shown or specified.
   2. Primary, major and accessory materials, and items necessary to complete the installation.
   3. Labor operations and material items reasonably incidental for finishing.
   4. Performing of Work and delivery of materials in accordance with established construction schedules.
   5. Development of procedures for implementation of all utility shutdowns, pathway closures; wayfinding signage and directives; development and construction of alternative pathways, barricading and related signage.
   6. Coordination of and obtaining approval for all schedules, schedule modifications, Work Plans, utility shutdowns, pathway closures, wayfinding and alternative pathways, barricading, and all signage with District.
   7. Submittal of Access Request Forms and development, coordination and submittal of other forms as appropriate for communicating work efforts, changes or clarifications to the District and impacted personnel.
8. Coordination with Campus Facilities and Trades personnel as regards on-going support of peripheral equipment and systems (e.g. electric panels, manhole access, central plant shutdown, fire water and fire alarm system shutdown or relocation, security/alarm system shutdown or relocation, etc.).

M. Contractor shall coordinate all aspects of his construction operations, generally, and specifically as required under various Articles of this Section and other parts of the Contract Documents, to provide the District with a complete and operable facility. Other Contractors working at the project site, including those delivering materials or equipment, shall coordinate their operations with each other to provide the District with a complete and operable facility.

1. Any dispute over coordination, or failure to coordinate, shall be brought to the District for resolution.

2. If any part of the work depends on proper execution or on proper results of the work or systems or equipment of any other provider or of the District, Contractor shall inspect and promptly report to the District, any defects in the work that render it unsuitable for such proper execution and necessary results. Failure to so inspect the providers' or District's work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the provided work, system or equipment. This requirement is waived only to the extent that defects develop in the other providers' or District's work or systems or equipment after the execution of subsequent work.

3. Contractor shall cooperate with other Contractors on the project site and with the District so that completion of all work may proceed with all possible speed. Contractor shall attend a monthly Campus project coordination meeting and shall furnish other Contractors, whose work is fitted to this work, details and erection drawings giving full information regarding the scheduling, fabrication and assembly of this Work. So far as possible, drawings shall indicate checked field measurements. Contractor shall cooperate in timing this work to join with the work of other Contractors or the District.

4. Contractor shall check the drawings of other Contractors for interferences with this work and promptly report, in writing, any such interferences to the District. In addition, Contractor shall submit complete information, including drawings, descriptions, sketches, marked prints, etc., as required for District coordination of drawings by others which are not a part of this work.

5. To ensure the proper evaluation of subsequent work of this contract, Contractor shall measure work already in place and report to the District any discrepancy between the executed work and the contract documents. Failure to so measure work or equipment as fit and proper for the reception of this work, shall constitute acceptance of the available space(s).

6. Contractor shall do all cutting and fitting of this work and of other work that may be required to properly fit this work to receive, or be received by, the work of other Contractors as shown on or reasonably implied by, the contract documents. Contractor shall properly finish and complete this work after other Contractors have finished. Any costs for additional cutting and fitting caused by defective work shall be borne by the party responsible thereof. Contractor shall not endanger any work by cutting, fitting or otherwise, and shall not cut or alter the work of other Contractor without the consent of the District.

1.02 INCIDENTAL COSTS

A. Contractor shall furnish at his own cost and expense all tools, consumable supplies, appliances, equipment, etc. necessary for the execution of his work, and shall be responsible for care and guarding thereof.

B. Contractor shall be entirely responsible for professional trade, business, or other licenses required by State statute or local government.

1.03 CORRESPONDENCE AND NOTICES

A. Contractor shall clearly identify correspondence, notices, requests for information (RFI's) and submittals with project name, subject, and detailed references to drawings and specifications.
In order to properly track and document all correspondences and notices, a unique sequential numbering system shall be applied for each type of correspondence or notice.

B. Contractor shall notify the District’s representatives in writing 6 working days, unless otherwise specified, in advance of all required inspections.

1.04 MISCELLANEOUS PROVISIONS

A. Contractor shall immediately refer to the District, any requirement shown or specified which Contractor finds or believes:
   1. Is not equal to industry standards for achieving the intended results.
   2. Is excessive in cost or effort to effect the intended results.
   3. Is below standard for proper enforcement of the guarantees required.
   4. Is at variance with governing laws, regulations, codes or standards.

B. Failure to so inform the District, in advance of Work, shall constitute acceptance by the Contractor for resolution of the requirements at Contractor's expense.

C. Contractor shall shop fabricate and preassemble interrelated parts where possible.

D. Closing up of walls, partitions or furred spaces, backfilling, or other "covering up" operations shall not proceed until all required tests and inspections have been completed.

E. Prior to starting a particular type or kind of work, Contractor shall:
   1. Examine for relevant information all contract documents and subsequent data issued to the project.
   2. Check accepted submittals and verify dimensions at job site.
   3. Consult manufacturers for instructions applicable to conditions under which work is to be installed.
   4. Inspect areas, surfaces, or any construction location receiving the work. Start of work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory condition to achieve proper installations and first quality workmanship as intended under these specifications.

1.05 WORK ON OCCUPIED FACILITIES

A. This section shall apply to all modifications or additions to work on all occupied facilities. In this case, all buildings and all grounds are considered fully occupied.

B. Contractor shall cooperate with the District to sequence his work so as not to unnecessarily interfere with operation of occupied facilities. Prior to demolition or construction work, Contractor shall consult with the District as a part of the Work Plan process and Contractor shall develop a construction schedule and Work Plan which will permit the existing users (staff, students, administrators) to function without interruption; while remaining in compliance with the schedules and limitations as delineated in other portions of the Contract Documents. This includes power outages, noise levels greater than 65dB, dislocation, or other interruptions as would cause intrusion to users or disruption of the user environment.

C. Campus operations cannot be impacted by the Contractor without prior written approval from the District’s representatives. Requests to perform activities which potentially impact campus operation, or occur in occupied buildings, shall be made by utilizing the Access Request Form. The Contractor shall sequentially number each access request and maintain a log of the requests issued. After receiving approval for Contractor's 3 week Work Plan, Contractor will submit properly completed Access Requests to the District’s representative. Each Access Request shall occur a minimum of two weeks prior to the proposed date of the work. Submittal of the Access Request Form shall provide the District a minimum of 4 days during which the District may coordinate with campus personnel and ongoing campus activities; and subsequently suggest changes to the requested Access. Such changes to the requested access time shall not form a basis for Contract time extensions regardless of the critical nature of the proposed activity. For this reason, Contractor shall always have one or more "spare" locations or operations planned for construction as a part of the Work Plan process.

D. In planning and performing the work, every effort shall be made to control the noise, dirt and fugitive dust levels as required by these contract specifications.

DSA Re-submittal 6/21/2012

01 13 00 - 3

PROJECT COORDINATION
E. Ingress and egress to and from existing buildings shall be continuously maintained for purposes of normal personnel access (i.e. to classes, offices, administrative events and social events), fire and emergency entrances and escape, loading and delivery, and building maintenance, to the satisfaction of the District, and the local fire and building departments. Contractor shall determine and install all necessary wayfinding signage as indicated on the Work Plan and approved in advance by the District. Said signage shall be installed prior to any shutout or interruption of access to a room, pathway, system, building, doorway or hallway.

F. All utilities shall be protected against interruption, damage, or contamination during construction. Temporary utilities shall be installed, if necessary, to maintain services continuously. Such utilities shall include but shall not be limited to electricity, water, gas, sewerage, chilled water, steam, telephone and data.

G. Contractor shall limit equipment and vehicles in ingress and egress and use of service areas to the minimum essential to Contractor's operations. Other vehicles and equipment shall be kept out of such areas. In the event of unavoidable conflict with Contractor's equipment in such areas, upon request of the District, Contractor shall remove such equipment immediately.

PART 2 PRODUCTS
2.01 NOT USED

PART 3 EXECUTION
3.01 GENERAL

A. Because of the sensitive nature of campus operations, to the extent that unplanned outages create unreplaceable loss of time, and operation deficiencies, the planning and execution of work procedures to reduce outages to an absolute minimum is of prime importance in this project. Such planning and execution is the full responsibility of the Contractor performing the work under these contract documents.

3.02 POWER OUTAGES

A. Interruption of the power to any electrical system for performing the construction work shall be scheduled in advance by use of an Access Request and approval will be at the convenience of the District.

B. Time of outages in individual buildings shall be scheduled for the times that the classrooms are not in session. Contractor to mobilize required work force and equipment to be able to accomplish individual tasks within permitted Work sequences.

C. Scheduling of any power outages shall be performed and approved as a part of the Work Plan and Scheduling process. In all cases, approval of power outages and procedures shall be obtained in writing by use of an Access Request at least two weeks prior to the Work. Request to be filed on Access Request Forms. This includes shut down of any equipment, system or system(s).

D. The work to any area with power outages shall be performed and proceed on a continuous, non-stopping basis until power is restored to all areas.

E. Contractor to consider all costs associated with difficulty of performing the work under restricted conditions in its bid price. Contractor shall also be responsible for any damages to District properties resulting from lack of performance in accordance with the requirements of this section and these contract documents.

3.03 FIELD INVESTIGATION OF INFORMATION

A. The information regarding each feeder and feeding each individual building as appear on the existing single line diagrams, is based on the best information available. However, it was considered impractical to verify the data by test outages prior to the actual need. The Contractor shall thus verify all buildings power sources, feeders data and initiate the work accordingly.
3.04 SPECIAL REQUIREMENTS FOR TRENCHING/EXCAVATING

A. To minimize access interference and facility disruption, open trench headings shall be limited to a maximum of 300 feet of trench. District may, upon written request allow additional headings to be open concurrently, if acceptable access and wayfinding means are provided by contractor.

B. Existing utilities shall be located by contractor through the contractor provided utility locating service subcontractor. USA will not locate utilities that are not within the public right of way (ie, no locating on campuses or private property). Utilities shall be clearly marked with non-permanent paint with depth estimates provided by the locating subcontractor.

C. Contractor shall pothole a minimum of 10' in advance of any powered trenching or excavating operations. Potholing shall locate and expose any and all utilities in the path of trenching or excavating activities. Potholing shall be by vacuum excavating equipment or hand digging. All utilities encountered shall be clearly marked, and hand excavated to prevent damage. (Exception: irrigation utilities are usually not readily located with underground survey equipment, and breakage is expected to occur - see Section 01 21 12 Allowances, for special allowances).

D. All utilities located, whether or not shown on contract drawings are to be marked on the project record drawings, as to size and service, with either a reference to station number or reference to permanent surface features, and elevations noted (referenced to sea level). At completion of the project, all such located utilities shall be incorporated in the electronic As-Built drawings required to be provided by this contract. Regardless of other requirements (or lack thereof) for As-Built Drawings, contractor shall provide As-Built, electronic documentation of ALL utilities crossed or exposed, indicating location, size, service and elevation, whether shown on contract documents or not.

3.05 SAFETY - (REGARDING POWER OUTAGES)

A. Contractor shall coordinate through the District, and implement a procedure to prevent accidental shut-down or injury. The procedure shall include a systematic method of tagging and locking the circuit breakers and switches. All circuit breakers and switches which can energize a circuit wherein work needs to be performed must be opened, tagged with warning signs and locked. Temporary grounding of the circuit and locking the circuit breaker(s)/switch(es) is required for all long circuits and for all circuits with operating voltage above 480 volts. Proper isolation of circuits on which work is to be performed shall be required for safety of the workers. The Contractor shall be fully responsible for implementing all required safety procedures to protect personnel.

B. The Contractor shall never assume, no matter how obvious the circumstances, that any conductor or piece of equipment is de-energized before it is handled by the workman, without actually testing for de energization. Primary conductors shall be tested with hot stick or similar means.

END OF SECTION
PART 1 GENERAL

1.01 OCCUPANCY

A. The District intends to occupy all buildings and to run a normal campus schedule and environment over the entire duration of the Work. All activities, all classes and all operations associated with the entire population of students, staff and administrators will be in full operation. Therefore, access to and through the Campus and to and through each and every building must be available and clearly marked at all times.

B. The Contract, the Work, the Work Sequences and the Work Schedules shall be developed and deployed so as to accommodate this fully operational Campus environment. For this reason, a formal Work Plan shall be developed and updated weekly. Within the Work Plan process, the Contractor shall be responsible to notify the District a minimum of three weeks in advance of work which will directly affect a specific area.

C. This Work is of critical importance to the long range viability of the campus. For this reason, it is the intent of the District to develop a high functioning, supportive and fully cooperative relationship between the Contractor and the District. Critical components relating to this relationship include that:
   1. The Contractor shall cooperate with the District to minimize conflict and to facilitate District operations.
   2. The Contractor shall ensure that all work is scheduled (and, as necessary, rescheduled) to accommodate anticipated and unanticipated interference to Campus learning activities, operations and social activities.
   3. The Contractor shall implement all possible procedures to protect property adjacent to the construction project from damage resulting from work specified and performed within this Contract.
   4. The Contractor shall provide safe, clearly marked, unobstructed access to and throughout the Campus and to and throughout each building over the entire duration of the project. Furthermore, the Contractor shall maintain fire lanes and related access at all times.
   5. The Contractor shall take special considerations for pedestrian safety and convenience when any work area encroaches upon a sidewalk, walkway or crosswalk area.
   6. The District will make every possible effort to ensure that the Contractor is paid on a timely basis.
   7. The District will make every possible effort to ensure that Contractors submittals, requests, and Work Plans are reviewed, modified and approved in a timely and realistic manner.

1.02 INTERFACE WITH EXISTING FACILITIES

A. Contractor is required to protect and maintain in service all existing plumbing, mechanical, electrical, communications, security, fire protection, and control systems and components. In the event that existing systems are being replaced, the existing system shall be maintained fully operational until the new system is fully tested and accepted by the District's Representative. To permit this to occur without adversely impacting continuity, specific procedures must be developed as a part of the Work Plan process. This procedure shall be approved in advance by the District and shall identify and incorporate necessary accommodations to the systems and equipment which will ensure the desired continuity.

B. Where new products are to be installed in existing systems, the existing elements are shown on the Contract Drawings as schematic and are not necessarily shown to scale. As a result, in preparing proposed new equipment and piping layouts (and related schedules and Work Plan), the Contractor must base each plan and procedure upon the actual as-built existing conditions in the affected mechanical/electrical room and/or mechanical/electrical/telecommunications/domestic/water/sewer/storm/other system or component; and must locate new or relocated equipment in a manner which does not conflict with existing equipment and which complies with all manufacturer's recommended installation requirements, such as clearances, anchorage, accessibility, and applicable code requirements.

DSA Re-submittal 6/21/2012

WORK RESTRICTIONS
C. Access to or modification of any existing system for any purpose must be coordinated with Campus Facilities through the District's Representative. Access requests must be submitted in writing, using the Access Request Form and each must be consecutively and uniquely numbered. Access requests must be submitted a minimum of fourteen (14) calendar days prior to the date required. Delays which occur due to the failure of the Contractor to follow the access request procedure will be the responsibility of the Contractor.

1.03 CONTRACTOR GENERAL CONSIDERATIONS

A. Superintendent
   1. In addition to the requirement of the General Conditions:
      a. Failure to maintain a Superintendent on the Project site at all times work is in progress shall be considered a material breach of this Contract entitling the District to terminate the Contract or, alternatively, issue a Stop Work order until the Superintendent is on the Project site. If, by virtue of issuance of said stop order notice, Contractor fails to complete the Contract on time, it will be assessed liquidated damages in accordance with this. No extension of this to the Contract will be allowed as a result of the stoppage of work as a result of the absence of a Superintendent.
      b. Superintendent approved for this Project shall be able to read, write and verbally communicate fluently in English.

B. Storage of Materials and Equipment:
   1. All materials and equipment to be incorporated in the work shall be placed so as not to cause any damage to any part of the Work or to any existing facilities and so that free and safe access can be had at all times to all parts of the Campus and environs and to all public utility installations in the vicinity of the Work.
   2. Material and equipment storage shall be only as provided for in the Contract Documents and/or only as approved in writing (by the District) and in advance of placement. Material or equipment stored at other than pre approved and pre-designated areas may be removed by the District and at no liability to the District if the Contractor is notified of an improper storage situation or improper placement (and if no action has been taken by the Contractor within 2 days after notification). Fees incurred by the District for removal of the equipment or material shall be back-billed to the Contractor.

C. Safety:
   1. The Contractor shall take all necessary precautions and provide all necessary safeguards to prevent personal injury and to prevent property damage.
   2. The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This responsible safety officer shall have the authority to take immediate action to correct unsafe or hazardous conditions and to enforce safety precautions and programs. This responsible person shall have a cellular telephone on his or her person at all times.

D. Owner Access to Contractor and crews:
   1. In order to facilitate open and rapid communications between the District and the Contractor (and subsequent response to issues regarding safety, interference, unexpected field conditions, field changes and field clarification) Contractor's key and responsible personnel (supervisors, foremen and managers) shall have a cellular phone and/or an active and available 2-way radio on their person at all times. This requirement applies to:
      a. The Contractor's superintendent - cellular phone
      b. Each foreman on each active crew - cellular phone or active 2-way radio in constant communication with the superintendent's trailer and the superintendent.

E. Utilities Services: Each and every existing utility service must be maintained on the Campus at all times. No interruption of any utility or service is allowed without advance written approval as discussed in other sections of this document and as a part of the Work Plan process.

1.04 NO SMOKING

A. The District has adopted a no-smoking provision in all Campus buildings. The Contractor, his forces and his employees will observe this requirement while performing work in and around

DSA Re-submittal 6/21/2012

01 14 00 - 2 WORK RESTRICTIONS
District buildings. Smoking shall not be permitted except in Contractor designated smoking areas, away from Campus personnel, and as approved in advance by the District.

1.05 WORK BY OTHERS

A. Coordinate the work for this Contract with other construction operations as directed by the District. This includes the scheduling of traffic and use of roadways.

B. The District has awarded (or will award) other contracts which will be under construction in full or in part during construction of this project. The Contractor shall coordinate his/her work with the District in order to identify any and all interface or interference issues. These “other” contracts include, but are not limited to, the following:
   1. Library (Building L) Renovation
   2. Library Utilities Extension - Phase I (Note: Phase I project is scheduled to be complete prior to start of this project. Further note, Phase I project will provide underground electrical survey for use and reference on this project - area near future science, and cooling tower area near Building F).
   3. New Science Building

C. Contractor’s Superintendent shall attend a monthly coordination meeting. This meeting is separate from the normal project/progress meetings, and is for the express purpose of assisting the Contractor in meeting his responsibilities with respect to coordination of his Work with the other independent, concurrent construction contracts which will be underway on campus including, but not limited to, the projects listed herein. The Contractor is required to bring a current Work Plan and CPM schedule to the meeting to aid the discussion.

1.06 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed (temporary or permanent) and from demolition of equipment, systems, buildings or structures, or parts thereof, shall be disposed of as follows:
   1. Reserved items or items to be reused and/or relocated and/or which are to remain the property of the District are noted in the contract documents or will be identified by Facilities or the Engineer and shall be clearly marked, by the Contractor, as items to be reused and/or retained.
   2. Items which remain the property of the District shall be removed or dislodged from present locations in such a manner as to prevent damage and shall be stored in a local area as designated by the District.
   3. In the event that damage to the equipment or property occurs during the Work, Contractor shall notify the District immediately and shall upon approval of the repair procedure by the District, shall commence repair at his/her own cost so as not to affect the Work schedule.
   4. Items or materials not retained by the District shall become the property of the Contractor and shall be removed by the Contractor from the Campus and shall be disposed of by the Contractor at Contractors expense (or recycled as appropriate). Disposal or recycling shall be in compliance with local, State and Federal laws. Once the item or material is removed from its existing location it becomes the sole property (and liability) of the Contractor.

1.07 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the Work or work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall remove trees which are absolutely an obstruction for installation of the new work, only with prior, written authorization by the District (unless specifically shown to be removed on the Contract Drawings).

B. Avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a
tree-painting compound as approved by the District. In the event that trees or foliage are damaged beyond repair due to careless operation or improper activity, the Contractor shall be responsible to replace the lost item(s) with equivalent trees or foliage as approved by the District.

C. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work.

D. If the Contractor fails or refuses to repair the damage promptly, the District may have the necessary repair or replacement work performed and charge the cost to the Contractor.

1.08 STOP WORK

A. The District shall have the right, at any time, to stop any or all of the Contractor's work by written notification to the Contractor by the District's Construction Manager or by the District's Project Manager. Such notification does not relieve the Contractor of other contract requirements, such as maintenance of the site, and does not modify specified milestones if not a critical path activity. Upon receipt of a notice to Stop Work, the Contractor shall immediately and in a safe manner halt the associated work and, as directed by the District, clean up and stabilize the work by fencing, backfilling, or other action deemed appropriate by the District.

1.09 USE OF ELEVATORS

A. Unless otherwise approved in writing, only freight elevators shall be used for material moving. Use of elevators which are not specifically defined or designated as freight elevators must be approved in advance and in writing by the District. Contractor shall assume that there is at least one elevator in each building (containing three floors or more), but that this elevator is not necessarily a freight elevator.

B. It shall be the sole responsibility of the Contractor to prepare the elevator to accommodate any and all material moving so as to protect elevator(s) from damage. By use of the elevator, Contractor accepts full responsibility for repair of any and all damage or breakage that occurs during the time of material transfer. If the Contractor fails or refuses to repair the damage promptly, the District may have the necessary work performed and charge the cost to the Contractor.

C. Contractor shall make every effort to accommodate and allow access to handicapped persons for use of elevator when needed. To this end, at least one (1) elevator in the building must be operable at all times during construction to provide access for disabled persons.

D. Whenever the contractor uses an elevator which requires that student(s) or member(s) of the general public share the elevator (i.e., in the event that the contractor's means and methods require joint use of the elevator with the general public), Contractor shall name the general public as additionally insured.

1.10 SYSTEMS STARTUP, INTERRUPTION OR SHUTDOWN

A. Systems critical to building safety or security (such as fire protection system(s), and building security systems) which are required to be interrupted, altered, relocated or temporarily shut down as a result of any of this Work shall only be shut down upon advance notification to the District and upon implementation of a procedure approved by the District and which is in compliance to prevailing codes and standards (including but not limited to providing an NFPA Fire Watch when a Fire Protection System is interrupted or shut down, and providing fire sprinkler piping relocation in compliance with NFPA 13). Development of these procedures is the responsibility of the Contractor and these procedures shall be approved as part of the Work Plan process.
PART 2 PRODUCTS
2.01 NOT USED
PART 3 EXECUTION
3.01 NOT USED

END OF SECTION
SECTION 01 21 12
ALLOWANCES

PART 1 GENERAL
1.01 SECTION INCLUDES:
   A. Product/Installation Allowances
   B. Contract Sum Allowances
   C. Allowances for Specific Campus Situations

PART 2 PRODUCTS
2.01 PRODUCT/INSTALLATION ALLOWANCES
   A. This Section of the Specification sets forth the extent of Allowances described hereafter. Work performed under allowances shall conform fully to all applicable parts of these specifications and drawings.
      1. As shown on the bid form, Contractor shall include in the total amount, the base bid and all allowances stated in the Contract Documents.
      2. The Contractor shall cause the work/materials and critical path time covered by these allowances to be performed for such amounts and by such persons as the District may direct, but Contractor will not be required to employ persons against whom Contractor makes a reasonable objection. If the actual cost, when determined, is more than or less than the allowance, the contract sum shall be adjusted accordingly by Change Order.
      3. Cash allowances shall include complete work in place with all costs fully accounted for.
      4. Payment to the contractor shall be made as per normal payment procedures discussed in other portions of the Contract Documents.
      5. Payment to a District-designated third party shall be made by the Contractor as approved by the District. Contractor shall pay designated third party within 15 days of receipt of payment from the District.
      6. Funds unused in any allowance item will be credited to the contract by credit change order, and shall carry no contractor markup.

2.02 CONTRACT SUM ALLOWANCES
   A. The Allowances below correspond to the total allowance amounts defined on the Bid Form. In addition, each allowance item has applied to it a critical path duration that shall be included within the critical path schedule in anticipation of the Allowance activity (i.e. in order to accomplish the completion time as provided for in the Contract Documents, the critical path duration, below, shall be accommodated within the progress schedules defined elsewhere in these contract documents):
      1. Unforeseen Site Conditions:
         a. Cash Allowance:
            1) A cash allowance of $100,000 shall be available for the purpose of accommodating unforeseen site conditions.
         b. Critical Path Duration:
            1) Add 10 calendar days of critical path time.
      2. Unforeseen Hazardous Material Abatement:
         a. Cash Allowance:
            1) A cash allowance of $10,000 shall be available for proper handling of asbestos, lead, PCB or other hazardous materials which are not defined as part of the bid documents. This allowance is for work over and above that already defined in the Contract Documents.
         b. Critical Path Duration:
            1) Add 5 calendar days of critical path time.
      3. Facilities Services:
         a. Cash Allowance:
1) A cash allowance of $5,000 shall be available for time applied by the District's trades (i.e. in the Facilities Department) in support of the Contractor or contractors construction activities.

b. Critical Path Duration:
   1) Add 0 calendar days of critical path time.

2.03 ALLOWANCES FOR SPECIFIC FACILITY SITUATIONS

A. Excavation work interference with irrigation piping:
   1. The Contractor shall assume in the base bid, that during the course of excavation, irrigation piping will be accidentally cut or in some way broken. This base bid allowance shall include all material and labor to repair the irrigation piping in 1 break per 10 feet of trench separate locations including:
      a. capping, cutting and replacement of damaged irrigation pipe
      b. repair of control wiring
      c. repair and replacement of control valves
      d. pumping of excess water or any pooled water into the nearest storm drain
      e. immediate notification to the District of the irrigation piping incident
   2. Active irrigation piping must be capped immediately upon line breakage and the District must be notified immediately.
   3. Inactive irrigation piping must be capped immediately and the District shall be notified immediately.
   4. In the event that water is allowed to flow unchecked from a broken or ruptured line for greater than 15 minutes, the District shall have the right to have the line repaired and the Contractor shall be billed for the repair work (i.e. against the base bid contract amount).
   5. This allowance item has been identified in order to accommodate the inevitable breakage of irrigation piping and related wiring, valves and controls. It is believed that the 1 break per 10 feet of trench incidents are realistic for a facility of this size and type. If Contractor anticipates a request for payment for breakage associated with more than the number of incidents listed above, Contractor shall keep continuous count, on a formal log, and document on a pre-approved form, all of the incidents which have occurred and been repaired by the Contractor.

PART 3 EXECUTION

3.01 UNDERGROUND PIPING - UNIT PRICING

A. Existing soil is unusually rocky, that is a known condition of the site. The quantities listed on the Bid Form assume that large rocks/boulders up to three feet (3') in approximate diameter will be encountered for every ten feet (10') of lineal trench. Base bid shall include the unit cost for boulder removal, off hauling and removal from site, as well as subsequent backfilling with suitable clean fill. Contractor shall maintain a cumulative log of rock removal satisfying these requirements to perform unit price adjustments. Final payment shall be made in accordance with this Allowance and the Unit Prices and procedures as set forth in Section 01 22 00, and in accordance with the General Conditions.

END OF SECTION
SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.
B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit. This includes both excavation and backfill associated with removed rock as defined as unforeseen conditions in Section 01 21 12, Allowances.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

A. Take all measurements and compute quantities. Measurements and quantities will be verified by District.
B. Assist by providing necessary equipment, workers, and survey personnel as required.
C. Measurement Devices:
   1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
   3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.
D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
E. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
F. Contractor’s Engineer Responsibilities: Sign surveyor’s field notes or keep duplicate field notes, calculate and certify quantities for payment purposes. Maintain current, cumulative record of quantities removed, reviewed by Owner’s Representative. Final payment for rock removal will be adjusted by additive or deductive change order based on the actual quantities of rock removed as described in Section 01 21 12 Allowances.

1.05 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Engineer, multiplied by the unit price. Contract price will be modified by deductive or additive change order to account for actual Work versus Bid Form quantities.
B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products remaining on hand after completion of the Work.
   4. Loading, hauling, and disposing of rejected Products.
1.06 SCHEDULE OF UNIT PRICES
A. Item: Rock; Provide units pricing by volume in $/CY (Cubic Yards). Provide Unit Price (and extension) on Bid Form.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Description of alternates.

1.02 DESCRIPTION OF ADDITIVE ALTERNATES
   A. Additive Alternates shall be quoted as provided on the Bid Form. Additive Alternates listed
      thereafter refer to all materials installed and completely in place in accordance with all applicable
      portions of the Plans, Specifications and Contract Documents and include all costs connected
      with such items including, but not necessarily limited to, material, labor, overhead and profit for
      Contractor and/or Subcontractor.
   B. Section 1.03, below provides a listing of the specific Additive Alternates and of drawings (or
      specs) where the Additive Alternates are identified. Drawing and Specification sections
      identified below are for the convenience of the Contractor and do not necessarily indicate each
      and every location in the Contract Drawings and specifications which would fully describe the
      particular additive alternate.
   C. Drawings were not marked to identify and/or summarize Additive Alternates. Contractor shall
      study all of the drawings and Contract Documents and ensure that the overall scope, and
      Contractor's subsequent bid for each Additive Alternative, shall comply with all requirements of
      all of the Contract Documents.

1.03 LISTING OF ADDITIVE ALTERNATES
   A. The overall project will have a total of 2 additive alternates as indicated below:
      1. Install Shotcrete concrete Cooling Tower enclosure in lieu of chainlink fence enclosure.
      2. Provide, install, pipe, power, control and make operational chiller CH-3 as shown on
         drawings.
   B. Contractor shall study all of the drawings and Contract Documents and ensure that the overall
      scope, and Contractor's subsequent bid for each Additive Alternative, shall comply with all
      requirements of all of the Contract Documents.

1.04 SELECTION OF ADDITIVE ALTERNATES
   A. Additive Alternates will be taken in the order listed until all funds are exhausted. Bids will be
      evaluated based on the Base Bid, and increased by additive alternates until either all alternates
      are taken, or the highest number of additive alternates may be selected with the available
      funding.

1.05 ACCEPTANCE OF ALTERNATES
   A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at District's option.
      Accepted alternates will be identified in the Owner-Contractor Agreement.
   B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preconstruction meeting.
B. Site mobilization meeting.
C. Progress meetings.
D. Construction progress schedule.
E. Submittals for review, information, and project closeout.
F. Number of copies of submittals.
G. Submittal procedures.

1.02 PROJECT COORDINATION
A. Project Coordinator: Construction Manager.
B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for vehicular access, traffic, and parking facilities.
C. During construction, coordinate use of site and facilities through the Project Coordinator.
D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
G. Make the following types of submittals to Engineer through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING
A. District will schedule a meeting after Notice of Award.
B. Attendance Required:
   1. District.
   2. Engineer.
   3. Contractor.
C. Agenda:
   1. Execution of District-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Engineer, District, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. District will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. District.
   3. Engineer.
   4. Contractor's Superintendent.
   5. Major Subcontractors.

C. Agenda:
   1. Use of premises by District and Contractor.
   2. District's requirements and occupancy prior to completion.
   3. Construction facilities and controls provided by District.
   4. Temporary utilities provided by District.
   5. Survey and utility layout.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, District, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, District, participants, and those affected by decisions made.
3.04 CONSTRUCTION PROGRESS SCHEDULE
A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
C. Samples will be reviewed only for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - CLOSEOUT SUBMITTALS.

3.06 SUBMITTALS FOR INFORMATION
A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.
B. Submit for Engineer's knowledge as contract administrator or for District. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT
A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. As-Built Drawings.
   6. Other types as indicated.
B. Submit for District's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS
A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Engineer.
   2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Engineer.

DSA Re-submittal 6/21/2012
01 30 00 - 3
ADMINISTRATIVE REQUIREMENTS
B. Documents for Information: Submit two copies.
C. Extra Copies at Project Closeout: See Section 01 78 00.
D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES
A. Transmit each submittal with approved form.
B. Sequentially number the transmittal form. Revised submittals shall be indicated with original number and a sequential alphabetic suffix.
C. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate on each copy.
D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
E. Contractor shall verify both the field dimensions and the drawing layouts prior to submitting products for review to verify that installation is properly coordinated. It is the contractor's responsibility to submit products that are appropriate for the actual field conditions.
F. Deliver submittals to Engineer at business address.
G. Schedule submittals to expedite the Project, and coordinate submission of related items.
H. For each submittal for review, allow 15 calendar days excluding delivery time to and from the Contractor.
I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
J. Provide space for Contractor and Engineer review stamps.
K. When revised for resubmission, identify all changes made since previous submission.
L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
M. Submittals not requested will not be recognized or processed.
N. Engineer's review will result in the return of the submittal with one of the following marks:
   1. "No Exceptions - materials may be provided as described in the submittal.
   2. "Exceptions Noted, Resubmittal Not Required" - materials may be provided as described in the submittal, in accordance with comments or notes or additional requirements noted by the reviewer.
   3. "Not Acceptable" - Materials are unacceptable and shall not be provided.
   4. "Exceptions Noted, Resubmit" - Requires that the submittal be modified, according to requirements noted, and resubmitted.
O. Materials or equipment shall not be delivered to the jobsite without first obtaining a submittal which has the "No Exceptions" or "Exceptions Noted, Resubmittal Not Required" stamp mark.

END OF SECTION
 SECTION 01 30 55
SAMPLE FORMS

PART 1 GENERAL
1.01 SECTION INCLUDES:
   A. This section includes sample forms to be used during execution of this Contract.

1.02 FORMS INCLUDED:
   A. Substitution Request
   B. Access Request

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
# TABLE OF CONTENTS

**DIVISION 01 - GENERAL REQUIREMENTS**

- 01 10 00 SUMMARY
- 01 13 00 PROJECT COORDINATION
- 01 14 00 WORK RESTRICTIONS
- 01 21 12 ALLOWANCES
- 01 22 00 UNIT PRICES
- 01 23 00 ALTERNATES
- 01 30 00 ADMINISTRATIVE REQUIREMENTS
- 01 30 55 SAMPLE FORMS
- 01 40 00 QUALITY REQUIREMENTS
- 01 50 00 TEMPORARY FACILITIES AND CONTROLS
- 01 60 00 PRODUCT REQUIREMENTS
- 01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS
- 01 78 00 CLOSEOUT SUBMITTALS
- 01 79 00 DEMONSTRATION AND TRAINING

**DIVISION 05 - METALS**

- 05 51 00 METAL STAIRS
- 05 52 13 PIPE AND TUBE RAILINGS

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

- 07 46 46 FIBER CEMENT SIDING
- 07 90 05 JOINT SEALERS

**DIVISION 08 - OPENINGS**

- 08 11 13 HOLLOW METAL DOORS AND FRAMES
- 08 33 23 OVERHEAD COILING DOORS
- 08 71 00 DOOR HARDWARE
- 08 91 00 LOUVERS

**DIVISION 09 - FINISHES**

- 09 21 16 GYPSUM BOARD ASSEMBLIES
- 09 90 00 PAINTING AND COATING

**DIVISION 10 - SPECIALTIES**

- 10 14 00 SIGNAGE
- 10 44 00 FIRE PROTECTION SPECIALTIES

**DIVISION 22 - PLUMBING**

- 22 10 05 PLUMBING PIPING
- 22 10 06 PLUMBING PIPING SPECIALTIES

**DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)**
23 05 19 METERS AND GAGES FOR HVAC PIPING
23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 19 HVAC PIPING INSULATION
23 08 00 COMMISSIONING OF HVAC
23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
23 09 30 ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS
23 21 13 HYDRONIC PIPING
23 21 14 HYDRONIC SPECIALTIES
23 21 23 HYDRONIC PUMPS
23 25 00 HVAC WATER TREATMENT
23 31 00 HVAC DUCTS AND CASINGS
23 34 23 HVAC POWER VENTILATORS
23 64 16 CENTRIFUGAL WATER CHILLERS
23 65 13 INDUCED DRAFT COOLING TOWERS

DIVISION 26 - ELECTRICAL

26 05 01 MINOR ELECTRICAL DEMOLITION
26 05 10 ELECTRICAL GENERAL PROVISIONS
26 05 12 BASIC MATERIAL AND METHODS
26 05 13 MEDIUM-VOLTAGE CABLE
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 73 POWER SYSTEM STUDY
26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS
26 08 02 ELECTRICAL ACCEPTANCE TESTING
26 11 16 SECONDARY UNIT SUBSTATIONS
26 13 21 AIR INTERRUPTER SWITCHES
26 24 13 SWITCHBOARDS
26 24 16 PANELBOARDS
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 35 10 REFRIGERANT MONITORING SYSTEM

DIVISION 31 - EARTHWORK

31 23 16.13 TRENCHING
31 23 16.26 ROCK REMOVAL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING
32 13 13 CONCRETE PAVING
32 31 13 CHAIN LINK FENCES AND GATES

DIVISION 33 - UTILITIES

33 05 13 MANHOLES
33 61 13 UNDERGROUND HYDRONIC ENERGY DISTRIBUTION
33 71 19 ELECTRICAL UNDERGROUND DUCTS AND MANHOLES
PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.
B. Control of installation.
C. Tolerances.
D. Testing services.
E. Manufacturers' field services.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
B. Test Reports: After each test/inspection, promptly submit two copies of report to Engineer and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Engineer, provide interpretation of results.
   2. Test report submittals are for Engineer's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for District's information.
C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Engineer, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.
D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the District's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
E. Manufacturer's Field Reports: Submit reports for Engineer's benefit as contract administrator or for District.

DSA Re-submittal 6/21/2012

01 40 00 - 1
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. District will employ and pay for services of an independent testing agency to perform other specified testing.

B. As indicated in individual specification sections, District or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Laboratory: Authorized to operate in the State in which the Project is located.
   2. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

DSA Re-submittal 6/21/2012

QUALITY REQUIREMENTS
3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests and inspections required by Engineer.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlange on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS’ FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct an appropriate remedy or adjust payment.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Project identification sign.

1.02 TEMPORARY UTILITIES

A. District will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.
B. New permanent facilities may be used.
C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Email: Account/address reserved for project use.
   3. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
E. Gates in barriers shall be maintained in the closed position when not in use. Provide signs on all gates stating: "NOTICE - GATES MUST BE CLOSED AFTER ENTRY OR EXIT."
F. Shield all welding operations from public view with solid barrier.
G. Protective barricades, fencing, handrails and bridges, together with warning and guidance devices and signs, must be utilized so that passageway for pedestrians, especially blind and other physically disabled persons, is safe and well defined.
H. Walkways in construction areas shall be maintained at least 4 feet in width or equal to sidewalk/entry way width, whichever is greater, unless expressly permitted otherwise by the district in writing; and shall be free of abrupt changes in the grade. These walkways shall be clearly marked and shall provide safe passage for pedestrians (i.e. free from potential danger from construction activities). Obstructions within the walkways shall be illuminated during hours of darkness. Minimum vertical clearance to any obstruction within the walkway shall be seven feet.

I. Where walks, pathways or accessways are closed by the Work, an ADA compliant, alternate walkway shall be provided, preferably within the immediate location of the pathway or access to be closed. Where it is necessary to divert pedestrians into a major detour and/or into a parking lane or traffic area, at no time shall pedestrians be diverted into a portion of a street used for vehicular traffic. Any deviation from the above must have prior approval of the District.

J. At locations where adjacent alternate walkways cannot be provided (i.e. where no pathway or access is available within the immediate location of the interruption) ADA compliant detours shall be clearly planned, marked and constructed. Appropriate signs and barricades must be installed at the limits of construction and in advance of the closure (or detour) in order to divert pedestrians to the appropriate walkway or detour.

K. Wherever it is necessary that trenches and excavation be bridged, bridges shall be constructed in an ADA compliant manner. These bridges shall permit unobstructed flow of traffic or pedestrians and shall meet the following criteria:
   1. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts or other devices.
   2. Bridging shall be installed to operate with minimum noise.
   3. The trench shall be adequately shored to support the bridging and traffic.
   4. Only steel plates shall be used for bridging. Steel plates used for bridging shall extend one foot (minimum) beyond the edges of the trench. The steel plates shall be beveled in order to provide smooth and uninterrupted wheelchair and other access. Temporary paving materials may be used in conjunction with the beveled steel plates. Provide handrails.

L. Remove barriers and enclosures only after acceptance of that portion of the Work.

1.06 FENCING
   A. Construction: Commercial grade chain link fence.
   B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES
   A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY
   A. Provide security and facilities to protect Work, existing facilities, and District's operations from unauthorized entry, vandalism, or theft.
   B. Security of Construction areas, including, but not limited to, work in place, work in storage; Contractor's equipment and tools shall be the sole responsibility of the Contractor.
   C. Coordinate with District's security program.

1.09 VEHICULAR ACCESS AND PARKING
   A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
   B. Coordinate access and haul routes with governing authorities and District.
   C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Existing on-site roads may be used for construction traffic.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL
A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION
A. Provide project identification sign of design, construction, and location approved by District.
B. No other signs are allowed without District permission except those required by law.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations and procedures.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.
D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.
B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC’s or HCFC’s.
C. Provide interchangeable components of the same manufacture for components being replaced.
D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. A Substitution is a change from one product or material to another of equal or like value, quality, features, appearance or durability. The burden of proof is on the submitter and the determination of equality rests solely with the District’s Representative and District. In general, substitutions will be considered and indicated in the “Conditions” or when the cost differential and benefit is favorable to the District without affecting the final results of the Project. All "Requests for Substitutions" must be accompanied by a completed request form.

B. Within a period of fifteen (15) calendar days after award of Contract, the District’s Representative will consider formal requests from the Contractor for substitution of products in place of those specified.

C. After the end of that period, requests will be considered only in case of product unavailability or other conditions beyond the control of Contractor.

D. Product unavailability shall be verified in writing by manufacturer.

E. A request for substitution constitutes a representation that the submitter:

   1. Has investigated proposed product and determined that it is equal or better than the specified product in all aspects.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the District.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse District’s Representative for review or redesign services associated with approval and re-approval by authorities.

F. Submit separate Requests for each substitution with requirements stated in Contract Documents:

   1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
      a. Product identification, including manufacturer's name and address.
      b. Manufacturer's literature identifying:
         1) Product's description.
         2) Reference Standards.
         3) Performance and test data.
         4) Samples: as applicable.
         5) Name and address of similar projects on which product has been used, and date of each installation.
   2. Itemized comparison of the proposed substitution with product specified; list significant variations. Provide tabbed and marked manufacturer's data for specified product and the substitution for documentation.
   3. Data relating to changes in Construction Schedule.
   4. Any effect of substitution on separate Contracts.
   5. List of changes required in other work or products.
   6. Detailed cost data comparing proposed substitution with product specified.
7. Designation of availability of required license fees or royalties.

G. Substitutions will not be considered for acceptance when:
   1. They are indicated or implied on Shop Drawings or product data submittals without a
      formal request from Contractor.
   2. They are requested directly by a Subcontractor.
   3. Acceptance will require substantial revision of Contract Documents.
   4. Insufficient information is available.

H. Products and materials described on the Drawings and in these Specifications are known to be
   available at the time of bidding. Failure on the part of the Contractor to procure, receive and
   store such products and materials will not be considered as a basis for substitution or an
   increase in the Contract Price.

I. Should the Contractor fail to furnish specified products or materials in a timely manner and such
   products or materials are no longer available, the Contractor shall furnish such substitution as
   determined by the District's Representative to be equal to the original Specification at no
   additional cost to the District.

J. The District shall assume no responsibility for failure on the part of the Contractor to provide the
   specified products or materials.

K. Substitute products shall not be ordered or installed without prior written review by the District's
   Representative.

L. District's Representative shall determine acceptability of proposed substitutions and reserves
   the right to reject proposals due to insufficient information or to reject proposals, if, in the
   District's Representative's judgment, the proposed substitution does not meet the aesthetic
   criteria of the specified materials.

M. Compensation: Contractor shall reimburse District for compensation paid to the District's
   Representative for evaluation of substitution proposals made during construction, whether or
   not substitution is accepted by District.

3.02 TRANSPORTATION AND HANDLING
   A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site
      storage time and potential damage to stored materials.
   B. Transport and handle products in accordance with manufacturer's instructions.
   C. Transport materials in covered trucks to prevent contamination of product and littering of
      surrounding areas.
   D. Promptly inspect shipments to ensure that products comply with requirements, quantities are
      correct, and products are undamaged.
   E. Provide equipment and personnel to handle products by methods to prevent soiling,
      disfigurement, or damage.
   F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION
   A. Designate receiving/storage areas for incoming products so that they are delivered according to
      installation schedule and placed convenient to work area in order to minimize waste due to
      excessive materials handling and misapplication.
   B. Store and protect products in accordance with manufacturers' instructions.
   C. Store with seals and labels intact and legible.
   D. Store sensitive products in weather tight, climate controlled, enclosures in an environment
      favorable to product.
   E. For exterior storage of fabricated products, place on sloped supports above ground.
   F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to
      prevent condensation and degradation of products.
G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Prevent contact with material that may cause corrosion, discoloration, or staining.

I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Cutting and patching.
D. Surveying for laying out the work.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Demonstration and instruction of District personnel.
H. Closeout procedures, except payment procedures.
I. General requirements for maintenance service.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Efficiency, maintenance, or safety of any operational element.
   4. Work of District or separate Contractor.
   5. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of District or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.
C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS
A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by District.

DSA Re-submittal 6/21/2012
F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
   2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

H. Pest Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work or invading the premises.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

K. Moisture Control: Provide methods, means, and facilities to prevent moisture from entering the building.

1.05 COORDINATION
A. See Section 01 10 00 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After District occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of District's activities.

PART 2 PRODUCTS
2.01 PATCHING MATERIALS
A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION
A. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.
B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.
C. Remove debris and abandoned items from area and from concealed spaces.
D. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.
E. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.
F. Clean substrate surfaces prior to applying next material or substance.
G. Seal cracks or openings of substrate prior to applying next material or substance.
H. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK
A. Promptly notify Engineer of any discrepancies discovered.
B. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
C. Periodically verify layouts by same means.

3.04 GENERAL INSTALLATION REQUIREMENTS
A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
F. Make neat transitions between different surfaces, maintaining texture and appearance.
3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 01 10 00 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   3. Verify that abandoned services serve only abandoned facilities.
   4. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

H. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

I. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

DSA Re-submittal 6/21/2012
J. Refinish existing surfaces as indicated:
K. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
L. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
M. Clean existing systems and equipment.
N. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
O. Do not begin new construction in alterations areas before demolition is complete.
P. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING
A. Whenever possible, execute the work by methods that avoid cutting or patching.
B. See Alterations article above for additional requirements.
C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.
D. Execute cutting and patching including excavation and fill to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
F. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
H. Restore work with new products in accordance with requirements of Contract Documents.
I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
K. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
L. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to patching finish. Finish patches to produce

DSA Re-submittal 6/21/2012
3.07 PROGRESS CLEANING
A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK
A. Protect installed work from damage by construction operations.
B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
F. Prohibit traffic from landscaped areas.
G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP
A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Engineer and owner seven days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION
A. See Section 01 79 00 - Demonstration and Training.
B. Demonstrate operation and maintenance of products to District's personnel two weeks prior to date of Substantial Completion.
C. Perform instruction in a classroom environment located at at the Campus.
D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with District's personnel in detail to explain all aspects of operation and maintenance.
E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING
A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93.

3.12 FINAL CLEANING
A. Execute final cleaning after Substantial Completion but before making final application for payment.
   1. Clean areas to be occupied by District prior to final completion before District occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Replace filters of operating equipment.
F. Clean site; sweep paved areas, rake clean landscaped surfaces.
G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
H. Clean District-occupied areas of work.

3.13 CLOSEOUT PROCEDURES
A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer and District.
B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
C. Notify Engineer when work is considered ready for Substantial Completion.
D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer's review.
E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to District-occupied areas.
F. Accompany Project Coordinator on preliminary final inspection.
G. Notify Engineer when work is considered finally complete.
H. Complete items of work determined by Engineer's final inspection.
I. The Engineer will make only two (2) inspections to determine substantial completion. If these inspections determine that the work is not substantially complete, either because of major items not completed or an excessive number of punchlist items, successive inspections requested by the Contractor shall be charged to the Contractor at a rate of $400.00 per person per half day.

3.14 MAINTENANCE
A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the District.

END OF SECTION
SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.
D. As-Built Drawings

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by District, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with District's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. As-Built Drawings:
   1. Submit two compact disks with electronic as-built drawings in AutoCad 2008 or newer. Include all pen settings.
   2. Submit two opaque copies and one reproducible original of drawings to Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling future reference by District.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.


D. Additional information as specified in individual product specification sections.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.
H. Include sequence of operation by controls manufacturer.
I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide control diagrams by controls manufacturer as installed.
K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
M. Include test and balancing reports.
N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
B. Prepare data in the form of an instructional manual.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with District's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

DSA Re-submittal 6/21/2012
01 78 00 - 3
CLOSEOUT SUBMITTALS
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
F. Cover: Identify each binder with typed or printed title Warranties And Bonds, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 AS BUILT DRAWINGS
A. Prepare as-built drawings utilizing AutoCad 2008 or later. Use nationally recognized drawing standards, including layer management and organization.
B. Engineer will provide original design drawing files for starting point of as-builts.
C. Drawings shall indicate actual installed location, elevation, orientation, size and features of all equipment and materials installed under this contract.
D. Revise all sheets from the design drawings as required to reflect actual construction. This includes but is not limited to all diagrams, panel schedules, equipment schedules, controls points lists, floor plans, elevations, profiles and sequences.
E. As Built drawings for underground utilities shall include showing and marking of all utilities crossed, whether shown on Contract Drawings or not. Information for existing utilities shall include utility type, size, depth or elevation, and station number or location to permanent, fixed above grade features.

END OF SECTION
SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of District personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Contractor's Commissioning Authority.
   2. Submit one copy to the Contractor's Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Contractor's Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Contractor's Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: District will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Contractor's Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training, include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such as slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by District.

B. Demonstrations conducted during Functional Testing need not be repeated unless District personnel training is specified.

C. Demonstration may be combined with District personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventative maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Contractor's Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. District will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the District.

E. Provide training in minimum two hour segments.

F. The District or District's Representative is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of District's personnel to be trained; re-schedule training sessions as required by District; once schedule has been approved by District failure to conduct sessions according to schedule will be cause for District to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventative maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION
SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Stairs with concrete treads.
B. Structural steel stair framing and supports.
C. Handrails and guards.

1.02 REFERENCE STANDARDS
F. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.
G. ASTM A600/A600M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.

1.03 SUBMITTALS
A. See Division 1 for submittal requirements.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.
C. Welders' Certificates.

1.04 QUALITY ASSURANCE
A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Unit Stair Towers:

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical
   and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other
   and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent
      requirements of local, state, and federal regulations including CBC 2010 Chapters 16A &
      17A; where requirements of the contract documents exceed those of regulations, comply
      with the contract documents.
   2. Dimensions: As indicated on drawings. Field verify all dimensions and floor elevations
      prior to shop drawing submittal and fabrication.
   3. Shop assemble components; disassemble into largest practical sections suitable for
      transport and access to site.
   4. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   5. Separate dissimilar metals using paint or permanent tape.

B. Metal Joining and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality
         gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with
   design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except
   where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to
      stringers.
   5. Concrete Reinforcement: None.
   6. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Depth: Not more than 1-1/2 inch overhang.
   3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as
   required to achieve design load capacity.

G. Railings: Steel pipe railings.
H. Finish: Galvanized after fabrication, except sheet components to be galvanized before fabrication.

2.04 HANDRAILS AND GUARDS
A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
   2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
      b. Material: Steel pipe or tube, round.
      c. Vertical Spacing: Maximum opening to be 4 inches.
      d. Jointing: Welded and ground smooth and flush.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.

2.05 MATERIALS
A. Steel Sections: ASTM A 36/A 36M.
B. Steel Tubing: ASTM A500 or ASTM A501 structural tubing, round and shapes as indicated.
C. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
D. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
E. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.
F. Concrete Reinforcement: Bar type as detailed, galvanized.
G. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
H. Steel Bolts, Nuts, and Washers: galvanized to ASTM A 153/A 153M where connecting galvanized components.
I. Welding Materials: AWS D1.1; type required for materials being welded.
J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING
A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
B. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. When field welding is required, clean and strip primed steel items to bare metal.
B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION
A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on shop drawings. Perform field welding in accordance with AWS D1.1.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION
SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wall mounted handrails.
B. Stair railings and guardrails.
C. Free-standing railings at steps.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Handrails and Railings:
   3. Substitutions: See Division 1 for requirements and procedures.

2.02 RAILINGS - GENERAL REQUIREMENTS
A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code including section 1704A.3 of CBC 2010.
B. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
C. Allow for expansion and contraction of members and building movement without damage to connections or members.
D. Dimensions: See drawings for configurations and heights.
E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
   2. For anchorage to stud walls, provide backing plates, for bolting anchors.
F. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM
A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
B. Galvanizing: In accordance with requirements of ASTM A123/A123M.

DSA Re-submittal 6/21/2012

05 52 13 - 1
2.04 FABRICATION
   A. Accurately form components to suit specific project conditions and for proper connection to
      building structure.
   B. Fit and shop assemble components in largest practical sizes for delivery to site.
   C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to
      accommodate site assembly and installation.
   D. Welded Joints:
      1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic
         filler. Drill condensate drainage holes at bottom of members at locations that will not
         encourage water intrusion.
      2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic
         filler.
      3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints
         butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.
   B. Supply items required to be cast into concrete or embedded in masonry/concrete with setting
      templates, for installation as work of other sections.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight
      joints.
   C. Anchor railings securely to structure.
   D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds
      smooth.
   E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush
      countersunk fastenings.

3.04 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION
SECTION 07 46 46
FIBER CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wood-fiber cement siding.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.
B. Warranty: Submit copy of manufacturer's warranty, made out in District's name, showing that it
   has been registered with manufacturer.

PART 2 PRODUCTS

2.01 SIDING
A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high
   pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with
   machined edges, for screw attachment.
   1. Length (Height): 96 inches, nominal.
   2. Width: 48 inches.
   3. Thickness: 5/16 inch, nominal.
   5. Color: To match existing.
   6. Warranty: 50 year limited siding warranty; transferable. 15 year limited paint warranty.
   7. Panel Siding Manufacturers:

2.02 ACCESSORIES
A. Furring Strips: Galvanized metal channels.
B. Trim: EZ trim.
C. Fasteners: Double dip Galvanized or Stainless steel; length as required to penetrate minimum
   1-1/4 inch.
D. Sealant/Primer: FiberTect Sealant/Primer.
E. Sheet Metal Flashing: Minimum 26 gauge hot-dipped galvanized steel sheet, or coated
   aluminum.
F. Touch Up Kit: Provide CertainTeed Color Max touch-up kit for each color provided.
G. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by
   paint manufacturer.

PART 3 EXECUTION

3.01 PREPARATION
A. Examine substrate and clean and repair as required to eliminate conditions that would be
   detrimental to proper installation.
B. Do not begin until unacceptable conditions have been corrected.
C. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory
   preparation before proceeding.
3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with all terms necessary to maintain warranty coverage.
   2. Use trim details indicated on drawings.
   3. Touch up all field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. Over Steel Studs: Minimum 20 gauge steel, 3-5/8" C-studs. Use 1-5/8" long, #8-18 x 3/8" HD self-tapping, corrosion-resistant ribbed bugle head screws, with the points of at least 3 screws penetrating each stud the panel crosses and at panel ends.

C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

D. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

E. Before installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.

F. Finish Painting: Within one month after installation, paint siding and trim with one coat primer and two coats finish paint.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 07 90 05

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.
B. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.
C. Joints in vertical surfaces and horizontal surfaces as indicated below:
   1. Perimeter joints between materials listed above and frames of doors and glazed assemblies.
   2. Other joints as indicated and required to make the building weathertight.
   3. Pavement and sidewalk joints.
   4. Concrete construction joints.
   5. Floor joints (interior).
   6. Wall joints (exterior).
   7. Flashing and coping joints.
   8. Interior wall/ceiling joints.

D. Precompressed foam sealers.

E. Hollow gaskets.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics.
B. Samples: Submit two samples, illustrating sealant colors for selection.
C. Manufacturer’s Installation Instructions: Indicate special procedures.
D. Certified Tests: With product data submit certified test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low-temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposures to ozone and ultraviolet.

1.04 QUALITY ASSURANCE

A. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent bases, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

B. Sealants must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants must meet or exceed Bay Area Air Quality Management District Reg. 8, Rule 51.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
1.06 WARRANTY
A. Correct defective work within a five year period after Date of Substantial Completion.
B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Delivery: Deliver materials in the manufacturer's unopened containers bearing the manufacturer's mixing directions. Containers must be clearly marked with manufacturer's name, brand, type, color grade, and packaging date.
B. Storage: Store in accordance with manufacturer's instructions. Do not use sealant materials that have been stored for a period of time exceeding the maximum recommended shelf life of the materials.

1.08 JOB CONDITIONS
A. Weather: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are above or below the manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of the manufacturer's recommended installation temperature range so that sealant will not be subjected to excess elongation and bond stress at subsequent low temperatures. Notwithstanding any recommendations by the manufacturer to the contrary, do not install sealant if the ambient temperatures are below 40°F or over 80°F without written authorization from Architect.

PART 2 PRODUCTS
2.01 SEALANTS
A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
B. General Sealer Requirements: Provide colors indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures and except as otherwise indicated select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated. Where exposed to foot traffic, select nontracking materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system.
C. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: To be selected by Engineer from manufacturer's standard range.
   2. Product: Sikaflex manufactured by Sika Corp or approved equal.
   3. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.
D. Type 2 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Product: BR - 96 Curtain Wall Sealant manufactured by Pecora Corp or approved equal.
   2. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.
E. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
   a. Interior wall and ceiling control joints.
   b. Other interior joints for which no other type of sealant is indicated.

F. Type 4 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
   2. Product: Sikaflex - 1CSL manufactured by Sika Corp.
   3. Applications: Use for:
      a. Joints in sidewalks and vehicular paving.

G. Type 5 - Silicone Sealant: ASTM C920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: Match adjacent finished surfaces.
   2. Product: 786 manufactured by Dow Corning.
   3. Applications: Use for:
      a. Ceramic Tile.

H. Foam-Type Filler-Sealants:
   1. Fire-resistant Foam-in-place Filler (FR-Fm-F): Provide manufacturer's standard, 2-part, silicone-based, room-temperature-vulcanizing, foam elastomer, recommended by mfg for filling joints and other openings in construction work; with cured density of 15 or 20pcf, partially (50%) closed-cell structure, cohesive/tensile strength of 25 psi, 40% compression deflection of 10 psi, and flame-spread rating of 25 (ASTM E 84); tested and rated by UL for 3-hr. fire resistance for penetration seals (ASTM E 119).
   2. Preformed Compressible-Foam Sealants (CmpF-S): Provide manufacturer's standard open-cell, flexible foam strip of polyurethane or other weather-resistant foam, saturated with butylene or other non-drying liquid sealant/adhesive, to a formulation which will form a paintable watertight joint at 50% compression, without staining, migrating, hardening, or other performance failure.

2.02 ACCESSORIES
A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1867, closed cell PVC; oversized 30 to 50 percent larger than joint width. Shall be Approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
D. Sealant Backer Rod (S-BR): Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorbent material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION
3.01 EXAMINATION
A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
B. Verify that substrate surfaces are ready to receive work.
C. Verify that joint backing and release tapes are compatible with sealant.
3.02 PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealant or calking compound. Remove dirt, insecure coatings, moisture and other substances which could interfere with seal of gasket or bond of sealant or calking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

B. Remove loose materials and foreign matter that could impair adhesion of sealant.

C. Clean and prime joints in accordance with manufacturer's instructions.

D. Vacuum clean or remove loose particles by blowing oil-free compressed air in joints. Surfaces must be sound, clean, dry and free from oil or grease.

E. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

F. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

B. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

C. Perform installation in accordance with ASTM C1193.

D. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

E. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.

F. Install bond breaker tape where indicated and where required by manufacturer's recommendations to ensure that liquid-applied sealants will perform as intended.

G. Install bond breaker where joint backing is not used.

H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

I. Install liquid-applied sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead; (not applicable to sealants in lapped joints):
   1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.
   2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
   3. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in range of 75% to 125% of joint width.

J. Spillage: Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

K. Do not overheat or reheat hot-applied sealants; discard (do not use).

L. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will protrude from joints.
M. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings as indicated or as required.

N. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Install fire-resistant foamed-in-place filler in openings where indicated, and at thicknesses indicated. Dam bottom of vertical openings and one side of horizontal openings with temporary containment forms or, where required to achieve fire-resistance ratings, provide permanent mineral composition board forms. On horizontal penetrations, provide partial face containment forms where required for form placement. Allow installed fillers to cure 24 hours; remove temporary forms, trim ragged edges with sharp knife; inspect and fill voids with additional filler to form uniform thickness of filler.

P. Bond ends of gaskets together with adhesively or "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.

3.04 CLEANING
   A. Clean adjacent soiled surfaces.

3.05 CURING / PROTECTING
   A. Cure sealants in compliance with their manufacturer's printed instructions to obtain high early bond strength, internal cohesive strength and durability.

   B. Protect sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

   C. If, despite such protection, damage or deterioration occurs, cut-out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

3.06 PROTECTION
   A. Protect sealants until cured.

   B. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Steel doors and frames.
B. Fire-rated steel doors and frames.
C. Accessories, including glazing.

1.02 REFERENCE STANDARDS
G. BHMA A155.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
L. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

1.03 SUBMITTALS
A. See Division 1 for submittal procedures,
B. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
C. Shop Drawings: Submit for fabrication and installation of steel frames. Include details of each frame type, elevations of each type, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
   1. Provide schedule of frames using same reference numbers for details and openings as those on Contract Drawings.
   2. Indicate coordination of glazing frames and stops with glass and glazing requirements.
D. Identify work that cannot be permanently factory assembled before shipment.
E. Label Construction Certification: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, submit manufacturer's certification for that each frame has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.
F. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

G. Installation Instructions: Manufacturer’s published instructions, including any special installation instructions relating to this project.

H. Manufacturer’s Certificate: Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

C. Provide frames complying with Steel Door Institute “Recommended Specifications: Standard Steel Doors and Frames” (SDI - 100) and as herein specified.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated frames that comply with NFPA 80 “Standard for Fire Doors and Windows”, and have been tested, listed, and labeled in accordance with ASTM E 152 “Standard Methods of Fire Tests of Door Assemblies” by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

E. Provide fire-rated door and frame assemblies per current California Building Code and bearing the label of a testing agency acceptable to the DSA for the fire resistance indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Packing: Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

C. During delivery, provide temporary steel spreaders securely fastened to the bottom of each frame.

D. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

E. The storage spaces shall be dry and accessible, adequately ventilated and free from dust or water, and shall permit easy access for inspection and handling.

F. If doors are shipped with fiberboard wrapper and it becomes wet, remove it immediately.

G. Store frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non vented plastic or canvas shelters which could create humidity chamber.

H. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:

2.02 MATERIALS


B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized steel sheets: Commercial quality, Class 1, zinco-coated carbon steel sheets complying with ASTM A 526, with ASTM A 525, A 60 zinc coating, mill phosphatized.
D. Supports and Anchors: Fabricate of hot-dip galvanized if less than 16 gauge. Hot dip -
galvanize all items in exterior walls.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to
be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop Applied Primer: Rust-inhibitive enamel or paint, either air drying or baking, suitable as a
base for specified finish paints.

2.03 FINISH MATERIALS

A. Paints:
   1. Shop primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base
      for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance
      Criteria for Prime Painted Steel Surface for Steel Doors and Frames", and compatible with
      finish paint system specified in Section 09900.
   2. For touch-up of damaged galvanized surfaces: SSPC Paint No. 20, Type II (Organic),
      Tneme-Zinc 90-97 by Tnemec Co., MZ-4 by Valspar Corp., 308 Zinc-Lok by Porter
      International or Amercoat 68HS by Ameron Protective Coating Division.

B. Door filler: In compliance with SDI 100, except use UL listed materials in fire-rated doors.

2.04 FINISH

A. Shop priming: After assembly, clean steel surfaces of mill scale, rust, oil, grease, dirt, and other
   foreign materials before painting. Grind welds and fabrication marks flush and smooth with
   parent metal. Fill depressions with metal filler before applying the shop primer. Apply one or
   more coats or epoxy mineral filler to conceal spot welds.

B. Acid-etch galvanized surfaces before pretreating.

C. Apply shop primer, within time limits recommended by pretreatment manufacturer, to provide a
   smooth coat of even consistency and to produce a dry film thickness of not less than 1-1/2 mil.

D. Doors & frames with visible welds before or after application of finish paint will be unacceptable.

2.05 ACCESSORY MATERIALS

A. Louvers: Roll formed steel with overlapping frame; factory-painted finish, color as selected;
   factory-installed.

B. Removable Stops: Formed sheet steel, None - N/A mitered or butted corners; prepared for
   countersink style tamper proof screws.

C. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike
   jambs of single-swing frames and 2 silencers on heads of double-swing frames.

D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as
      indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in
      place, in addition to other requirements specified in door grade standard.
   7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated
      (galvannealed), manufacturer's standard coating thickness.
   8. Fabricate doors and frames at the following locations from galvanized steel; exterior walls,
      toilet rooms, locker rooms and shower rooms. Fabricate doors and frames at other
      locations from non-galvanized steel.
10. Do not begin fabrication until the hardware schedule approved by the Architect and submitted by the hardware supplier has been received by the fabricator.

B. Provide sound insulation filler of fiberboard, mineral-wool board, asbestos, or other approved noncombustible material solidly packed full door height to fill the voids between inner core reinforcing members.

C. Reinforce doors with rigid tubular frame where stiles and rails are less than 8" wide. Form tubular frame with 16 gage steel, welded to outer sheets.

2.07 STEEL DOORS

A. Hollow metal doors:

1. SDI Grade II, Model 2, seamless, (16 gage) for doors up to 3 ft. wide, and Grade III, Model 2, seamless. Close the top of outswinging exterior doors with an inverted flush channel.


3. Texture: Smooth faces

4. Finish: Factory primed, for field finishing.

5. Provide exterior doors with a U factor of 0.24 BTU/hr. x sq. ft. x deg. F when tested in compliance with ASTM C 236. Core: Polystyrene foam.

B. Exterior Doors:

1. Construct doors with smooth, flush surfaces without visible joints or seams or exposed faces or stile edges, except around glazed or louvered panel inserts. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.

2. Reinforce inside of doors with vertical galvanized sheet steel channel-shaped sections or interlocking z-shaped sections not less than 22 gage. Space vertical reinforcing 6" o.c. and extend full door heights. Spot-weld at not more than 6" o.c. to both face sheets.

3. Continuous truss-form inner core of 28 gage galvanized sheet steel reinforcing may be provided as inner reinforcement, in lieu of above. Spot-weld at not more than 3" o.c. vertically and horizontally over entire surface of both sides.

4. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to the outer sheets. Close top and bottom edges to provide weather seal, as integral part of door construction or by addition of inverted steel channels.

C. Interior Doors:

1. Fabricate interior doors of 2 outer cold-rolled, stretcher-leveled steel sheets not less than 18 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.

2. Reinforce inside of doors with vertical, hot-rolled, not less than 22 gage steel channel-shaped sections or interlocking z-shaped steel sections. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.

3. Continuous truss-form inner core of 28 gage sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.

4. Reinforce tops and bottoms of doors with 18 gage, horizontal steel channels, welded continuously to the outer sheets.

D. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with NFPA 252.

1. Rate of Temperature Rise Across Door Thickness: In accordance with code

2. Provide units listed and labeled by UL.

3. Core: Mineral fiberboard.

4. Attach fire rating label to each fire rated unit.

E. Vision panels in doors:

1. Make cutouts for vision panels square and parallel with door edges.

2. Provide integrally-formed glass stops on security side of doors and removable glass stops on opposite side.

   a. Size rabbet to fit glass thickness indicated.
b. Attach removable glass stops securely in place with countersunk oval head machine screws spaced equally at not more than 12 in. o.c. and 2 in. from corners.

2.08 STEEL FRAMES

A. General:
   1. Provide metal frames for doors of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16 gauge cold-rolled furniture steel.
      a. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame, unless otherwise indicated.
      b. Knock-down type frames are not acceptable.
      c. Fabricate steel frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer’s plant.
      d. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project Site. Comply with SDI-100 requirements.
      e. Fabricate work of this Section to required profiles by roll-forming, brake-forming and welding to produce hollow metal work with straight and square edges, with surfaces free from warp, wave, buckle, oil-canning and other defects.
      f. Conform to AWS standards for welding. Frames shall be face welded with exposed welds ground flush and smooth with parent metal.
      g. Except on weatherstripped frames, drill stops to receive 3 silencers on strike jams of single-door frames and 2 silencers on heads of double-door frames.

B. Where shown or scheduled, provide frame assemblies which have been fabricated as sound-reducing type, tested in accordance with ASTM E 90, and classified in accordance with ASTM E 413.
   1. Finish: Factory primed, for field finishing.
   2. Form frames of galvanized steel sheets for exterior, and either cold or hot-rolled sheet steel for interior.
      a. Gage: Not less than 14, for exterior openings up to and including 4'-0" wide.
      b. Gage: Not less than 16, for interior openings up to and including 4'-0" wide.
      c. For openings over 4'-0" wide, increase thickness by at least two standard gages.
   3. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

C. Exterior Door Frames: Face welded, seamless with joints filed.
   1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer’s standard coating thickness.
   2. Finish: Factory primed, for field finishing.

D. Mullions for Pairs of Doors: Fixed, of profile similar to jams.

E. Anchors:
   1. Jamb Anchors:
      a. Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gage galvanized steel.
      b. Masonry Construction: Adjustable, flat or corrugate or perforated, t-shaped to suit frame size with leg not less than 2" wide by 10" long. Furnish at least 3 anchors per jamb up to 7'-6" height; 4 anchors up to 8'-0" jamb height; one additional anchor for each 24" or fraction thereof over 8'-0" height.
      c. In-Place Concrete or Masonry: Anchor frame jams with minimum 3/8" concealed bolts into expansion shields or inserts at 6" from top and bottom and 26" o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.
   2. Floor Anchors:
      a. Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet, as follows:
b. Monolithic Concrete Slabs: Clip type anchors, with 2 holes to receive fasteners, welded to bottom of jambs and mullions.
c. Separate Topping Concrete Slabs: Adjustable type with extension clips, allowing not less than 2" height adjustment. Terminate bottom of frames at finish floor surface.

3. Head Anchors:
   a. Provide 2 anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.

F. Frame Accessories
   1. Removable Stops: Formed sheet steel, mitered or butted corners; prepared for countersink style tamper proof screws.
   2. Astragals for Double Doors: Specified in Section 08 71 00.
   3. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
   4. Temporary Frame Spreaders: Provide for all factory- or shop-assembled double frames.

2.09 FINISH HARDWARE PREPARATION

A. Prepare frames to receive to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
   1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastenings in top rail of doors or head of frames, as applicable.

B. Reinforce frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at Project Site.

C. Reinforce doors for required finish hardware, as follows:
   1. Hinges: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than 6 spot-welds.
   2. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than 2 spot-welds.
   3. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.
   4. Cylinder Locks: 12 gage steel sheet, secured with not less than 2 spot-welds.
   5. Flush Bolts: 12 gage steel sheet, secured with not less than 2 spot-welds.
   7. Concealed Closers: Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.
   8. Push Plates and Bars: 16 gage steel sheet, (except when through bolts are shown or specified), secured with not less than 2 spot-welds.
   9. Surface Panic Devices: 14 gage sheet steel (except when through bolts are shown or specified), secured with not less than 2 spot-welds.
   10. Automatic Door Bottoms: Reinforce for mortise-type units with 12 gage steel, and 16 gage for surface-applied units.

D. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with DSA/ADA requirements and "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Inspect adjacent construction and supports.
D. Make sure that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface, and that other conditions detrimental to the proper or timely completion of this work are corrected before proceeding with installation.

3.02 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
B. In addition, install fire rated units in accordance with NFPA 80.
C. General: Install standard steel frames and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
D. Coordinate frame anchor placement with wall construction.
E. Placing Frames: Comply provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
1. Provide a minimum of 2 anchors for head of double door frames.
2. Provide a minimum of 3 anchors per jamb for frame with doors under 81 in. high; provide one additional anchor for doors in frame over 81 in.
3. Attach jamb anchors to studs with a minimum of four 3/8 in. diameter self-tapping screws or bolts (2 per side).
F. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
G. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.
H. Provide UL tested adjustable floor clips for all frames. Anchor clips to floor with powder-driven pins or bolts in expansion shields.
I. Leave frame spreader bars intact, wherever possible, until frames are set perfectly square and plumb and all anchors are securely attached and grouted where required.
J. Placing Frames: Set frames accurately in position, plummed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
K. Coordinate installation of hardware.
L. Coordinate installation of glazing.
M. Touch up damaged factory finishes.

3.03 HANGING DOORS

A. Install finish hardware in compliance with its manufacturer's templates and printed instructions.
B. Hang doors in compliance with their manufacturer's instructions, and adjust to the clearances specified in SDI publication 100, paragraph 2.2.1, except where more stringent clearances are indicated on the Drawings or required by UL listing for fire-rated doors.
C. Fit hollow metal doors accurately in their respective frames, with the following clearances:
1. Jambs and Head: 3/32".
2. Meeting Edges, Pairs of Doors: 1/8".
3. Bottom: 3/8", where no threshold or carpet.
4. Bottom: at Threshold or Carpet: 1/8".
D. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
E. Do not install doors warped, bowed, dented or otherwise damaged.
F. Adjust hardware so that doors operate freely for their entire travel, but not loosely, without sticking or hinge binding, with all hardware adjusted and functioning properly.
3.04 TOLERANCES
   A. Clearances Between Door and Frame: As specified in ANSI A250.8.
   B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.
   B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel frames undamaged and in complete and proper operating condition.
   C. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
   D. Before application of primer, touchup galvanized surfaces with zinc-rich coating where zinc coating has been removed or damaged.

3.06 SCHEDULE
   A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION
SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Overhead coiling doors, operating hardware, non-fire-rated and exterior, manual operation.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Provide general construction, component connections and details.
C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
D. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Overhead Coiling Doors:
   2. Substitutions: See Division 1 for substitutions.

2.02 COILING DOORS
A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
   2. Single thickness slats.
   3. Finish: Factory painted, from standard color chart.
   5. Hood Enclosure: Manufacturer’s standard; galvanized steel.
   7. Mounting: Surface mounted.

2.03 MATERIALS
A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
B. Steel Slats: Minimum 18 gage ASTM A653/A653M galvanized steel sheet.
C. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.
D. Steel Guides: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A 123/A 123M.
E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
F. Hardware:
   1. Latching: Inside mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position.
   2. Latch Handle: Interior handle.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION
   A. Install units in accordance with manufacturer's instructions.
   B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
   C. Securely and rigidly brace components suspended from structure.
   D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 ADJUSTING
   A. Adjust operating assemblies for smooth and noiseless operation.

3.04 CLEANING
   A. Clean installed components.
   B. Remove labels and visible markings.

END OF SECTION
SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for doors.
B. Hardware for fire-rated doors.
C. Thresholds.
D. Weatherstripping, seals and door gaskets.
E. Gate locks.

1.02 REFERENCE STANDARDS

B. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.1).
C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.2).
D. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.3).
E. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2000 (ANSI/BHMA A156.4).
F. BHMA A156.5 - American National Standard for Auxiliary Locks & Associated Products; Builders Hardware Manufacturers Association; 2001 (ANSI/BHMA A156.5).
G. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.6).
H. BHMA A156.7 - American National Standard for Template Hinge Dimensions; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.7).
I. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2005 (ANSI/BHMA A156.8).
J. BHMA A156.12 - American National Standard for Interconnected Locks & Latches; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.12).
M. BHMA A156.16 - American National Standard for Auxiliary Hardware; Builders Hardware Manufacturers Association; 2002 (ANSI/BHMA A156.16).
N. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).
O. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.
B. Convey District's keying requirements to manufacturers.
C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

1.04 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Include manufacturer's complete product literature for specified items, including detailed installation diagrams and instructions.
C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.
D. Keying Schedule: Submit for approval of District.
E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
F. Maintenance Data: Include one set of adjusting tools, data on operating hardware, maintenance manuals for all hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
G. Keys: Deliver with identifying tags to District by security shipment direct from hardware supplier.
H. Keying Schedule: Submit separate detailed schedule indicating clearly how the District's final instructions on keying of locks has been fulfilled.
I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.
J. Submit hardware schedule in a timely manner so as not to delay the progress of related trades (i.e. hollow metal work) or the progress of the construction schedule.
K. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
a. Quantities.
b. Type, style, function, size and finish of each hardware item.
c. Name and manufacturer of each item.
d. Fastenings and other pertinent information.
e. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
f. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
g. Mounting locations.
h. Door and frame size.
L. Mounting locations for hardware.
M. Door and frame sizes and materials:
N. Keying information:
1. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordination review of hardware schedule.
O. Submittal Sequence: Submit initial draft of schedule along with essential product data in order to facilitate the fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Submit final draft of schedule after samples, product data, coordination with shops drawings of other work, delivery schedules, and similar information has been completed and accepted.

P. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operations and quality as the type specified, and shall be subject to the approval of District's Representative.

Q. Construction Schedule: Inform Contractor at earliest possible date of estimated times and dates to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing Finish Hardware for purposes of including in construction progress schedule and then comply with this schedule.

1.05 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience. Must employ an experienced architectural hardware consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to District, Architect and Contractor.

B. Supplier Qualifications: Hardware supplier shall have minimum 5 years experience in supplying hardware for projects of similar size and scope and shall have in his employ a certified architectural hardware consultant (AHC) to prepare hardware submittals and coordinate proper preparation for and installation of hardware items.

C. Hardware Supplier Qualifications: Local company specializing in supplying commercial door hardware with 3 years of experience. Must employ an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to District, Architect and Contractor.

D. Performance: This section is based on use of products of manufacturers listed on schedule included at end of this Section; however, materials by other manufacturers as specifically accepted in writing may be substituted, provided they meet specified requirements in all respects. Use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer products as listed will not be acceptable, unless they are not equal in design, size, weight, finish, function, or other qualities of significance, or followed by the words "No Substitution(s)". After District acceptance of hardware supplier's completed hardware schedule, manufacturer selection shall not be changed.

E. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

F. Design Criteria: Intent of Specification contemplates providing hardware for all doors in Project, specifically listed. It is Contractor's responsibility to examine Contract Documents and call omissions to Architect's attention prior to bid for instructions. No extras allowed. Omissions not rectified as stated herein shall be furnished at no extra cost to District.

G. Special Requirement: Comply with latest applicable publications of Builders Hardware Manufacturing Association (BHMA) "Builders Hardware Handbook".

H. Source Quality Control: Each type of kind of hardware shall be obtained from only one manufacturer, even though several may be specified as acceptable.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ship hardware items in lots coordinated with openings, as numbered in opening schedule.
B. Packaging of hardware is the responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Package shall include all fastenings and appurtenances. Two or more identical sets may be packaged in the same container.
   1. Mark each package on the outside to show the contents and specific location in the work.
   2. Mark each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

C. Inspect hardware items upon delivery to assure that specified products have been received.

D. Store in clean, dry, secure area.

E. Storage: Provide secure lock-up for hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items with are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

F. Coordinate hardware with other Work. Furnish all hardware items of proper design for use on doors and frames of thickness, profile, swing, security, and similar requirements indicated as necessary for proper installation and function.

G. Furnish printed templates or actual hardware to the various subcontractors responsible for installation of, or preparation for installation of hardware furnished under this Section. Check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

H. Coordinate Campus keying requirements during the course of the Work.

I. All exit doors shall be openable from the inside at all times without the use of a key or special knowledge or effort. All hardware shall be as determined by building, accessibility and fire codes in effect and current at the time of furnishing the finish hardware to the Project.

1.07 WARRANTY

A. Provide five year warranty for door closers and locksets, mortise locks and lever handles.

B. Warrant, against defective materials and workmanship, door closers for 5 years after Substantial Completion, and remaining finish hardware for 2 years after Substantial Completion.

C. Door Closers: Provide a 10 year warranty against failure or leakage in addition to warranty/guaranty requirements of the Conditions of the Contract beginning on date Work is Accepted by District.

D. Replace defective hardware during the warranty period at no cost to the District.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Furnish hardware following receipt of review comments on detailed schedules and samples. Furnish templates or sample items to shops and trades fabricating Work which will receive hardware. Package sets individually with labels attached, identifying contents in same manner as in schedules.

B. Miscellaneous Items: Furnish hardware with incidental items such as screws, bolts, expansion shields, tampins, anchors, or other fastenings required by manufacturer to ensure heavy usage and long life.

C. Fasteners: Manufacture hardware to conform to published templates, generally prepared for wood or machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws. Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fasteners.
   1. Screws: Furnish installation screws with each hardware item; generally phillips flat-head type and finished same as or closely matching hardware item finish.
   2. Concealed Fasteners: Typically provide concealed fasteners for hardware items which are exposed when door is closed except to extent no standard units of type specified are
available with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed except where it is not feasible to adequately reinforce the Work or where required by building code.

D. Hand of Door: Drawings indicate direction of slide or swing. Determine hand of each door leaf and furnish each item of hardware for proper installation and operation of door movement.

E. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in visible location.

F. Keying: Provide construction keying systems for all locks.

G. Keys: Include construction keys for Campus and Architect as well as Contractor.

H. Finish: Hardware shall be commercial grade to match existing or stainless steel finish.

2.02 FASTENINGS

A. Furnish all hardware complete with all necessary screws, bolts, and other fasteners of suitable type and size to anchor the hardware in position for hard use and long life. All fastenings shall harmonize with the hardware as to material and finish. Furnish fastenings where necessary with expansion shields, sex bolts, toggle bolts, or other anchors approved by the District's Representative, according to the material to which the hardware is to be applied, and the recommendations of the hardware manufacturer.

2.03 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: One or more manufacturers are listed for each hardware type required. An asterisk (*) after a manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

B. ANSI/BHMA designations used elsewhere in this section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this section.

2.04 MANUFACTURERS - BASIS OF DESIGN

2.05 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.
3. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Finishes: Identified in schedule or match existing unless noted otherwise.

E. Fasteners:

1. Concrete and Masonry Substrates: Stainless steel machine screws and lead expansion shields.

2.06 HARDWARE

A. Hardware sets listed below fully show extent of finish hardware to be provided at each opening. Hardware Schedule shall be modified only as directed in writing by Architect.
B. Specified and Acceptable Manufacturers and Products: Products by the following manufacturers are acceptable for bidding provided item or product meets preamble specification of each item. If, in opinion of Architect, item or product is not of same or similar type, then scheduled item shall be furnished. Hardware items are listed below to establish standard of quality.

1. Butt Hinges: Maximum of 5 knuckles, and 4-1/2" height (unless otherwise noted) at 1-3/4" doors. Use 2 pairs of hinges for doors 7'-6" and over.
2. Specified Acceptable Products:
   a. McKinney.
   b. Hager, Stanley.
3. Cylinders: Furnish 6 pin cylinders as required where indicated; no substitutions.
4. Locksets and Latchsets: Mortise design as listed by American National Standards Institute (ANSI).
5. Specified Acceptable Products:
   a. Schlage - No substitutions.
6. Surface-Mounted Door Closers: Product of one manufacturer, reversible and nonhanded; fully hydraulic, full rack and pinion action with high strength cast iron cylinder, having either slim line or full covers. Pieces of door closer shall be painted to match adjacent hardware.
7. Specified Acceptable Products:
   a. LCN.
   b. Sargent, Norton, Dorma.
8. Exit devices shall be product of one manufacturer, where specified at fire-rated door openings, carrying listing by Underwriter's Laboratories as fire exit hardware.
9. Specified Acceptable Products:
   a. Von Duprin - No Substitutions.
10. Automatic and semi-automatic flushbolts and coordinator's shall bear underwriter's listing for use on fire-rated door openings.
11. Specified Acceptable Products:
    a. Door Control.
    b. Ives, Glynn Johnson.
12. Wall Stops, Push Plates, Armor Plates, and Door Trim: Builders Brass Works (BBW) is specified. Acceptable manufacturers include Trimco, Baldwin, Glynn Johnson, Master Manufacturing, and Ives.
13. Weatherstrip, Smoke Seal, and Astraqals: Pemko is specified. Acceptable manufacturers include Zero, Master Manufacturing, Reese, and National Guard.
14. Magnetic Holders: Rixson. Products by other manufacturers may be used provided that projection of armorture unit is same and they are compatible with fire alarm stystem.
15. Silencers for hollow metal frames shall be similar to BBW No. W-07. Stick-on silencers shall not be used on this Project.
16. Manufacturers used in this schedule unless otherwise noted:
    b. Locksets and Latchsets: Schlage.
    c. Closers: LCN
    d. Exit Devices: Von Duprin.
    e. Automatic Flushbolts and Coordinator s: Door Control.
    g. Thresholds & Weatherstrip: Pemko.
    h. Miscellaneous: As noted.
17. Hardware Sets: Refer to Door Schedule Drawings for assignment to specific doors.
    a. Hardware sets to be selected.

C. Hinges: Provide hinges on every swinging door.
1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
2. Provide ball-bearing hinges at all doors.
3. Provide hinges in the quantities indicated.
4. Provide non-removable pins on exterior outswinging doors.

2.07 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. Hardware Sets indicate locking functions required for each door.
   2. If no hardware set is indicated for a swinging door provide an office lockset.
   3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.
   1. Include construction keying.
   2. Key to existing keying system.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.08 FLUSHBOLTS

A. Flushbolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
   1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
   2. Floor Bolts: Provide dustproof strike except at metal thresholds.

B. Coordinators: Provide on doors having closers and self-latching or automatic flushbolts to ensure that leaves close in proper order.

2.09 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
   1. Provide wall stops, unless otherwise indicated.
   2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
   3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

B. Kick Plate: Trimco
   1. Trimco, Triangle Brass Manufacturer Co., Inc.: www.trimcoabbw.com

C. Door Stops: IVES
   1. IVES: www.schlagelock.com/brands/iveshome.htm

D. Thresholds: Pemko
   1. Pemko Manufacturing Company: www.pemko.com

2.10 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:
   1. Kickplate: Provide on push side of every door with closer, except storefront and all-glass doors.

B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.

2.11 HARDWARE SCHEDULE

A. While the Hardware Schedule is intended to cover all doors and other moveable parts of the building and establish a type and standard of quality, it shall be the specific duty and responsibility of the finish hardware supplier to examine the Drawings and Specifications and furnish proper hardware for all openings whether listed or not.
B. If there are any omissions in the hardware groups, they shall be called to the attention of the Architect prior to bid opening for instructions. Otherwise the list shall be considered complete. No extra will be allowed for omissions, changes or corrections necessary to facilitate proper installation.

C. Hardware supplier shall meet with School District to determine keying requirements. A keying schedule will then be prepared and submitted for approval prior to ordering of factory keyed locks and cylinders.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare openings and doors in accordance with manufacturer's installation instructions.

B. Contractor shall field verify opening size, <E> hardware locations, threshold requirements and make all necessary adjustments for an ADA approved system. See drawings for appropriate details.

C. Prior to installation of hardware at Project Site, conduct a general orientation meeting attended by hardware supplier, hardware installers, Architect, District, and Contractor. Review installation procedures related to schedules of hardware, doors, and frames. Establish final provisions related to security and key control. Examine hardware items for unusual provisions including special operational features, security devices, UL labels, and similar considerations related to installation.

3.02 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions, details, and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

D. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:
   1. Comply with T-24 CBC, 11338.2.5.1.
   2. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
   3. Seal thresholds to exterior pavement and walls. Use mildew resistant sealant.
   5. Exit devices: Between 30 and 40 inches above floor.

E. Floor mounted door stops shall be installed no more than 4 inches from face of walls or partitions per DSA policy 99-08, dated 12-1-99.

F. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

G. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Position: Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation. Install closers on room side of doors.
10200 - Merritt College CHW Infrastructure

H. Position: Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation. Install closers on room side of doors.

I. Fasteners: Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Exposed fasteners Phillips head, counter sunk.

J. Check: Adjust and examine each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for application intended.

K. Seal thresholds to exterior pavement and walls. Use mildew resistant sealant and anchor securely to concrete a minimum of 3 flat head machine screws in expansion shields.

3.04 ADJUSTING

A. Check: Adjust and examine each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for application intended.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00.

B. Do not permit adjacent work to damage hardware or finish.

3.06 SCHEDULE - ATTACHED.

A. Hardware Group HW-1

1. 3 Ea Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
2. 1 Ea Lock ND96TD RHO US10B Schlage
3. 1 Ea Core Only 20-740 IC Everest Primus Level 9Z Schlage
4. 2 Ea. Kickplates 10 x 34" 8400 US10B Ives
5. 1 Ea. Door Stop FS18S Black Ives
6. 1 Ea. Closer 4041EPA-TB Drk Bronze LCN
7. 1 Ea. Door Seal 162SA Drk An NPG
8. 1 Ea. Lock Guard LG12 US10B Ives
9. 1 Ea. Drip Guard 17DKB Drk. Bronze NPG
10. 1 Set Silencer SR64 Gray Ives

B. Hardware Group HW-2

1. 3 Ea Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
2. 1 Ea Lock ND96TD RHO US10B Schlage
3. 1 Ea. Core Only 20-740 IC Everest Primus Level 9Z Schlage
4. 1 Ea. Panic Device 9875-EO-F-3' US10B Von Duprin
5. 2 Ea. Kickplates 10 x 34" 8400 US10B Ives
6. 1 Ea. Door Stop FS18S Black Ives
7. 1 Ea. Closer 4041EPA-TB Drk Bronze LCN
8. 1 Ea. Door Seal 162SA Drk An NPG
9. 1 Set Silencer SR64 Gray Ives
10. 1 Ea. Threshold 272AxSS MS/A 630 Pemko

C. Hardware Group HW-3

1. 6 Ea. Butts 5BB1HW 4-1/2 x 5 NRP US10B Ives
3. 1 Ea. Dust Proof Strike DP-2 US10B Ives
4. 1 Ea. Lock ND96TD RHO US10B Schlage
5. 2 Ea. Panic Device 9827-EO-F-3' US10B Von Duprin
6. 1 Ea. Core Only 20-740 IC Everest Primus Level 9Z Schlage

DSA Re-submittal 6/21/2012

DOOR HARDWARE
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>1 Ea.</td>
<td>Astragal 139SP or by HM Door Mfr.</td>
<td>NPG</td>
</tr>
</tbody>
</table>
| 8. | 2 Ea. | Door Stop FS18S | Black  
Ives |
LCN |
| 10. | 4 Ea. | Kickplates 10x34 8400 | US10B  
Ives |
| 11. | 2 Ea. | Door Seal 162SA | Drk. An  
NPG |
| 12. | 1 Ea. | Lockguard LG12 | US10B  
Ives |
| 13. | 1 Ea. | Threshold 272AxSS MS/A | 630  
Pemko |
| 14. | 2 Set | Silencer SR84 | Gray  
Ives |

END OF SECTION
SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Louvers.

1.02 REFERENCE STANDARDS
B. CBC 2010 Sections 1609A.1.2.1, 1615A.1.2.1 and 2403.5.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Manufacturer shall submit shop drawings incorporating key plans, elevations, sections and details showing profiles, angles and spacing of louver blades and frames; unit dimensions related to wall openings and construction; and, anchorage details and locations.
C. Submit theoretical calculations prepared by a professional engineer specializing in the application of welding technology demonstrating that each fillet weld joining blade and frame members will withstand a minimum of 526 pounds of force in shear.
D. Provide samples of manufacturer's finish and color charts showing the full range of colors available. For each type of product specified, submit free area, air performance and water penetration ratings determined in accordance with AMCA Standard 500-L and licensed under the AMCA Certified Ratings Program.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Wall Louvers:

2.02 ACOUSTICAL LOUVERS (CHILLER ROOM)
A. GENERAL
   1. Furnish and install where indicated on plans or described in schedules Acoustic Louver Type T9108 designed and manufactured by The AiroLite Company LLC, Schofield, Wisconsin. Louvers shall be furnished with insect screen, supports, installation hardware and finishes as specified and as required for a complete installation. Louver shall be aluminum construction with visible vertical mullions.
B. PRODUCTS
   1. Louvers shall be acoustic type incorporating stationary, parallelogram blades in a single frame. Louvers shall be 8-inches deep and assembled entirely from fabricated aluminum components. Blades and frames shall be 0.080-inch thick aluminum, alloy 3003-H32. Blades shall be positioned at 45-degrees and spaced 5-inches on center. Each blade and top and bottom frame cavity shall be filled with fiberglass acoustic insulation to absorb the transmission of sound. Acoustic insulation shall be held in place by 0.032-inch thick perforated aluminum panels.
   2. Louvers finish shall be 3-coat fluoropolymer finish.
C. ALL-WELDED ASSEMBLY
   1. Join stationary blade and frames and frame members with fillet welds concealed from view, unless the size of the louver makes bolted connections between louver sections necessary. Louver blades shall be joined to each jamb frame with a minimum of two fillet
welds produced with the Pulsed Gas Metal Arc Welding (GMAW/Mig) process. Each weld shall be a minimum of 1-inch in length with a minimum 1/8-inch LEG. Frames shall be joined at each corner with a full-length GMAW fillet weld with a minimum 1/8-inch leg.

D. STRUCTURAL DESIGN CRITERIA
1. Manufacturer shall design and furnish all supports required to withstand a wind force of not less than 25 pounds per square foot. Louvers larger than 60-inches wide x 96-inches high will be fabricated and installed in multiple sections. Louver blades, frames, mullions and anchorages shall be demonstrated to withstand the specified wind design load.

2.03 EXHAUST LOUVERS (ROOFTOP)

A. GENERAL
1. Furnish and install where indicated on plans or described in schedules drainable Louver Type K6774 as designed and manufactured by The Airoline Company LLC, Schofield, Wisconsin. Louvers shall be furnished with bird screen, supports, installation hardware and finishes as specified and as required for a complete installation.

B. PRODUCTS
1. Louvers shall be drainable Louver Type K6774 with visible vertical mullions. Louvers shall be 4-inches deep and assembled entirely from extruded aluminum components. Blades and frames shall be 0.081-inch thick extruded aluminum, alloy 6063-T5. Blades shall be stationary, incorporate drainable gutters, and be spaced 4-inches on center. Jamb frames shall incorporate drainable gutters to ensure resistance to water penetration.
2. Louvers finish shall be 3-coat fluoropolymer finish.

C. ALL-WELDED ASSEMBLY
1. Join stationary blade and frames and frame members with fillet welds concealed from view, unless the size of the louver makes bolted connections between louver sections necessary. Louver blades shall be joined to each jamb frame with a minimum of two fillet welds produced with the Pulsed Gas Metal Arc Welding (GMAW/Mig) process. Each weld shall be a minimum of 1-inch in length with a minimum 1/8-inch leg. Frames shall be joined at each corner with a full-length GMAW fillet weld with a minimum 1/8-inch throat.

D. STRUCTURAL DESIGN CRITERIA
1. Manufacturer shall design and furnish all supports required to withstand a wind force of not less than 25 pounds per square foot. Louvers 72-inches wide x 144-inches high or 144-inches wide x 72-inches high will be fabricated and installed in multiple sections. Louver blades, frames, mullions and anchorages shall be demonstrated to withstand the specified wind design load.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install louver assembly in accordance with manufacturer's instructions.
B. Install louvers level and plumb.
C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
D. Secure louver frames in openings with fasteners.

3.02 CLEANING
A. Clean louver surfaces in accordance with manufacturer's instructions.

END OF SECTION
SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Gypsum wallboard.
D. Textured finish system.

1.02 REFERENCE STANDARDS
D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2010.

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
C. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

1.04 QUALITY ASSURANCE
A. Fire-Resistance Rating: Where gypsum drywall systems with fire-resistance ratings area indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.
B. Provide fire resistance rated assemblies identical to those indicated by reference to those indicated by reference to:
   1. GA File No'S in GA "Fire Resistance Design Manual".
2. Design designations in UL "Fire Resistance Directory".
3. Listings of other testing and agencies acceptable to authorities having jurisdiction.

1.05 DELIVERY STORAGE AND HANDLING
A. Deliver Materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect material corner beads from being bent or damaged.

PART 2 PRODUCTS
2.01 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C640 and GA-216.
B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: ; 2 hour rating.
   2. Fire Rated Shaft Walls: ; 1 hour rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

DIRECT SUSPENSBASE MANUFACTURERION SYSTEMS:
3.01 CHICAGO METALLIC CORPORATION: WWW.CHICAGO-METALLIC.COM.
3.02 DONN CORPORATION.
   A. National Rolling Mills Company.

3.03 METAL FRAMING MATERIALS
A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E72 using assemblies specified by ASTM C754.
   2. Studs: "C" shaped with flat or formed webs with knurled faces.
B. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754.

3.04 METAL SUPPORT MATERIALS
A. Wall/Partition Support Materials:
   1. Studs: ASTM C 645; 0.0179" min. thickness of base metal unless otherwise indicated.
      a. Depth of Section: 3-5/8", except as otherwise indicated.
      b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
   2. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.
      a. Where shown as "Resilient", provide manufacturer’s special type designed to reduce sound transmission.
   3. Z-Furring Members: Manufacturer's standard screw-type galvanized steel, zee-shaped furring members; ASTM A 525, G60, 0.0179" min. thickness of base metal; of depth indicated; designed for mechanical attachment of insulation boards or blankets to monolithic concrete and masonry walls.
3.05 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass-mat-faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
   5. Glass-Mat-Faced Products:
      a. National Gypsum Company; Gold Bond e2XP Fire-Shield Interior Extreme.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
   1. Application: Stairs.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M: Ends square cut.

E. Gypsum Shaftwall or Coreboard: ASTM C 442; sizes to minimize joints in place; 4 inch thick; square edges, ends square cut.

3.06 ACCESSORIES

A. General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with knurled and perforated for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.
   1. Semi-Finishing Type: Manufacturer's standard trim units which are not to be finished with joint compound (nonbeaded).

B. H-Molding: Manufacturer's standard extruded aluminum H-molding of height required for board, designed for combination trim and control joint in exterior gypsum board ceiling/soffit work.

C. JOINT TREATMENT MATERIALS
   1. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
      a. Grade: A single multi-purpose grade, for entire application.
   4. Joint Compound: On interior work provide chemical-hardening-type for bedding and filling, ready-mixed vinyl-type or vinyl-type powder type for topping.


E. Screws for Attachment to Steel Members From 0.033 to 0.112 Inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

3.07 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

B. Board Screws: Comply with ASTM C 646.

C. Water-Resistant Adhesive: Type I organic adhesive for ceramic tile complying with ANSI A136.1.
D. Thermal Insulation: FS HH-I-521, Type I; semi-rigid mineral fiber blanket without membrane; Class 25 flame spread, K value of 0.25; designed for use with Z-furring members, of thickness and width to completely fill void formed by Z-furring members; density between 4.0 and 6.0 lbs. per cu. ft. depending on thickness.

E. Polyethylene Vapor Retarder: A single polyethylene film, 4.0 mils thick, with a vapor rating of 0.20 perms per ASTM E 96.

3.08 TEXTURE FINISH MATERIALS

A. Primer: Of type recommended by manufacturer of texture finish.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.
   1. Coordinate installation with work of other trades whose work connects with or is affected or concealed by gypsum wallboard. Do all the butting, and patching or work as may be required to accommodate other trades.
   2. Before applying gypsum wallboard, see that corners and framing are plumb, true, and solid. Do not apply wallboard until conduits, pipes, ducts, vents, supports, fixture frames, etc., are in place and tested as required. Solid bearing required at all edges and ends of wallboard.
   3. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
   4. Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F (13 degrees C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 degrees F (13 degrees C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
   5. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

4.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer’s installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

4.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer’s instructions.

B. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer’s instructions.
   3. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.
   4. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
   5. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
   6. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support or substrate above the ceiling.
7. Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.

C. Frame door openings to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co; www.usg.com.
   1. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames.
   2. Install runner track section (for jack studs) at head and secure to jamb studs.
   3. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

D. Frame openings other than door openings to comply with details indicated or if not otherwise indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

E. Expansion Joints:
   1. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

4.04 BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
   1. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
   2. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
   3. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
   4. Located either edge or end joints over supports, except in horizontal applications or where intermediate supports, or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs at opposite sides of partitions.
   5. Attach gypsum board to supplementary framing and blocking provide for additional support at openings and cutouts.
   6. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishig edge trim. Seal joints with acoustical sealant.
   7. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Installation on Metal Framing: Use screws for attachment of all gypsum board.

D. Apply wallboard first to ceilings then to walls using maximum lengths to minimize end joints. Apply gypsum wallboard to framing members in horizontal application (long edges of board at right angles to framing), with all abutting ends and edges over supports. Install all panels plumb, level, and with all joints on bearing. Smooth all cut ends and edges of panels where necessary to obtain a smooth joint. Neatly fit and stagger all end joints. Boards brought into moderate contact, but not forced into place. Maximum width joint shall be 1/8". Cut and fit neatly around all devices in surface. For cut-outs in panels for pipes, fixtures, or other small openings, make holes and cut-outs by sawing or by such other method that will not fracture the core or tear the covering, and with such accuracy that plates, escutcheons, trim, etc., will cover all edges. "Score-and-knockout" methods will not be permitted.
4.05 INSTALLATION OF TRIM AND ACCESSORIES
A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
B. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
C. Corner Beads: Install at external corners, using longest practical lengths.
D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.
E. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
F. Install semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings or indicated to receive trim with face flanges covered with joint compound.
G. Install plastic edge trim where indicated on wall panels at juncture with ceilings.

4.06 TEXTURE FINISH
A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.
B. Texture Required: match existing texture.
C. Surface Preparation and Primer: Prepare and prime drywall and other surfaces in strict accordance with texture finish manufacturer's instructions. Apply primer to all surfaces to achieve texture finish.
D. Finish Application: Mix and apply finish to drywall and other surfaces indicated to receive finish in strict accordance with manufacturer's instructions to produce a uniform texture without stained spots or other evidence of thin application, and free of application patterns.
E. Remove any texture droppings or overspray from door frames, windows and other adjoining work.

4.07 TOLERANCES
A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

4.08 CLEAN-UP
A. During the progress of this portion of the Work, do not allow the accumulation of scrap and debris resulting from the gypsum drywall installation and finishing. Take all means necessary to prevent spilling and splashing compound. In the event of spilling or splashing of compound on other surfaces, immediately remove the spilled or splashed material and all traces of residue.
B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints and other coatings.
C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. See Division 1 for submittal requirements.
B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

1.04 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
   1. Provide ready mixed paints and coatings, except field-catalyzed coatings.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PAINT SYSTEMS
A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

2.04 EXTERIOR PAINT SYSTEMS
A. Ferrous- Flat- Acrylic: Surfaces:
   1. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   2. First Coat: KM 1240 - Acrylic Exterior Flat Finish
   3. Finish Coat: KM 1240 - Acrylic Exterior Flat Finish
B. Ferrous-Semi Gloss - Acrylic:
   1. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   2. First Coat: KM 1250 -
   3. Finish Coat: KM 1250 -
C. Galvanized Steel and Aluminum - Flat - Acrylic:
   1. Surface Preparation: Kelly Moore JASCO
   2. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   3. Finish Coat: Two coats KM 1240 -
D. Galvanized Steel and Aluminum - Semi-Gloss - Acrylic:
   1. Surface Preparation: Kelly Moore JASCO
   2. Prime Coat: KM 1725 - Kelguard 100% Acrylic Metal Primer.
   3. Finish Coat: Two coats KM 1250

2.05 INTERIOR PAINT SYSTEMS
A. Interior Gypsum Board: Eggshell Surfaces:
   1. First Coat: KM 971 - Acry-Plex Interior PVA Primer/Sealer.
   2. Second Coat: KM 1500 - Enviro Coat Interior Acrylic Eggshell Enamel
   3. Third Coat: KM 1500 - Enviro Coat Interior Acrylic Eggshell Enamel
B. Interior Gypsum Board: Semi-Gloss Surfaces:
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
C. Metal Piping: Ferrous Metals
   1. Prime Coat: KM 1725 - Kel-Guard 100% Acrylic Metal Primer
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
D. Metal Piping: Galvanized Metals
   1. Prime Coat: KM 1725 - Kel-Guard 100% Acrylic Metal Primer
   2. First Coat: KM 1520 - Enviro Coat Interior Acrylic Semi-Gloss Enamel
PART 3 EXECUTION

3.01 SCOPE – SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
   4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
   5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars and supports occurring in finished areas to match background surfaces, unless otherwise indicated.
   7. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
   8. Paint shop-primed mechanical and electrical items occurring in finished areas.
   9. Paint interior surfaces of air ducts and convectors and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
  10. Paint dampers exposed behind louvers, grilles, and convectors and baseboard cabinets to match face panels.
  11. Paint condenser water piping.

C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Engineer’s approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

E. Measure the pH factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
   1. Report results in writing to Engineer before starting work.
   2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Engineer.
3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corrod ing metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

3.04 APPLICATION

A. Apply products in accordance with manufacturer’s instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
   1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
   2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
   4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.
D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
1. Number of coats and film thickness required are the same regardless of application method.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.05 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Engineer.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION
SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Room and door signs.
B. Emergency evacuation maps.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing number on schedule.
   2. When content of signs is indicated to be determined later, request such information from District through Engineer at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by District through Engineer prior to fabrication.
D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Flat Signs:
B. Other Signs:

2.02 SIGNAGE APPLICATIONS
A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with injection molded panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 1 inch.
4. Sign Height: 6 inches, unless otherwise indicated.
5. Rooms: Identify with the room names and numbers shown on the drawings.

C. Emergency Evacuation Maps:
   1. Update existing evacuation maps to match existing type and style.

2.03 SIGN TYPES
   A. Flat Signs: Signage media in matching plastic frame.
      1. Edges: Square.
      2. Corners: Square.
   B. Color and Font: Unless otherwise indicated:
      1. Character Font: Helvetica, Arial, or other sans serif font.
      2. Character Case: Upper case only. Characters on sign shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width to height ratio of between 1:5 and 1:10.
      3. Background Color: As scheduled.

2.04 TACTILE SIGNAGE MEDIA
   A. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
      1. Total Thickness: 1/8 inch.

2.05 ACCESSORIES
   A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install neatly, with horizontal edges level.
   C. Locate signs where indicated:
      1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
      2. If no location is indicated obtain District's instructions.
   D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION
SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Fire extinguishers.
   B. Fire extinguisher cabinets.
   C. Accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Division 1 for submittal procedures.
   B. Product Data: Provide extinguisher operational features and color and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Fire Extinguishers:
   B. Fire Extinguisher Cabinets and Accessories:

2.02 FIRE EXTINGUISHERS
   A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
      1. Class: A:B:C.
      2. Size and classification as scheduled.
      3. Finish: Baked polyester powder coat, match existing color.

2.03 FIRE EXTINGUISHER CABINETS
   A. Metal: Formed galvanized steel sheet; 0.036 inch thick base metal.
   B. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.
   C. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
   D. Finish of Cabinet Exterior Trim and Door: match existing finish and color.
   E. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES
   A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install cabinets plumb and level, 48 inches from finished floor to handle.
   C. Secure rigidly in place.

END OF SECTION
SECTION 2210 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.

1.02 REFERENCE STANDARDS
A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).
E. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
N. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).
R. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
C. Pipe Test Reports: Submit pipe pressure test reports for all piping installed under this contract indicating that piping systems have been tested in accordance with the California Plumbing Code.

1.04 QUALITY ASSURANCE
A. Welder Qualifications: Certified in accordance with ASME (BPV IX).
B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS
A. Perform Work in accordance with State of California plumbing code.
B. Conform to applicable code for installation of backflow prevention devices.
C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS
A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING
A. Cast Iron Pipe: ASTM A 74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C 564 neoprene gaskets, or lead and oakum.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING
A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spiugot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.03 SANITARY SEWER PIPING, ABOVE GRADE
A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.04 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING
   1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2.05 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
   1. Fittings: Ductile or gray iron, standard thickness.

2.06 WATER PIPING, ABOVE GRADE
A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

DSA Re-submittal 6/21/2012

22 10 05 - 2 PLUMBING PIPING

2.07 FLANGES, UNIONS, AND COUPLINGS
A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.08 PIPE HANGERS AND SUPPORTS
A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
B. Plumbing Piping - Drain, Waste, and Vent
C. Plumbing Piping - Water:

2.09 BALL VALVES
A. Manufacturers:
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Construction, 2 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, stainless steel ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION
A. Install and test all plumbing piping systems in strict accordance with the California Plumbing Code.
B. Install in accordance with manufacturer's instructions.
C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
D. Group piping whenever practical at common elevations.
E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
F. Install water piping to ASME B31.9.
G. Sleeve pipes passing through partitions, walls and floors.
H. Inserts:
   1. Provide inserts for placement in concrete formwork.
I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

3.04 APPLICATION
A. Install unions downstream of valves and at equipment or apparatus connections.
B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
C. Install ball valves for throttling, bypass, or manual flow control services.

3.05 TOLERANCES
A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

END OF SECTION
SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Floor drains.
B. Cleanouts.
C. Hose bibbs.
D. Backflow preventers.

1.02 REFERENCE STANDARDS
A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).
B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 DRAINS
A. Manufacturers:
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Floor Drain (Indoor):
   1. ASME A112.21; cast iron floor drain with anchor flange, weepholes, adjustable round cast iron head.
C. Floor Drain (Outdoor):
   1. ASME A112.21.1M; cast iron area drain with anchor flange, membrane clamp with weepholes, cast iron grate and sediment bucket.

2.02 CLEANOUTS
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

2.03 HOSE BIBBS
A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

2.04 BACKFLOW PREVENTERS

A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Positive displacement meters.
B. Pressure gages and pressure gage taps.
C. Thermometers and thermometer wells.
D. Test Plugs.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

A. Manufacturers:
   1. Badger Meter Inc.: Model Recordall Disc Meter; www.badgermeter.com
      a. Substitutions: See Section 01 60 00 - Product Requirements.
   2. AWWA C700, positive displacement disc type for fluid in cast bronze and lead-free alloy.
   3. Electronic Transmitter
      a. Provide and install for water meter.
      b. Badger Meter Model RET Recordall Electronic Transmitter or equal.
      c. Transmitter shall include:
         1) Liquid crystal display, permanently sealed, magnetic pickups, multiple outputs, water proof connection.
         2) Unit of measure: U.S. Gallons
         3) Rate of flow: U.S. Gallons per hour
         4) Totalization function
         5) Pulse output for 10 gallons per pulse
         6) 4-20mA output for instantaneous flow rate
         7) Internal power source: One Lithium, 2.4A-hr battery
         8) External power source: 9.0 - 50.0 VDC for 4-20 mA.

2.02 PRESSURE GAGES

A. Manufacturers:
   1. Ashcroft Model Duragage; Model 1279;
   2. Substitutions: See Section 01 60 00 - Product Requirements
B. Gage: ASME B40.1, phenolic case, phosphor bronze bourdon tube, rotary geared brass movement, brass socket, with front recalibration adjustment, black scale on white background. 1/2" NPT bottom system connection.
   1. Size: 4-1/2 inch diameter.
   2. Mid-Scale Accuracy: 1/2 percent.
   3. Scale: Psi.

2.03 DIGITAL THERMOMETERS

A. Manufacturers:
   2. Substitutions: See Section 01 60 00 - Product Requirements.

   1. Size: 3-1/2 inch industrial stem
   2. Display: 3/8" LCD digits, wide ambient formula.
   3. Accuracy: 1 percent.
   4. Resolution: 1/10 Degrees F between -19.9/199.9 Degrees F
   5. Range: -40/300 Degrees F
   6. Ambient Operating Temperatures: -30/140 Degrees F
   7. Power: Integrated Photo Voltaic Cells

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, with and cap and chain.

2.05 CONTROLS SUPPORTS

A. Provide taps: Forged, ASTM A105 carbon steel, threaded branch connection suitable for sizes and schedules to be connected for 150 psig working pressure. Bonney Forge Thred-o-let or approved equal. Coordinate with Controls Subcontractor for size, location and quantities.

B. Differential Pressure Transmitter Support: Provide taps, 1/4" stainless steel tubing with swagelok fittings and needle valves for shut off, bypass and drain connections.

2.06 TEST PLUGS

A. Manufacturer: Peterson Equipment Company Model Pete's Plug II.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size vailed bypass with globe valve for liquid service meters.

C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

D. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
1. Locate test plugs adjacent to thermometers and thermometer sockets.

END OF SECTION
SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Nameplates.
   B. Tags.
   C. Pipe Markers.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
   C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
   D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS
2.01 IDENTIFICATION APPLICATIONS
   A. Major Control Components: Nameplates.
   B. Piping: Pipe Markers.
   C. Pumps: Nameplates.
   D. Chillers: Nameplates.
   E. Cooling Towers: Nameplates.
   F. Valves: Tags.
   G. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES
   A. Manufacturers:
      4. Substitutions: See Section 01 60 00 - Product Requirements.
   B. Laminated three-layer plastic with engraved letters.
      2. Letter Height: 1/4 inch.

2.03 TAGS
   A. Manufacturers:
B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS
A. Manufacturers:
   3. Substitutions: See Section 01 60 00 - Product Requirements.
B. Color: Conform to ASME A13.1.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
E. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 EXECUTION
3.01 PREPARATION
A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION
A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
E. Identify control panels and major control components outside panels with plastic nameplates.
F. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow, direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Testing, adjustment, and balancing of air systems.
B. Testing, adjustment, and balancing of hydronic and refrigerating systems.
C. Commissioning activities.

1.02 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Engineer.
   2. Submit to the Commissioning Authority.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Total flow calculations.
         2) Rechecking.
         3) Diversity issues.
      h. Expected problems and solutions, etc.
      i. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
      j. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
      k. Procedures for formal deficiency reports, including scope, frequency and distribution.
D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

5. Units of Measure: Report data in I-P (inch-pound) units only.

6. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Engineer.
   g. Project Contractor.
   h. Project altitude.
   i. Report date.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Test Instruments:
   1. Balancing Contractor shall provide all necessary test instruments required to take readings including, but not limited to: Pressure gauges, thermometers, humidity instruments, sling psychrometers, flow meter readout instruments (differential pressure gauges, etc.), air flow hoods, pitot tubes, anemometers, ammeters, voltmeters, tachometers, sound level meters, vibration analyzers, etc., as required to perform measurements required to perform the work of this section and applicable Commissioning specifications. These instruments are considered to be the property of the balancing contractor and required for usual performance of testing and balancing work. No allowance will be made for contractor’s failure to provide adequate test instruments.

B. Incidental Equipment and Materials:
   1. Balancing Contractor shall provide at his own expense incidental and/or temporary equipment required to make such readings as required for the performance of this work. Such incidentals include but are not limited to: pipe nipples, couplings, tees, elbows, plugs and caps, gauge valves, teflon tape, and other miscellaneous fittings required to make readings required for balancing work. Incidental materials and fittings shall be removed and the facility restored to ‘as found’ condition after completion of readings and balancing activities.

C. Tools and Labor:
   1. Balancing Contractor shall provide all tools and labor required to effect necessary readings for balancing work, including but not limited to electric drill and bits, wrenches, pliers, screwdrivers, teflon tape, flashlights, rags, pocket knife or leatherman, pencils, pens, test forms, paper, and other minor tools required for work of this section.

2. Provide labor to alter minor piping and other systems to allow temporary installation of test gages and thermometers, etc., required to make necessary readings. This includes removal of plugs on pump castings and temporary installation of piping, valves, gauges and nipples required to attach pressure gauges for readings, drilling required holes in ductwork and subsequent installation of plugs to allow ductwork pitot tube traverses, connections to flow elements, including a reasonable effort to clear obstructions from test ports, etc. Remove temporary fittings, valves and gauges at completion of readings and restore equipment to ‘as found’ condition.
PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Access doors are closed and duct end caps are in place.
   7. Air outlets are installed and connected.
   8. Duct system leakage is minimized.
   9. Hydronic systems are flushed, filled, and vented.
   10. Pumps are rotating correctly.
   11. Proper strainer baskets are clean and in place.
   12. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.
3.04 ADJUSTMENT TOLERANCES
A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING
A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   4. Lists of completed tests.
B. Ensure recorded data represents actual measured or observed conditions.
C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE
A. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
B. Measure air quantities at air inlets and outlets.
C. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required, including sheaves and labor. See RMS and Controls sequence of operation.

3.07 WATER SYSTEM PROCEDURE
A. After systems are balanced, work with the controls contractor to determine optimal final setpoint of pump system static pressure controls. Final setpoint shall be determined by supplying design water flow to all zones with no valves throttling.
B. Adjust water systems to provide required or design quantities.
C. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING (BY CONTRACTOR)
A. Perform prerequisites prior to starting commissioning activities.
B. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.
C. Verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off
downstream of the static pressure sensor, the terminal unit on the critical leg has its
damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting
design loads, less diversity; this shall include a review of TAB methods, established control
setpoints, and physical verification of at least one leg from the pump to the coil having all
balancing valves wide open and that during full cooling the cooling coil valve of that leg is
90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. Chilled Water Loop
   2. Condenser Water System
   3. Exhaust Fan
   4. HVAC Pumps
   5. Centrifugal Water Chillers
   6. Induced Draft Cooling Tower

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP
   7. Actual flow rate, pressure drop, BHP
   8. Discharge pressure
   9. Suction pressure
   10. Total operating head pressure
   11. Shut off, discharge and suction pressures
   12. Shut off, total head pressure

D. Chillers:
   1. Identification/number
   2. Manufacturer
   3. Capacity
   4. Model number
   5. Serial number

DSA Re-submittal 6/21/2012

TESTING, ADJUSTING, AND BALANCING FOR
HVAC

23 05 83 - 5
6. Evaporator entering water temperature, design and actual
7. Evaporator leaving water temperature, design and actual
8. Evaporator pressure drop, design and actual
9. Evaporator water flow rate, design and actual
10. Condenser entering water temperature, design and actual
11. Condenser leaving water temperature, design and actual
12. Condenser pressure drop, design and actual
13. Condenser water flow rate, design and actual

E. Cooling Tower:
1. Tower identification/number
2. Manufacturer
3. Model number
4. Serial number
5. Rated capacity
6. Entering air WB temperature, specified and actual
7. Leaving air WB temperature, specified and actual
8. Ambient air DB temperature
9. Condenser water entering temperature
10. Condenser water leaving temperature
11. Condenser water flow rate
12. Fan RPM

F. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

G. Tower and Chilled Water Loop Balancing:
1. Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-1, CHWP-1 @ 461 GPM
2. Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-2, CHWP-1 @ 461 GPM
3. Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-1, CHWP-2 @ 461 GPM
4. Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-2, CHWP-2 @ 461 GPM
5. Test CT-1 and CT-2, CWP-1 and CWP-2 together @ 750 gpm each, CH-1 and CH-2 together and CHWP-1 & 2 @ 461 GPM each.
6. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-1 @ 750 gpm, CH-3, CHWP-1 @ 461 GPM
7. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-2 @ 750 gpm, CH-3, CHWP-2 @ 461 GPM
8. If Add Alternate #2 is accepted: Test CT-1 and CT-2, CWP-1 and CWP-2 together @ 1125 gpm each, CH-1, CH-2 and CH-3 together and CHWP-1 & 2 @ 692 GPM each.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Jackets and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer’s Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS
A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.
PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C 795; rigid molded, noncombustible.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.04 THERMAL HANGER SHIELDS

A. Thermal hanger shields shall be designed for use with pipe rollers or strut framing systems and shall provide structural calcium silicate inserts to provide insulation and pipe supports at all new support locations. Piping Technology and Products, Pipe Shields, Inc. or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

DSA Re-submittal 6/21/2012

HVAC PIPING INSULATION

23 07 19 - 2
C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including but not necessarily limited to fittings, control valves, valves (including drain and vent valves), unions, flanges, reducers, elbows, tees, branch fittings, strainers, flexible connections, pump bodies, air separators, air scoops, piping to air vents, thermometer wells, instrumentation wells, pressure gage piping and other instrument piping, flow meter bodies, flow conditioners, pipe guides and anchors, pipe supports, expansion joints, expansion loops and expansion fittings, sample lines, heat exchangers and any other cold surface. Any surface that may condense water vapor shall be insulated and covered with a vapor barrier, and jacketed as required for weather protection. Flow balancing valves shall be insulated with removable insulation covers for access, measurement and adjustment, or field insulated to allow adjustment and measurement without disturbing adjacent insulation. "These 'full insulation' requirements shall apply to all systems, regardless of location: interior, exterior, in manholes, accessible trenches, direct buried or any other location. For insulation systems to be used in manholes, trenches or direct buried, see Section 33 61 13 Underground Hydronic Energy Distribution."

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with All Service Jacket.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping and elbows.

J. Buried Piping: See Section 33 61 13 Underground Hydronic Energy Distribution.

3.03 SCHEDULE

A. Cooling Systems:
   1. Chilled Water: Glass Fiber Insulation with all service jacket and vapor barrier:
      a. 40 to 60 degrees F. Through 2" pipe size - 1/2" thickness; Above 2" pipe size - 1" thickness.

END OF SECTION
SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Contractor or Subcontractors will be responsible for coordinating and documenting their own commissioning activities and providing all prefunctional and functional checklists as part of the close-out documentation.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Controls sequence of operation.
   3. Central plant water and air balancing.
   4. Major and minor equipment items.
   5. Chiller control components and sequence of operation including BACnet interface.
   6. Piping systems and equipment.
   7. Ductwork and accessories.
   8. RMS system.
   9. Variable frequency drives.
   10. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996

1.03 SUBMITTALS

A. Updated Submittals: Keep the District's representative informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.

DSA Re-submittal 6/21/2012

23 08 00 - 1

COMMISSIONING OF HVAC
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the District’s representative and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of District’s representative.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
a. Floor.
b. Room number.
c. Room name.
d. Reference drawing number.
e. HVAC equipment ID.
f. Control Valve ID.
g. Minimum air flow rate.
h. Maximum air flow rate.
i. Minimum water flow rate.
j. Maximum water flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
a. Sequences of operation.
b. Control drawings.
c. Points lists.
d. Controller and/or module data.
e. Thermostats and timers.
f. Sensors and DP switches.
g. Valves and valve actuators.
h. Dampers and damper actuators.
i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer’s recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 79 00 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS
2.01 TEST EQUIPMENT
A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of District.
B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to District; such equipment, tools, and instruments are to become the property of District.

PART 3 EXECUTION
3.01 PREPARATION
A. Cooperate with the District’s representative in development of the Prefunctional Checklists and Functional Test Procedures.
B. Furnish additional information requested by the District’s representative.
C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the District’s representative; update the schedule as appropriate.
D. Notify the District’s representative when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the District’s representative has the scheduling information needed to efficiently execute the commissioning process.
E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
G. Provide temperature and pressure taps in accordance with the contract documents.

3.02 INSPECTING AND TESTING - GENERAL
A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
B. Perform the Functional Tests directed by the District’s representative for each item of equipment or other assembly to be commissioned.
C. Provide two-way radios for use during the testing.
D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to District.

3.03 TAB COORDINATION
A. TAB: Testing, adjusting, and balancing of HVAC.
B. Coordinate commissioning schedule with TAB schedule.
C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the District’s representative prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the District’s representative.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to District.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the District's representative during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the District’s representative:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to District.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to District.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant over-rides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to District.
3.05 OPERATION AND MAINTENANCE MANUALS
A. See Section 01 78 00 for additional requirements.
B. Add design intent documentation furnished by Engineer to manuals prior to submission to District.
C. Submit manuals related to items that were commissioned to District’s representative for review; make changes recommended by District’s representative.
D. District’s representative will add commissioning records to manuals after submission to District.

3.06 DEMONSTRATION AND TRAINING
A. See Section 01 79 00 for additional requirements.
B. Demonstrate operation and maintenance of HVAC system to District’s personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the District’s representative during Functional Testing.
D. Provide classroom and hands-on training of District’s designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.
E. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer’s facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from District. Also be prepared to address topics brought up and answer questions concerning operation of the system.
F. Provide the services of manufacturer representatives to assist instructors where necessary.
G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION
Part 1 General

1.0 SECTION INCLUDES

A. Products Furnished But Not Installed Under This Section
B. Products Installed But Not Furnished Under This Section
C. Products Not Furnished Or Installed But Integrated With The Work Of This Section
D. Related Sections
E. Description
F. Approved Control System Contractors and Manufacturers
G. Quality Assurance
H. Codes and Standards
I. System Performance
J. Submittals
K. Warranty
L. Ownership of Proprietary Material

1.1 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 21 13– Hydronic Piping:
   1. Control Valves
   2. Flow Switches
   3. Temperature Sensor Wells and Sockets
   4. Temperature Sensor and Wet Bulb Sensor
   5. Flow meters
   6. Differential Pressure Transmitters
   7. Electric Meter

1.2 PRODUCTS INSTALLED AND FURNISHED UNDER THIS SECTION

A. Section 23 35 00 – ReFrigerant Monitoring System:
   1. Refrigerant Leak Detection System:

1.3 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Section 23 60 00 – Central Cooling Equipment:
   1. Chiller Controls
   2. Cooling Tower Controls
B. Section 23 09 30 - Variable Frequency Drives

1.4 DESCRIPTION

A. General: The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and operator workstation residing and communicating on a BACnet IP (Internet Protocol) network. The existing operator workstation will be used. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics. A modem shall be provided for remote access to the network. Systems using gateways to route proprietary devices and objects to BACnet are not acceptable.

B. The system will provide for future expansion to include monitoring fire alarm, and lighting control systems.

C. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement.

1.5 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. The base bid shall be Delta Controls, installed by EMCOR Services / Mesa Energy Systems Inc. Delta controls is the only acceptable controls manufacture to meet the standards of the existing system.

Note:

1. The Contractor shall use only products from the corresponding manufacturer and product line listed.

2. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, Building Controllers, Advanced Application Controllers, and Application Specific Controllers. All other products specified herein (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

3. The installing contractor must have, under their direct employ, IBEW Inside Wiremen to provide the labor for the installation of the control system. Sub-contracting of this labor is not acceptable.
1.6 QUALITY ASSURANCE

A. Contractor/Manufacturer Qualifications
   1. The Installer shall have an established working relationship with the Control System Manufacturer, and be the authorized representative of the Manufacturer at bid time.
   2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
   3. All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.7 CODES AND STANDARDS

A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
   1. National Electric Code (NEC)
   2. California Building Code (CBC)
   3. California Mechanical Code (CMC)
   4. ASHRAE 135-2004
   5. FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference
   6. Underwriters Laboratories UL916
1.8 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:
   1. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 1 second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
   2. Performance. Programmable controllers shall be able to execute DDC PID control loops at a frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
   3. Reporting Accuracy. The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.
   4. Stability of Control. Control loops shall maintain measured variable at setpoint within the tolerances listed in Table 2.
### TABLE 1: Reporting Accuracy

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Outside Air</td>
<td>±1.0°C [±2°F]</td>
</tr>
<tr>
<td>Dewpoint</td>
<td>±1.5°C [±3°F]</td>
</tr>
<tr>
<td>Water Temperature</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Delta-T</td>
<td>±0.15°C [±0.25°F]</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>±5% RH</td>
</tr>
<tr>
<td>Water Flow</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Airflow (terminal)</td>
<td>±10% of full scale (see Note 1)</td>
</tr>
<tr>
<td>Airflow (measuring stations)</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Air Pressure (ducts)</td>
<td>±25 Pa [±0.1 &quot;W.G.&quot; ]</td>
</tr>
<tr>
<td>Air Pressure (space)</td>
<td>±3 Pa [±0.01 &quot;W.G.&quot; ]</td>
</tr>
<tr>
<td>Water Pressure</td>
<td>±2% of full scale (see Note 2)</td>
</tr>
<tr>
<td>Electrical (A, V, W, Power factor)</td>
<td>5% of reading (see Note 3)</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>±5% of reading</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>±50 ppm</td>
</tr>
</tbody>
</table>

**Note 1:** 10%-100% of scale  
**Note 2:** For both absolute and differential pressure  
**Note 3:** Not including utility-supplied meters

### TABLE 2: Control Stability and Accuracy

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>±50 Pa [±0.2&quot; w.g.]</td>
<td>0-1.5 kPa [0-6&quot; w.g.]</td>
</tr>
<tr>
<td></td>
<td>±3 Pa [±0.01&quot; w.g.]</td>
<td>-25 to 25 Pa [-0.1 to 0.1&quot; w.g.]</td>
</tr>
<tr>
<td>Airflow</td>
<td>±10% of full scale</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>±0.5°C [±1.0°F]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>±5% RH</td>
<td></td>
</tr>
<tr>
<td>Fluid Pressure</td>
<td>±10 kPa [±1.5 psi]</td>
<td>0-1 kPa [0-150 psi]</td>
</tr>
<tr>
<td>Fluid &quot;differential&quot;</td>
<td>±250 Pa [±1.0&quot; w.g.]</td>
<td>0-12.5 kPa [0-50&quot; w.g.]</td>
</tr>
</tbody>
</table>
1.9 SUBMITTALs

A. Product Data and Shop Drawings: Meet requirements of Division 01. In addition, Contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been reviewed and approved for conformity with the design intent. Six copies are required. All drawings shall be done in VSI format and provided on optical disk and as 11x17 drawings. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. Direct Digital Control System Hardware:
   
a) A complete bill of materials of equipment to be used shall be listed indicating quantity, manufacturer, model number, and other relevant technical data.
   
b) Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

   i Direct Digital Controller (controller panels)
   ii Transducers/Transmitters
   iii Sensors (including accuracy data)
   iv Actuators
   v Valves
   vi Relays/Switches
   vii Control Panels
   viii Power Supply
   ix Batteries
   x Wiring

   c) Wiring diagrams and layouts for each control panel. Show all termination numbers
   
d) Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware

2. Central System Hardware and Software
   
a) A complete bill of material of equipment used indicating quantity, manufacturer, model number, and other relevant technical data.
b) Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions for the items listed below and other relevant items not listed below:
   i  Interface Equipment Between CPU and Control Panels
   ii Third-party Software

c) A schematic diagram for all control wiring, communication wiring and power wiring shall be provided. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers, function and data link protocol(s). Show all interface wiring to the control system

d) Provide detailed riser diagrams of wiring between central control unit, operator workstation(s), routers, gateways and all control panels

e) A list of the color graphic screens shall be provided. For each screen, provide a conceptual layout of pictures and data, and show or explain which other screens can be directly accessed

3. Controlled Systems:

a) A schematic diagram of each controlled system. The schematics shall have all control points/objects labeled and with point/object names shown or listed. The schematics shall graphically show the location of all control elements in the system

b) A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled

c) A mounting, wiring, and routing plan view drawing. The design shall take into account HVAC, electrical and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work

d) A complete description of the operation of the control system, including sequences of operation.

4. Quantities of items submitted shall be reviewed, but are the responsibility of the Contractor

5. A description of the proposed process along with all report formats and checklists to be used in Part 3: “Control System Demonstration and Acceptance.”

6. A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and Operator Workstation included in the submittal. PICS to include for each product, as a minimum, a list of BACnet functional groups supported, BACnet services supported, BACnet data link options available and BACnet objects provided
B. Schedules:

1. Within one month of contract award, provide a schedule of the work indicating the following:
   a) Intended sequence of work items
   b) Start dates of individual work items.
   c) Duration of individual work items
   d) Planned delivery dates for major material and equipment, and expected lead times
   e) Milestones indicating possible restraints on work by other trades or situations.

2. Provide monthly written status reports indicating work completed, revisions to expected delivery dates, etc. An updated project schedule shall be included.
C. Project Record Documents: Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of optical media including VSI drawing files also shall be provided.

2. Testing and Commissioning Reports and Checklists. Completed versions of all reports and checklists, along with all trend logs, used to meet the requirements of Part 3: "Control System Demonstration and Acceptance."

3. Operation and Maintenance (O & M) Manual. This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M manual shall include:

   a) Names, addresses, and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representatives of each.

   b) Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point/object reports, trending data, overriding computer control, and changing setpoints and other variables.

   c) One set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point/object database creation and modification, program creation and modification, and use of the editor.

   d) Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points/objects, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.

   e) A listing and documentation of all custom software created using the programming language, including the setpoints, tuning parameters, and object database. One set of optical media containing files of the software and database also shall be provided.

   f) One set of optical media containing files of all color graphic screens created for the project.

   g) A list of recommended spare parts with part numbers and suppliers.

   h) Complete original issue documentation, installation, and maintenance information for all third-party hardware provided, including computer equipment and sensors.

   i) Complete original issue diskettes for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

   j) Licenses, guarantee, and warranty documents for all equipment and systems.

   k) Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.
D. Training Manuals: The Contractor shall provide a course outline and training manuals for all training classes at least six weeks prior to the first class. The Engineer may modify any or all of the training course outline and training materials to meet the needs of the Owner. Review and approval by the Engineer shall be completed at least three weeks prior to the first class.

1.10 WARRANTY

A. Warrant all work as follows:

1. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner’s request for warranty service within 24 hours during normal business hours.

2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.

3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Engineer, the Engineer shall sign certificates certifying that the control system’s operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.

4. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to the Owner by purchasing an in-warranty technical support agreement from the Contractor. Written authorization by the Owner must, however, be granted prior to the installation of any of the above-mentioned items.

5. Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Engineer’s acceptance.
1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:
   1. Project graphic images
   2. Record drawings
   3. Project database
   4. Project-specific application programming code
   5. All documentation
Part 2  Products

2.0 SECTION INCLUDES
   A. Materials
   B. Communication
   C. Controller Software
   D. Building Controllers
   E. Advanced Application Controllers
   F. Application Specific Controllers
   G. Input/Output Interface
   H. Power Supplies and Line Filtering
   I. Auxiliary Control Devices
   J. Wiring and Raceways

2.1 MATERIALS
   A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION
   A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2004, BACnet.
   B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this section.
   C. The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.
   D. All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/Physical layer protocol.
   E. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:
1. Connection of an Operator Workstation device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.

2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.

F. The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.

G. The network shall have the following minimum capacity for future expansion:
   1. Each Building Controller shall have routing capacity for 99 controllers.
   2. The Building Controller network shall have capacity for 1000 Building Controllers.
   3. The system shall have an overall capacity for 12,500 Building Controller, Advanced Application Controller, and Application Specific Controller input/output objects.

2.3 CONTROLLER SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security
   1. User access shall be secured using individual security passwords and user names.
   2. Passwords shall restrict the user to the site, objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts shall be recorded.

C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
   1. Provide an event scheduling system that allows the operator to specify a single event, multiple day event and/or recurring events. The event schedule specifies both the on/off times and the date in a calendar planning format similar to Microsoft Outlook®.
   2. Calendar Schedules. Provide the capability for the operator to define up to 99 special schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each calendar period.
Section 23 09 23
Direct-Digital Controls

D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

E. Remote Communication. The system shall have the ability to dial out in the event of an alarm using BACnet Point-To-Point at a minimum of 56K baud and text messaging to cell phones and email messages via SMTP protocol.

F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

G. Sequencing. Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.

H. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.

I. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage.

J. Energy Calculations. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.

K. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

L. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.

M. Run-time Totalization. Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.4 BUILDING CONTROLLERS

A. General. Provide an adequate number of BACnet® Building Controllers to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these panels shall meet the following requirements. Additionally, provide Building Controllers where shown on the drawings.

1. The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

3. Data shall be shared between networked Building Controllers.

4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

5. Controllers that perform scheduling shall have a battery or super-cap backed up real-time clock.

6. The Building Controller shall support the following BACnet Interoperability Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-WP-A,B</td>
<td>AE-N-E-B</td>
<td>T-ATR-B</td>
<td></td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-WPM-B</td>
<td>AE-ACK-B</td>
<td></td>
<td></td>
<td>DM-TS-A,B</td>
</tr>
<tr>
<td></td>
<td>AE-INFO-B</td>
<td></td>
<td></td>
<td>DM-ATS-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-RD-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-BR-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-R-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-OCD-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NM-CE-A</td>
</tr>
</tbody>
</table>
B. Communication
1. Each Building Controller shall support direct Ethernet or a communications card. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol, or BACnet IP (Annex J).
2. Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.
3. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol P-T-P for connection to a hand-held workstation/and/or modem.
4. The Building Controller secondary communication network shall support BACnet MS/TP.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 100°F and 10 to 90% RH.
2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Building Controllers shall be fully peer to peer.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips — or to a termination card connected by a ribbon cable.

F. Memory. The Building Controller shall have as a minimum standard SRAM of 256 KB, standard DRAM of 1MB and standard non-volatile 1 MB of flash memory in lieu of EPROM. Memory shall be user extendible through RAM chip sockets and SIMMs for future memory expansion.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. The Building Controller shall maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

H. Inputs/Outputs.
1. Inputs. Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC voltage, 4-20 mA current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be minimum 10-bit A to D.
2. Outputs. Controller input/output board shall support plug-and-play I/O modules or built in HAO modules configured with manual-auto-off override switch, potentiometer and input channel for feedback status or an unrelated analog or digital input. Output supported shall be 0-10 VDC. All HAO's shall be supervised.

3. Diagnostics. Controller input board shall have variable intensity LEDs providing input status indication. Outputs shall have variable intensity LEDs indicating the output voltage with color indication of HAO's status when present.

4. Bump-less Transfer. On analog outputs with override switches, provide a Hand-Auto-Off switch either built-in or external to the board that allows for manual positioning of the output, then transferring the output to automatic without any "bump" in the output voltage (don't go through off before transferring from manual to auto).

2.5 ADVANCED APPLICATION CONTROLLERS

A. General. Provide an adequate number of BACnet®Advanced Application Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.

1. The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.

2. Advanced Application Controllers shall be fully peer to peer.

3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

4. All equipment that requires scheduling shall be scheduled in that equipment controller.

5. Both firmware and controller database shall be loadable over the network.

6. Advanced Application Controllers shall support the following BACnet Interoperability Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-WP-A,B</td>
<td>AE-ACK-B</td>
<td>T-ATR-B</td>
<td></td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-WPM-B</td>
<td>AE-ASUM-B</td>
<td></td>
<td></td>
<td>DM-TS-B</td>
</tr>
<tr>
<td>DS-COV-A,B</td>
<td>AE-ESUM-B</td>
<td></td>
<td></td>
<td>DM-RD-B</td>
</tr>
<tr>
<td>DS-COV-A,B</td>
<td>AE-INFO-B</td>
<td></td>
<td></td>
<td>DM-BR-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-R-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-OCD-B</td>
</tr>
</tbody>
</table>
Communication.

1. Each Advanced Application Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/Physical layer protocol.

2. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to portable operators workstation and allow access to the entire network.

Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 100°F.

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips — or to a termination card connected by a ribbon cable.

Memory. The Advanced Application Controller shall be non-volatile FLASH memory.

Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

2.6 APPLICATION SPECIFIC CONTROLLERS

A. General. Provide BACnet® Application Specific Controllers (ASCs) as required to execute the sequence of operations. ASC's are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They shall be fully user-configurable.

1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.

2. Each ASC will contain sufficient I/O capacity to control the target system.

3. Both firmware and controller database shall be loadable over the network.

4. ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.

5. Application Specific Controllers shall support the following BACnet Interoperability Building Blocks (BIBBs):

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-RP-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DDB-B</td>
</tr>
<tr>
<td>DS-RPM-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DOB-B</td>
</tr>
<tr>
<td>DS-WP-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-DCC-B</td>
</tr>
<tr>
<td>DS-COV-B</td>
<td></td>
<td></td>
<td></td>
<td>DM-SC-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-RD-B</td>
</tr>
</tbody>
</table>
B. Communication

1. The controller shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol or BACnet® over ZigBee protocol.

2. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator’s tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.

C. Environment. The hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°F to 150°F and/or suitably installed in a heated or fan cooled enclosure.

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.

E. Memory. The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.

F. Immunity to power and noise. ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 3 ft.

G. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

H. Input/Output. ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC.

2.7 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and output points/objects may be wired into the system through Building, Advanced Application, or Application Specific Controllers.

B. All input and output points shall be protected such that shorting of the point to itself, to another point, or to ground, will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 volts of any duration, such that contact with this voltage will cause no damage to the controller.
C. Digital inputs shall allow the monitoring of ON/OFF signals from remote devices. The digital inputs shall provide a current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.

D. Analog inputs shall allow the monitoring of 0-5 VDC, 0-10 VDC-voltage, 4-20 mA-current, or thermistors. Analog inputs shall be compatible, and be field configurable to commonly available sensing devices.

E. Digital outputs shall provide for ON/OFF operation. Digital outputs on Building and Advanced Application Controllers shall have three-position override switches, Hand-Off-Auto with status lights. Outputs shall be selectable for either normally open or normally closed operation.

F. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide a 0 to 10 VDC signal as required to provide proper control of the output device. Analog outputs on Building or Advanced Application Controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

G. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.)

H. Input/Output points/objects shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point/object with appropriate properties. Application Specific Controllers are exempted from this requirement.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.8 AUXILIARY CONTROL DEVICES

A. Control valves.
   1. See control valve schedule on drawings.

B. Temperature sensors.
   1. Temperature sensors shall be thermistors.
2. **Immersion sensors shall be provided with a separable brass well.** Pressure rating of well is to be consistent with the system pressure in which it is to be installed.

3. **Space sensors shall be equipped with the following:**
   a) Communication port connected to entire network

4. Provide matched temperature sensors for differential temperature measurement.

C. **Flow switches.**
   1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
   2. Paddle type switches (water service only) shall be UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.

C. **Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as specified.**

D. **Relays.**
   1. Control relays shall be UL Listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application
   2. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

E. **Current transmitters**
   1. **AC current transmitters shall be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0 – 5vdc two-wire output.** Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, internal zero and span adjustment, and ±1% full scale accuracy at 500 ohm maximum burden
   2. **Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.**
   3. **Unit shall be split-core type for clamp-on installation.**

F. **Current transformers**
   1. **AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.**
   2. **Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full scale output.**
   3. **Transformers shall be split-core type for installation on new or existing wiring.**

G. **Voltage transmitters**
   1. **AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.**
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with ±1% full-scale accuracy with 500 ohm maximum burden.

3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

H. Voltage transformers.
   1. AC voltage transformers shall be UL/CSA recognized, 600 VAC rated, complete with built-in fuse protection.
   2. Transformers shall be suitable for ambient temperatures of 40 to 130°F and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.
   3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

I. Power monitors.
   1. Power monitors shall be three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers and UL Listed split-core current transformers.
   2. Shall provide a selectable rate pulse output for kWh reading and a 1–5vdc or 4 to 20 mA output for kW reading. Shall operate with 5 A current inputs with a maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

J. Current switches
   1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

K. Pressure transducers
   1. Transducer shall have linear output signal. Zero and span shall be field-adjustable.
   2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
   3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.
   4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

L. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

M. Local control panels
1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels.

2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide 120v receptacle at each local panel location.

2.9 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26.

B. All insulated wire to be copper conductors, UL labeled for 90C minimum service.
Part 3 Execution

3.0 SECTION INCLUDES

A. Examination
B. Protection
C. Coordination
D. General Workmanship
E. Field Quality Control
F. Existing Equipment
G. Wiring
H. Communication Wiring
I. Installation of Sensors
J. Flow Switch Installation
K. Actuators
L. Warning Labels
M. Identification of Hardware and Wiring
N. Controllers
O. Programming
P. Control System Checkout and Testing
Q. Control System Demonstration and Acceptance
R. Cleaning
S. Training
T. Sequences of Operation

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.
3.2 PROTECTION

A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge.

2. Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the “Submittals” Article in Part 1 of this specification for requirements.

C. Test and Balance

1. The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:
1. All communication media and equipment shall be provided as specified in Part 2: “Communication” of this specification.

2. Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.

### 3.4 GENERAL WORKMANSHP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

### 3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship

C. Contractor shall have work inspected by local and/or state/provincial authorities having jurisdiction over the work

### 3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where the requirements of this section differ with those in Division 26, the requirements of this section shall take precedence

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 26 requirement
C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations including ceiling return air plenum, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenum shall be UL Listed specifically for that purpose.

E. All wiring in mechanical, electrical, or service rooms — or where subject to mechanical damage — shall be installed in raceway at levels below 10 ft.

F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. Do not install wiring in raceway containing tubing

H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it, and neatly tied at 6 ft intervals

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems

J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals

L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.

M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points/objects

N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations

O. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer’s recommendation and NEC requirements, except as noted elsewhere.

P. Include one pull string in each raceway 1” or larger

Q. Use coded conductors throughout with different colored conductors

R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
S. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6" from high-temperature equipment (e.g., steam pipes or flues).

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

W. The Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

X. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Flexible metal raceway less than 1/2" electrical trade size shall not be used. In areas exposed to moisture — including chiller and boiler rooms — liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING

A. The Contractor shall adhere to the items listed in the “Wiring” Article in Part 3 of the specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrester must be installed between the lines and ground. The lighting arrester shall be installed according to the manufacturer's instructions.
G. All runs of communication wiring shall be un-spliced when that length is commercially available

H. All communication wiring shall be labeled to indicate origination and destination data.

I. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding

3.8 INSTALLATION OF SENSORS

A. Install all sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

E. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

F. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.9 FLOW SWITCH INSTALLATION

A. Use correct paddle for pipe diameter.

B. Adjust flow switch in accordance with manufacturer's instructions

3.10 ACTUATORS

A. Electric/Electronic
   1. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.11 WARNING LABELS

A. Permanent warning labels shall be affixed to all equipment which can be automatically started by the DDC system.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows:
      CAUTION
      This equipment is operating under automatic control
and may start or stop at any time without warning.

Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and all control panels which are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows
      CAUTION
      This equipment is fed from more than one
      power source with separate disconnects.
      Disconnect all power sources before servicing.
3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2” of termination with the DDC address or termination number.

B. Permanently label or code each point/object of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum ½” letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Identify room sensors relating to terminal box or valves with nameplates.

F. Manufacturers' nameplates

G. Identifiers shall match record documents

3.13 CONTROLLERS

A. Provide a separate controller for each HVAC system.

B. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.

1. Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points

3.14 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Object names shall be case-sensitive and clearly spell out the function of each object. Submit naming scheme to owner for prior approval. Do not use cryptic abbreviations. Valid examples are:

1. AHU-1 Supply Air Temperature
2. CH-1 Chilled Water Supply Temperature
3. FC-1 Room Temperature
4. **VAV-103 Room Temperature Trend**

C. **Software Programming**

1. *Provide programming for the system and adhere to the sequences of operation provided. The Contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:*

   a) **Text-based:**
      
      i. must provide actions for all possible situations
      
      ii. must be modular and structured
      
      iii. must be commented

   b) **Graphic-based**
      
      i. must provide actions for all possible situations
      
      ii. must be documented

   c) **Parameter-based**
      
      i. must provide actions for all possible situations
      
      ii. must be documented

D. **Operator Interface**

1. **Standard Graphics.** *Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints*

2. **Show terminal equipment information on a “graphic” summary table.** *Provide dynamic information for each point/object*

3. **The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all Operator Workstation software and their functions as described in this section. This includes any operating system software, the Operator Workstation database, and any third-party software installation and integration required for successful operation of the operator interface*

**3.15 CONTROL SYSTEM CHECKOUT AND TESTING**

A. **Start-up Testing:** *All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner’s Representative is notified of the system demonstration.*
1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.

7. Alarms and Interlocks
   a) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
   b) Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
   c) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests.

2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the “Control System Checkout and Testing” Article in Part 3 of this specification. The Engineer will be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1: “Submittals.” The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.


7. Demonstrate compliance with Sequences of Operation through all modes of operation

8. Demonstrate complete operation of Operator Workstation

9. Additionally, the following items shall be demonstrated:

   a) DDC Loop Response. The Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

   b) Demand limiting. The Contractor shall supply a trend data output showing the action of the demand-liming algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting setpoint, and the status of shed-able equipment outputs.

   c) Optimum Start. The Contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

   d) Interface to the building fire alarm system

   e) Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Architect/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

   f) Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.
Section 23 09 23
Direct-Digital Controls

2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: "Submittals."
3.17 CLEANING

A. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 TRAINING

A. General

1. Provide a minimum of one onsite training class 8 hours in length during the construction period for personnel designated by the owner.

2. Provide two additional training sessions at 6 and 12 months following building's turnover. Each session shall be 8 hrs in length and must be coordinated with the building Owner.

B. Train the designated staff of Owner's Representative and Owner to enable Day-to-day Operators to:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand DDC system components.
4. Understand system operation, including DDC system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log on and off the system.
7. Access graphics, point/object reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
10. Understand system drawings, and Operation and Maintenance manual.
11. Understand the job layout and location of control components.
12. Access data from DDC controllers and Application Specific Controllers (ASC's).

C. Train the designated staff of Owner's Representative and Owner to enable Advanced Operators to:

1. Make and change graphics on the workstation
2. Create, delete, and modify alarms, including annunciation and routing of these
3. Create, delete, and modify point/object trend logs, and graph or print these
4. Create, delete, and modify reports
5. Add, remove, and modify system's physical points/objects
6. Create, modify, and delete programming
7. Add panels when required
8. Add Operator Workstation stations
9. Create, delete, and modify system displays — both graphical and otherwise
10. Perform DDC system field checkout procedures
11. Perform DDC controller unit operation and maintenance procedures
12. Perform workstation and peripheral operation and maintenance procedures
13. Perform DDC system diagnostic procedures
14. Configure hardware including PC boards, switches, communication, and I/O points/objects
15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
16. Adjust, calibrate, and replace system components

D. Train the designated staff of Owner's Representative and Owner to enable System Managers/Administrators to:
   1. Maintain software and prepare backups
   2. Interface with job-specific, third-party operator software
   3. Add new users and understand password security procedures

E. Provide course outline and materials as per “Submittals” Article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.

F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

G. Classroom training shall be done using a network of working controllers representative of the installed hardware.

3.19 SEQUENCES OF OPERATION

A. See Drawings.
Part 4  Instructions to Other Contractors

4.0  CONTROL VALVE INSTALLATION

A. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

B. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the vertical position.

C. Valves shall be installed in accordance with the manufacturer’s recommendations.

D. Control valves shall be installed so that they are accessible and serviceable, and such that actuators may be serviced and removed without interference from structure or other pipes and/or equipment

E. Isolation valves shall be installed such that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at all connections to screw-type control valves.

F. Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5” in diameter, with ¾ ” high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.
4.1 CONTROLS COMMUNICATION PROTOCOL

A. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points/object list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ASHRAE Standard 135-2004 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of ASHRAE Standard 135-2004.

B. Distributed Processing. The Controller shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.

C. I/O Capacity. The Controller shall contain sufficient I/O capacity to control and monitor the target system.

D. Communication. The Controller shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol. Each network of controllers shall be connected to one Building Controller. The Controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator’s tool.

E. Environment. The hardware shall be suitable for the anticipated ambient conditions. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 3 days.

H. Immunity to Power and Noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

I. Transformer. Power supply for the Controller must be rated at minimum of 125% of power consumption, and shall be fused or current limiting type.

J. Protocol Implementation Conformance Statement (PICS). Supplier of the electronic controls packaged with this equipment shall provide to the controls contractor a PICS list, complete with object list and wiring diagrams for proper and complete interface

4.2 STARTUP AND CHECKOUT PROCEDURES
Section 23 09 23
Direct-Digital Controls

A. Start up, check out, and test all hardware and software, and verify communication between all components
B. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
C. Verify that all analog and binary input/output points/objects read properly.
D. Verify alarms and interlocks.
E. Verify operation of the integrated system
SECTION 23 09 30
ADJUSTABLE FREQUENCY DRIVES FOR VARIABLE TORQUE APPLICATIONS

PART 1  GENERAL

1.01 SECTION INCLUDES

A. This specification is to cover a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. It is required that the drive manufacturer have an existing:
   1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
   2. An independent service organization.

B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.

C. Specification is for ABB ACH drive to match District standard. No known equal

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronic Engineers (IEEE)
   2. Underwriters laboratories
      a. UL508C
   3. National Electrical Manufacturer's Association (NEMA)
      a. ICS 7.0, AC Adjustable Speed Drives
   4. IEC 16800 Parts 1 and 2

B. Qualifications:
   1. AFDs and options shall be UL listed as a complete assembly. AFD's that require the customer to supply external fuses for the AFD to be UL listed are not acceptable. The base AFD shall be UL listed for 100 KAIC without the need for input fuses.
   2. CE Mark - The AFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
   3. Acceptable Manufactures
      a. ABB ACH Series
   4. The AFD manufacturer shall have available a comprehensive, HVAC Drive Web Based Training (WBT) product. The WBT product shall include detailed, interactive sections covering AFD unpacking, proper mechanical and electrical installation, and programming. The WBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user’s site. The WBT product shall be repeatable, precise and shall include record keeping capability. The WBT product shall record answers to simulations and tests by student ID. The WBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.03 WARRANTY

A. Warranty AFD for a period of two years after installation, 2-1/2 years from shipment.

B. See DIVISION 1 - Closeout Submittals, for additional warranty requirements.

C. Correct defective Work within a two year period after Date of Substantial Completion.

1.04 SUBMITTALS

A. Submittals shall include the following information:

DSA Re-submittal 6/21/2012
10200 - Merritt College CHW Infrastructure

1. Outline dimensions, clearance requirements, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided.
4. Compliance to IEEE 519 - harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
   a. The AFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5% and the TDD complies with IEEE limits for the application. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519. All AFD’s shall include a minimum of 5% impedance reactors, no exceptions.

PART 2 PRODUCTS

2.01 ADJUSTABLE FREQUENCY DRIVES

A. The AFD package as specified herein shall be enclosed in a UL Listed Type 1, 12 or weatherproof enclosure as per the VFD schedule, completely assembled and tested by the manufacturer in an ISO9001 facility. If there is not a VFD schedule on the plans, then VFDs mounted indoors in dry environments shall be UL type 1, indoor wet or air plenums shall be UL type 12, and outdoor shall be NEMA 3R with hinged viewing door. The AFD tolerated voltage window shall allow the AFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

1. Environmental operating conditions: 0 to 40 C continuous. AFD’s that can operate at 40 C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
2. Enclosure shall be rated per above and shall be UL listed as a plenum rated AFD. AFD’s without these ratings are not acceptable.

B. All AFDs shall have the following standard features:

1. All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.
2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
3. There shall be a built-in time clock in the AFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the AFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The AFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
4. The AFD’s shall utilize pre-programmed application macro’s specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The AFD shall have two user macros to allow the end-user to create and save custom settings.
5. The AFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the AFD from the wall or removal of circuit boards. The AFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
6. The AFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

7. The AFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.

9. The AFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. AFD's with only one DC reactor shall add AC line reactors.

10. The input current rating of the AFD shall be no more than 3% greater than the output current rating. AFD's with higher input current ratings require the upstream wiring, protection devices and source transformers to be oversized per NEC 430-2.

11. The AFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

12. The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

13. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault; (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

14. The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

C. All AFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.

2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (i.e. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.

3. Two (2) programmable analog inputs shall accept current or voltage signals.

4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
a. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the AFD shall provide a dry contact closure that will signal the damper to open (AFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to an AFD digital input and allows AFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.

7. Seven (7) programmable preset speeds.

8. Two independently adjustable accel and decel ramps with 1 - 1800 seconds adjustable time ramps.

9. The AFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

10. The AFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual AFD temperature that allows the highest carrier frequency without derating the AFD or operating at high carrier frequency only at low speeds.

11. The AFD shall include password protection against parameter changes.

D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:

1. Start-up assistants
2. Parameter assistants
3. Maintenance assistant
4. Troubleshooting assistant

E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Calculated Motor Power (kW)
5. DC Bus Voltage
6. Output Voltage

F. The AFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the AFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the AFD shall resume normal operation.

G. Serial Communications:

1. The AFD shall have an RS-485 port as standard. The standard protocols shall be BACnet (BTL lab approved), Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Provide optional protocol for LonWorks. Each individual drive shall
have the protocol in the base AFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.

2. Serial communication capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the AFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote AFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus - keypad “Hand” or “Auto” selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

3. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any AFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.

4. The AFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve control, etc. Both the AFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The AFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.

H. EMI / RFI filters. All AFD's shall include EMI/RFI filters. The onboard filters shall allow the AFD assembly to be CE Marked and the AFD shall meet product standard EN 61800-3 for the First Environment restricted level.

I. All AFD's through 50HP shall be protected from input and output power mis-wiring. The AFD shall sense this condition and display an alarm on the keypad.

J. OPTIONAL FEATURES TO BE PROVIDED: All features shall be furnished and mounted by the drive manufacturer. All features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.

1. A complete factory wired and tested bypass system (if scheduled) consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted.

2. Door interlocked padlockable circuit breaker (if scheduled or if bypass is provided) that will disconnect all input power from the drive and all internally mounted options.

3. The following shall be provided with the Bypass:
   a. Bypass Hand-Off-Auto
   b. Drive mode selector and light
   c. Bypass mode selector and light
   d. Bypass fault reset pushbutton
   e. Bypass LCD display, 2 lines, for programming and status / fault / warning indications

DSA Re-submit 6/21/2012
VARIABLE TORQUE APPLICATIONS

ADJUSTABLE FREQUENCY DRIVES FOR
f. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.

g. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.

h. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.

i. Serial communications - the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1), Lonworks, and BACnet in the bypass controller. Provide communications interface required by the site.

j. Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus - keypad "Hand" or "Auto" selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

k. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

l. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failure contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.

m. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 - 120 seconds.

n. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.

o. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.
p. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.
q. The relay outputs from the bypass shall be programmable for any of the following indications:
   1) a. System started
   2) b. System running
   3) c. Bypass override enabled
   4) d. Drive fault
   5) e. Bypass fault
   6) f. Bypass H-O-A position
   7) g. Motor proof of flow (broken belt)
   8) h. Overload
   9) i. Bypass selected
  10) j. Bypass run
  11) k. System started (damper opening)
  12) l. Bypass alarm
  13) m. Over temperature
r. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.
s. Customer Interlock Terminal Strip - provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
t. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
u. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

PART 3 EXECUTION
3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Provide bracing, anchorage and/or seismic restraints for all mechanical and electrical equipment as determined from 2007 CBC chapter 10, chapter 16A and ASCE 7-05.
   C. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
   D. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

3.02 INTERFACE WITH OTHER WORK
   A. Coordinate with Electrical Subcontractor for power connections.
   B. Coordinate with Controls Subcontractor for controls connections.

3.03 SCHEDULES
   A. See Contract Drawings for AFD schedule.
3.04 START-UP
   A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the District, and a copy kept on file at the manufacturer.
   B. Drive and connected load shall be operated by a factory authorized representative at all speeds between min. and max. and any critical frequencies noted shall be locked out.

3.05 PRODUCT SUPPORT
   A. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.
   B. A web based training module or 8-hour professionally generated video (VCR format) shall be provided to the District at the time of project closeout. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

3.06 WARRANTY
   A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

END OF SECTION
SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe and pipe fittings for:
   1. Chilled water piping system.
   2. Condenser water piping system.
   3. Refrigerant vent and purge piping system.
   4. Equipment drains and overflows.
B. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

1.02 REFERENCE STANDARDS
A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2008).
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2006.
F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

DSA Re-submit 6/21/2012

23 21 13 - 1

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Submit complete shop drawings for piping system showing all fittings, elevations, pipe accessories, hanger locations and all connected equipment. Submit on reproducible velum, and compact disk. Drawings shall be produced in AutoCad 2008 or later release.
C. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
D. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).
E. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
F. Project Record Documents: Record actual locations of pipe routing, valve locations and unforeseen utilities.
G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
H. Piping Pressure Test Reports: Provide piping pressure test reports indicating:
1. District
2. Project Address
3. Project Name
4. Testing Contractor
5. Pipe Segment Tested
6. Pipe Size, Service and material (including wall thickness information (schedule, SDR, etc.))
7. Test Medium
8. Date and Time of Test Start
9. Starting Pressure and Temperature of Test Medium
10. Starting Ambient Temperature
11. Date and Time of Test End
12. Ending Pressure and Temperature of Test Medium
13. Ending Ambient Temperature
14. Observations and Conclusions
I. As-Built Drawings: At project closeout, provide as-built drawings of the piping systems installed. Drawings shall be prepared using AutoCad 2008 or later release. Submit two reproducible copies and two complete sets of drawing files on a compact disc.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.
C. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only, if specified for the application.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Engineer.
      b. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
D. Valves: Provide valves where indicated and as follows:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
   2. On discharge of condenser water pumps, use spring loaded check valves.
   3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.02 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe Sizes 10" and under: ASTM A 53, Grade A or B, electric resistance welded or seamless, Schedule 40, black.
   1. Fittings: ASME B16.3, malleable iron threaded or ASTM A 234/A 234M, forged steel welding type, or 150 lb factory fabricated grooved.
   2. Joints: Threaded (2" and under), Grooved, Victaulic Style 07 - Zero Flex, no known equal, Flanged or Welded.

2.03 CONDENSER WATER PIPING, ABOVE GRADE

A. EPOXY COATED
   1. Steel Pipe: ASTM A 53, Grade A or B, electric resistance welded or seamless, Schedule 40, black, with fusion epoxy coating, inside and out.
      a. Fittings: ASTM A 234/A 234M, forged steel welding type with fusion epoxy coating, inside and out.
      b. Joints: Threaded for pipe 2 inch and under, welded for pipe over 2 inch.
   2. Steel Pipe Sizes 12 Inch and Over: ASTM A 53, Grade A or B, electric resistance welded or seamless, 0.375 inch wall, black, with fusion epoxy coating, inside and out.
   3. Fusion Epoxy Coating System:
      a. Epoxy coating for piping system shall be 3M Scotchkote 226N+ (no known equal). Field welds, connections and otherwise damaged areas shall be field coated and patched according to the manufacturer's instructions and recommendations with 3M™ Scotchkote™ Hot Melt Patch Compound 226P Green (no known equal).
   4. Ultraviolet (UV) Protective Coating:
a. Fusion epoxy systems for use in sunlight shall be coated with 2 coats of a UV resistant coating suitable for outdoor use, such as Alkyd Enamel, semi gloss, color as specified in other sections, or as selected by Engineer.

2.04 REFRIGERANT VENT AND PURGE LINES

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40 black, using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
   3. Flanged: ASTM A105 weld neck or slip on flanges, class 150.

2.05 EQUIPMENT Drains and OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder; HB alloy (95-5 tin-antimony) or tin and silver.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

D. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

H. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

I. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

J. Vertical Support: Steel riser clamp.

K. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.07 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

DSA Re-submital 6/21/2012

HYDRONIC PIPING
C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Galvanized.
   4. When pipe is field grooved, provide coupling manufacturer's grooving tools.


2.08 BALL VALVES
A. Up To and Including 2 Inches:
B. Manufacturers:
   6. Substitutions: See Section 01 60 00 - Product Requirements.

C. Up To and Including 2 Inches:
   1. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends.

2.09 BUTTERFLY VALVES
A. Manufacturers:
   3. CenterlineSeries 200
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Body: ANSI Class 150, Cast or ductile iron with resilient replaceable EPDM seat, lug ends, extended neck where required for insulation.

C. Shaft: Stainless steel, one piece through disc design

D. Disc (for general duty): Aluminum bronze.

E. Disc (for condenser water service): Stainless steel.

F. Manual Operators: 10 position lever handle up through 4", above 4", provide gear operator and handwheel. Where mounted higher than 7' above floor, provide chain wheel and chain to 3' above floor.

2.10 SWING CHECK VALVES
A. Up To and Including 2 Inches:
B. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Up To and Including 2 Inches:
   1. Class 150 bronze body, bronze trim, renewable seat and disc, with composition disc, threaded ends.

DSA Re-submittal 6/21/2012

23 21 13 - 5

HYDRONIC PIPING
D. Over 2 Inches:
   1. Class 150, iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable
disc and seat, flanged ends.

2.11 BALANCING VALVES
A. Manufacturers:
B. Construction:
   1. 1/2" to 2" Pipe Size
      a. Bronze body, brass ball construction with glass and carbon filled TFE seat rings.
         Valves to have differential pressure read-out ports across valve seat area. Read-out
         ports shall have integral EPT insert and check valve. Valve bodies shall have 1/4"
         tapped drain/purge point. Valve to have memory stop feature and integral calibrated
         nameplate with position indication. 300 psig design pressure, NPT connections. 250
         F operating temperature.
   2. 2-1/2" to 12" Pipe Size
      a. Cast iron, flanged construction with 125 psig flanged connections suitable up to 175
         psig working pressure at 250 F. Valves 2-1/2" - 3" shall have a brass ball with glass
         and carbon filled TFE seat rings. Valves 4" - 12" shall be fitted with a bronze seat,
         replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves shall
         have memory stop feature and calibrated nameplate with position indication.

PART 3 EXECUTION
3.01 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
C. Remove scale and dirt on inside and outside before assembly.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or
caps.
E. After completion, fill, clean, and treat system.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Route piping in orderly manner, parallel to building structure, and maintain gradient.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors.
E. Slope piping and arrange to drain at low points.
F. Provide stainless steel escutcheon plates or other trim/flashing wherever pipes penetrate walls
   above grade, exterior and interior.
G. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

3.03 FUSION EPOXY COATED PIPING (CONDENSER WATER)
A. All fusion epoxy coated piping, supports and appurtenances shall be fully assembled, either in
   the shop, or in the field, prior to coating.
   1. Fabricate all piping sections, in lengths and configurations suitable for fluidized bed
      dimensions. Fabrication shall include all required couplings, thread-o-lets, taps, welded
      pipe supports, etc. Surface shall be blast cleaned to SSPC-SP 10. Application method
      shall be by the fluidized bed method, comprised of heating the pipe segment to 450 to 475
      degrees F (as recommended by manufacturer) and dipping into the fluidized bed of
      powder, effectively fusing the epoxy powder to the part. Flange faces and other areas
      requiring exposed metal surfaces shall be masked from the epoxy coating.
2. Field connections for all epoxy coated piping systems shall be of mechanical means. Field welding is not acceptable.
3. Any sections requiring modifications shall be modified, test fit, and returned to the furnace for coating. Allow sufficient fabricated and coated spool pieces to allow fit up in the field.
4. Touch up any damaged surfaces after installation as specified above.
5. All structural attachments welded to condenser water piping shall be fusion epoxy coated.
6. Coat all epoxy coated piping with UV inhibitor paint to prevent UV degradation of the epoxy coating.

3.04 TESTING
A. Unless otherwise noted, hydrostatically test all piping installed under this contract to 1-1/2 times the normal working pressure or 150 psig, whichever is higher for a period of not less than 4 hours with no visible signs of leakage.
B. Provide necessary caps or blinds to protect equipment not rated for test pressure (safety valves, regulators, etc.).
C. Refrigerant Vent and Purge Lines:
   1. Test purge and/or vent lines with air or nitrogen at 15 psig for 2 hours with no visible drop in pressure.
D. Pneumatic Testing:
   1. Pneumatic testing is expressly prohibited on any non-metallic piping.
   2. Other than as excepted above, pneumatic testing will not be considered without written consent from District or Engineer, and substantiation as to why hydrotesting is inapplicable. Additional testing requirements and measures may be required for a pneumatic test and will be considered on a case-by-case basis.
E. Reports: Submit test reports for all pipeline sections tested per Submittals requirements in Part 1 of this specification.

END OF SECTION
PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Expansion tanks.
   B. Air vents.
   C. Air separators.
   D. Strainers.
   E. Pump suction fittings.
   F. Combination fittings.
   G. Flow indicators, controls, meters.
   H. Relief valves.
   I. Pressure regulating valves.
   J. Link Seals.
1.02 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
1.03 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
1.04 DELIVERY, STORAGE, AND HANDLING
   A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
   B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
   C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS
2.01 BLADDER-TYPE EXPANSION TANKS
   A. Manufacturers:
      3. Wessels Company; Series NLA; www.westank.com
      4. Substitutions: See Section 01 60 00 - Product Requirements.
   B. Construction: Pre-charged steel expansion tank with heavy-duty butyl rubber bladder. The tank shall have NPT system connections and a .302"-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet the system requirements. The tank must be constructed in accordance with most recent addition of Section VIII of the ASME Boiler and Pressure Vessel Code.
   C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to as scheduled psi.
   D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.
   E. Size: As scheduled on Drawings
2.02 AIR VENTS

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Standard Duty: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. High Capacity: Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.03 AIR SEPARATORS

A. Combination Air Separators/Strainers:
   1. Manufacturers:
      b. ITT Bell & Gossett; Model Rolairtrol: www.bellgossett.com.
   2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.04 STRAINERS

A. Size 2 inch and Under:
   1. Manufacturers:
      a. Mueller Steam Specialty Model 11MFCB or 351M
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Screwed bronze, steel or iron body for 150 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Flanged carbon steel or cast iron body for 150 psig (WOG) working pressure, Y pattern with 1/16" stainless steel perforated screen.

C. Size 5 inch and Larger:
   1. Manufacturers:
      2. Substitutions: See Section 01 60 00 - Product Requirements.
      3. Flanged carbon steel or iron body for 150 psig (WOG) working pressure, Y pattern with 1/8" stainless steel perforated screen.

D. Startup Screens
   1. Provide 20 mesh start up screens with all chilled and condenser water strainers.
      a. Run condenser water through strainers at minimum 70% of design flow for 4 hours or until pressure drop becomes excessive.
      b. Remove screens, thoroughly clean, replace, and operate system for 12 additional hours.
      c. Remove startup screens and put system back in operation.
2.05 SUCTION DIFFUSERS

A. Manufacturers:
   1. Mueller Steam Specialties, Model 1011
   2. ITT Bell & Gossett; Model SD: www.bellgossett.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.06 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. Mueller Steam Specialties, Model 721.
   2. Bell & Gossett; Model 3D.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.07 BTU METERS AND FLOW METERS

A. BTU meters and flow meters specified and provided under 23 09 23 Direct-Digital Control System for HVAC, installed by mechanical contractor.

2.08 MOTORIZED CONTROL VALVES

A. Motorized control valves specified and provided under 23 09 23 Direct-Digital Control System for HVAC, installed by mechanical contractor.

2.09 RELIEF VALVES

A. Manufacturers:
   3. Hoffman Specialty.

B. Bronze body and spring cage, silicone seat, fabric reinforced molded diaphragm shall isolate spring from water at all times, automatic, direct pressure actuated, capacities ASME certified and labelled. Size and setting as shown on drawings.

2.10 PRESSURE REGULATING VALVES

A. Manufacturers:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Bronze body and spring cage, stainless steel spring, seat, adjusting screw and fasteners. Maximum working pressure of 400 psig, temperature range 33 to 180 degrees F. Integral bypass relief. Water tight sealed cage design and replaceable seat.

2.11 LINK SEALS

A. The pipe to wall penetration closures shall be Link-Seal, as manufactured by Thunderline Corporation, or approved equal.

B. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely
assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.

C. After the seal assembly is positioned in the opening, tightening of the bolts shall cause the rubber sealing elements to expand and effect a watertight seal between the pipe and opening.

D. Manufacturer shall be consulted for exact size of opening and model/construction of seal to be used for each application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blow down connection.

E. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

F. Support pump fittings with floor mounted pipe and flange supports.

G. Provide relief valves on low pressure side of reducing valves, and expansion tanks.

H. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

I. Pipe relief valve outlet to nearest floor drain.

END OF SECTION
SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Base mounted pumps.

1.02 REFERENCE STANDARDS
A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.
B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
D. Millwright's Certificate: Certify that base mounted pumps have been aligned.
E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. ITT Bell & Gossett: www.bellgossett.com.
B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HVAC PUMPS - GENERAL
A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 BASE MOUNTED PUMPS
A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 175 psi maximum working pressure.
B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
C. Impeller: Bronze, fully enclosed, keyed to shaft.
D. Bearings: Oil lubricated roller or ball bearings.
E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.
F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.
G. Drive: Flexible coupling with coupling guard.
H. Baseplate: Cast iron or fabricated steel with integral drain rim.

PART 3 EXECUTION

3.01 PREPARATION
A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
E. Provide air cock and drain connection on horizontal pump casings.
F. Provide drains for bases and seals, piped to and discharging into floor drains.
G. Check, align, and certify alignment of base mounted pumps prior to start-up.
H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.
I. Lubricate pumps before start-up.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Cleaning of piping systems.
   B. Chemical treatment.
   C. Non-chemical treatment.

1.02 SUBMITTALS
   A. See Division 1 for Submittal Procedures.
   B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
   C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
   D. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
   E. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
   F. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.03 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full-time service personnel.
   B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.04 REGULATORY REQUIREMENTS
   A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

1.05 COORDINATION
   A. Coordinate with chemical supplier for means and methods of flushing and cleaning operations.
   B. Coordinate with District for final filling and chemical treatment of the chilled water system.

1.06 ESTIMATED SYSTEM VOLUMES
   A. The following are estimates of the volumes of the systems installed under this contract. Bidders are encouraged to perform their own estimates for verification and accuracy. Actual chemical requirements shall be based on the as-built volume of the systems as determined by the fill metering specified herein. These estimates are provided as a courtesy and shall not be binding for determination of quantity or cost of chemicals for the final installed system. Any deviations from the quantities listed below shall not result in any increase in cost.
      1. Chilled Water System: approximately 8,500 gallons
      2. Condenser Water System: approximately 1,450 gallons

PART 2 PRODUCTS

2.01 CLEANING OF PIPING SYSTEMS
   A. MANUFACTURERS
      2. Substitutions: See Section 01 60 00 - Product Requirements.
B. MATERIALS
   1. Temporary Materials
      a. Pumps: Provide temporary circulating/injection pumps to flush and clean the new
         piping systems. Pumps shall be of the same size and capacity as required for the chemical
         cleaning operation as recommended by the chemical supplier/cleaning agency.
      b. Piping Systems: Provide necessary pipe, valves, fittings, hoses, etc. as required to
         complete piping loops to provide circulation necessary for cleaning operations.
      c. Power: Provide necessary power connections and safety devices to operate
         temporary pumps.
      d. Provide temporary water meters as required for determination of system volumes.
   2. System Cleaner:
      a. Manufacturers:
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Liquid alkaline compound with emulsifying agents and detergents to remove grease
         and petroleum products; sodium tripoly phosphate and sodium molybdate.
      c. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.
   3. Closed System Treatment (Chilled Water - steel):
      a. Manufacturers:
         2) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Sequestering agent to reduce deposits and adjust pH.
      c. Corrosion inhibitorsMolybdate based inhibitor. Provide a 15 gallon container of
         treatment listed above - deliver to the Central Plant. DO NOT treat system. system
         will be filled from Central Plant treated water. Note that fill rate will be extremely
         prolonged due to limited make up rate of the Central Plant.

2.02 BY-PASS (POT) FEEDER
   A. Manufacturers:
      1. J.L. Wingert.
   B. 5.0 gal quick opening cap for working pressure of 175 psi.
   C. Feeder body shall be welded steel, with minimum 3-1/2" opening for chemicals, and a minimum
      of two system connection fittings. Feeder shall be primed and finished with corrosion resistant
      coating.

2.03 WATER METER
   A. Specified in Section 15128 - Gages and Meters

2.04 NON-CHEMICAL TREATMENT (CONDENSER WATER)
   A. Manufacturers:
      1. Dolphin WaterCare
   B. Description:
      1. Dolphin System shall consist of a components delivering alternating current pulse power
         from a Signal Generator panel to a Treatment Module piping assembly via an Umbilical
         Cable. Each Treatment Module assembly shall be equipped with a dedicated individual
         Signal Generator panel.
   C. Functions:
      1. To keep system free from mineral scale on the fill material, pipes, heat exchangers, pipes,
         valves and other components in the system by changing calcium carbonate nucleation
         from surface nucleation to colloidal nucleation, thereby lowering activation energy of
         colloidal nucleation.
      2. To control the population of microorganisms such as bacteria to 10,000 CFU/ml or below,
         by incorporation into colloidal precipitates (encapsulation) or through the pulsed power
         fields (electroporation) within the coil pipe assembly, regardless of what species are
present and how they may have mutated. Typically the total bacteria count (TBC) is in the range of 1,000 - 3,000 CFU/ml.

3. Blowdown shall contain no added water treatment chemicals required to achieve performance listed.

D. Signal Generator
1. Wall mounted a minimum of NEMA 3R metal enclosure, 304 brushed stainless steel case. Painted enclosure is not acceptable.
2. Terminal block for hard wiring to electrical power service.
3. Fused primary on 115v/1ph, or 208-230v/1ph (1" to 6" Dolphins) and primary and secondary on 208-230v/1ph, 460v/1ph powered units (8" to 16" Dolphins)
4. Dry form C contact (for building management system).
5. Remote Start-Stop capability with switch field installed.
6. Female locking receptacle for connecting the Signal Generator to the Treatment Module. Connection coded based on unit size to prevent mismatching of components.
7. LED Status indicating lights.
8. Powered Fan ventilation with inlet screen filter.
9. Pulsed power transformer and circuitry, which through a single set of coils uses alternating current of 60 cycles per second combined with over layered high frequency pulse signal to create a harmonic “ringing” signal of increasingly higher frequency until the decreasingly lower amplitude of this echo signal is damped down to zero. This effect imparts high frequency electric fields into the flowing water that includes frequencies in the kilohertz and megahertz range.
   a. A total of 240 pulses per second shall be provided.
   b. Devices which separately generate the high and low frequency signals shall not be acceptable.
   c. Devices which utilize separate sets of coils to independently receive the high and low frequency signals shall not be acceptable.
10. Primary service:
   a. 1" thru 6": 120 VAC or 208-230 VAC, 60 cycle, 1 ph, primary service.
   b. 8" thru 16": 208-230 VAC or 460 VAC, 60 cycle, 1 ph, primary service.
   c. 11 to 45 VAC secondary (depending on size).
11. 140 to 1770 VA primary (depending on size).

E. Treatment Module
1. PVC Sch. 80 with bare pipe ends for sizes 1" thru 16".
2. High temperature coil bobbin assemblies secured to pipe by circular clamps.
3. The Coils contained within a larger diameter PVC covering cylinder around the pipe and closed with PVC end caps with ventilation ports.
   a. Equipment requiring field modification by addition of ventilation or weep holes shall not be approved.
4. Integral Umbilical Cable for connection between the Treatment Module and the locking fitting on the Signal Generator.
   a. Standard Umbilical cables are:
      1) 10 ft. (Size 1" to 6")
      2) 26 ft. (size 8" to 16").
5. Built in thermal protection which shall automatically turn the Treatment Module to the OFF status when the operating temperature exceeds 200°F (PVC units 1" thru 6") or 190°F (PVC units 8" thru 16").
   a. The thermal protection for PVC units protects the internal circuitry from internally generated heat.
   b. The maximum applied fluid temperature of PVC units shall not exceed 140°F.
6. Building Management System Interface within the Signal Generator Panel:
   a. The interface to the building management system shall be through a FORM "C" dry relay contact located on the circuit board in the Signal Generator.
   b. The interface shall verify the following Dolphin operating status conditions.

DSA Re-submittal 6/21/2012

HVAC WATER TREATMENT

23 25 00 - 3
1) Primary Power Status - e.g. Loss of utility power, tripped circuit breaker, blown fuse or unit unplugged.
2) Secondary Power Status - e.g. Severed or removed coil assembly cable connection, defective transformer.
3) Treatment Module Operation Status - e.g. coil overheated.
4) Circuit Board Operation Status - e.g. Board overheated, electronic failure
5) In the event of one of the above anomalies, the supervisory contact shall change relay status.
   (a) Supervisory Contact power rating
   (b) 0.6 A at 125 VAC
   (c) 0.6 A at 110 VDC
   (d) 2.0 A at 30 VDC

7. Remote Start-Stop capabilities within the Signal Generator from external switch furnished by others:
   a. Shall turn off the Dolphin Treatment Module, while maintaining power to the Signal Generator.
      1) Status shall be indicated by a flashing green LED
   b. Switch shall be wired into predetermined contacts in the Signal Generator.
      1) 24v rated normally closed switch shall be provided by others.

8. Optional Field Connections: [OPTION SELECT]
   a. Furnish PVC Van Stone style (Slip-on) flanges for field mounting of Treatment Module
   b. Furnish Straub type couplings (Flex-L or Grip-L) for field connections

2.05 CONDUCTIVITY CONTROLLER
   A. Packaged Conductivity Meter/Controller: Provide a Conductivity meter/controller equal to Pulsafeeder MicroTRAC with electrodeless sensor
      1. Provide NEMA 4x enclosure
      2. LCD Display for setpoint and actual conductivity readout, Solid-state circuitry, 5 percent accuracy.
      3. Control function lights, 120v/1ph output to control motorized bleed valve.
      4. Furnish with preassembled conductivity sensor in SCH 80 PVC Tee, PVC socket weld connections with preassembled cable connector to conductivity meter/controller.
      5. Conductivity sensor-probe shall be electrodeless. A contact-type electrode sensor shall not be accepted.
      6. Furnish with optional flow switch to disable motorized bleed valve when pumping system is off.

2.06 BLOWDOWN OR BLEED VALVE
   A. Provide Blowdown Solenoid valve or motorized ball valve equal to Belimo LF120 US, 115volt, single phase:
      1. Furnish cord with plug to connect to "Bleed" receptacle of the conductivity controller.
      2. Furnish with watertight cover to maintain NEMA 3R if installed outdoors.
      3. Install valved bypass around blowdown valve for servicing and emergency manual blowdown operation.
      4. Do not install strainer(s) in blowdown line.
      5. Install throttling valve downstream of the blowdown valve to make adjustments in blowdown volume rate if required.

2.07 CORROSION TEST COUPON ASSEMBLY
   A. Provide a corrosion coupon rack suitable for corrosion monitoring according to ASTM G-4-01(2008) equal to Advantage Controls Model ACR.
      1. Constructed of PVC pipe and fittings
      2. Furnish piping, isolation valves, and a visual water flow balancing device.
      3. Mount on a polyethylene panel suitable for wall mounting.
PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system, and to determine cleaning agent and final chemical dosing requirements.

B. Bypass terminal control valves during cleaning. Provide bypasses at each terminal unit.

C. Provide taps/nozzles and valves for temporary pump connections.

D. Do not chemically clean permanent pumps, heat transfer devices or control components. Isolate prior to cleaning.

E. Verify that electric power is available and of the correct characteristics.

3.02 CLEANING SEQUENCE

A. Clean the condenser water and chilled water system installed under this contract.

B. Concentration:
   1. As recommended by manufacturer.

C. Temporary Materials:
   1. Pumps: Provide temporary circulating/injection pumps to flush and clean the new piping systems. Pumps shall be of the size and capacity as required for the chemical cleaning operation as recommended by the chemical supplier/cleaning agency.
   2. Piping Systems: Provide necessary pipe, valves, fittings, hoses, etc. as required to complete piping loops to provide circulation necessary for cleaning operations. Provide necessary temporary piping and hoses to drain systems to sanitary sewer.
   3. Power: Provide necessary power connections and safety devices to operate temporary pumps.

D. Drainage: All systems draining shall be to sanitary sewer.

E. Chilled Water Systems:
   1. Provide temporary bypasses, nozzles, valves and crossovers to allow circulation of systems without the use of the permanent pumps (if any).
   2. Fill the system with water and initially circulate and flush the system without cleaner to remove large debris.
   3. After the initial flush is complete, circulate system with temporary pumps while injecting chemical. Test system at remote points to ensure chemical is being distributed throughout the system. Circulate with chemicals for a duration as recommended by the chemical supplier.
   4. Drain and flush system with clean water. Test for residual chemical. Re-flush as required to attain dilution as per supplier’s recommendation.
   5. Fill hydronic systems with clean water and treat with final chemicals.

F. Use neutralizer agents on recommendation of system cleaner supplier and approval of Engineer.

G. Remove, clean, and replace strainer screens.

3.03 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

3.04 CLOSEOUT ACTIVITIES

A. Training: Train District’s personnel on operation and maintenance of non-chemical and chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.
SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Metal ductwork.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS
   B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or
      Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.
   C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon,
      Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability,
      Solution Hardened, and Bake Hardenable; 2011.
   D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon,
      Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and
      Ultra-High Strength; 2010.
   E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National
      Fire Protection Association; 2009.
   F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air
      Conditioning Contractors' National Association; 2005.
   G. SMACNA Guidelines for Seismic Restraints of Mechanical Systems

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for duct materials.

1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the type of products
      specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

2.02 MATERIALS
   A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B,
      with G60/Z180 coating.
   B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and
         compatible with substrates, and recommended by manufacturer for pressure class of
         ducts.
      2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when
         tested in accordance with ASTM E84.
   C. All Ducts: Galvanized steel, unless otherwise indicated.
   D. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

2.03 DUCTWORK FABRICATION
   A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal
      and Flexible, and as indicated.
   B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

DSA Re-submittal 6/21/2012

HVAC DUCTS AND CASINGS
C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Install ductwork in accordance with SMACNA Guidelines for Seismic Restraints of Mechanical Systems.

END OF SECTION
SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline exhaust fan.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS


B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL

A. Base fan performance at standard conditions (density 0.075 Lb/ft³).

B. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.

C. Each fan shall be belt drive in AMCA arrangement 9.

D. Fans are to be equipped with lifting lugs.

E. After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc. Fan shall then be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be Industrial gray. Coating must exceed 1,000-hour salt spray under ASTM B117 test method.

DSA Re-submittal 6/21/2012

HVAC POWER VENTILATORS
2.03 FAN HOUSING AND OUTLET
A. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
B. Tubular fan housing shall be completely welded and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be gray. No uncoated metal fan parts will be allowed.
C. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
D. All mixed flow housings shall include welded steel vanes to straighten airflow prior to exiting the fan discharge.
E. Units up to size 27 shall incorporate a universal mounting system that allows the fan to be mounted in either vertical or horizontal configurations and field rotation of the motor position in 90 degree increments. Bearing life shall not be reduced below specified level in different configurations. Units size 30 and larger shall allow for field rotation of motor positions. Units shall accommodate base mount or ceiling hung mounting without structural modifications to the fan.
F. An access door shall be supplied for impeller inspection and service.
G. OSHA compliant belt guard or motor cover to be included to completely cover the motor pulley and belt(s).

2.04 FAN IMPELLER
A. Fan impeller shall be mixed flow design. The impeller shall be electronically balanced both statically and dynamically to balance grade G6.3 per ANSI S2.19.
B. Fan impeller shall be manufactured with continuously welded steel airfoils and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be industrial gray
C. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

2.05 FAN MOTORS AND DRIVE
A. Motors shall meet or exceed EPACT (Energy Policy ACT) efficiencies. Motors to be NEMA T-frame, 1800 or 3600 RPM, Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor.
B. Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
C. Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
D. Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.
E. Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.
F. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class Average Life or (L-50) of 400,000 hours.
G. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
H. Bearings shall have extended lube lines with Zerk fittings to allow for lubrication.
PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with contract drawings and manufacturer's instructions.
B. Provide sheaves required for final air balance.

END OF SECTION
SECTION 23 64 16
CENTRIFUGAL WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Chiller package.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.
D. Test Reports: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature.
E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
F. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.
G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in District's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.06 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide a five year warranty to include coverage for compressor including materials only.
C. A refrigerant warranty shall be provided for a period of 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. McQuay: www.mcquay.com

2.02 UNIT DESCRIPTION
A. Provide and install as shown on the plans a factory assembled, charged, and tested water-cooled packaged centrifugal chiller. Chillers shall have no more than two oil-free, magnetic bearing, semi-hermetic centrifugal compressors (no exceptions). Each compressor shall have an integrated variable-frequency drive operating in concert with inlet guide vanes for optimized full and part load efficiency. On two-compressor units, the evaporator and condenser...
refrigerant sides and the expansion valve shall be common and the chiller shall be capable of running on one compressor with the other compressor or any of its auxiliaries inoperable or removed.

B. Each chiller shall be factory run-tested under load conditions for a minimum of one hour on an AHRI certified test stand with evaporator and condenser water flow at job conditions (excluding glycol applications). Operating controls shall be adjusted and checked. The refrigerant charge shall be adjusted for optimum operation and recorded on the unit nameplate. Units operating with 50-Hz power shall be tested with a 50-Hz power supply. Any deviation in performance or operation shall be remedied prior to shipment and the unit retested if necessary to confirm repairs or adjustments. Manufacturer shall supply a certificate of completion of a successful run-test upon request.

2.03 DESIGN REQUIREMENTS

A. General: Provide a complete water-cooled, semi-hermetic oil-free centrifugal compressor water chiller as specified herein. The unit shall be provided according to standards indicated in Section 1.02. In general, unit shall consist of one or two magnetic bearing, completely oil-free centrifugal compressors, refrigerant, condenser and evaporator, and control systems including integrated variable frequency drive, operating controls and equipment protection controls. Chililers shall be charged with refrigerant HFC-134a. If manufacturer offers a chiller using any HCFC refrigerant that is subject to phase out by the Montreal Protocol or the U.S. Clean Air Act, manufacturer shall provide, in writing, documentation signed by an officer of the company assuring refrigerant availability and price schedule for a 20-year period.

B. The entire chiller system, including all pressure vessels, shall remain above atmospheric pressure during all operating conditions and during shut down to ensure that non-condensables and moisture do not contaminate the refrigerant and chiller system. If any portion of the chiller system is below atmospheric pressure during either operation or shut down, the manufacturer shall include, at no charge:

1. Purge System
   a. A complete purge system capable of removing non-condensables and moisture during operation and shut-down. The system shall consist of an air cooled condensing unit, purge condensing tank, pumpout compressor, and control system.
   b. A dedicated condensing unit shall be provided with the purge system to provide a cooling source whether or not the chiller is running. The condensing unit shall provide a low purge coil temperature to result in a maximum loss of 0.1 pounds of refrigerant per pound of purged air.
   c. The purge system shall be connected to a 100% reclaim device.
   d. A 20-year purge maintenance agreement that provides parts, labor, and all preventative maintenance required by the manufacturer's operating and maintenance instructions.

2. Annual Oil/Refrigerant Analysis
   a. The manufacturer shall also include at no charge for a period of 20 years an annual oil and refrigerant analysis report to identify chiller contamination due to vacuum leaks.
   b. If the analysis identifies water, acid, or other contaminant levels higher than specified by the manufacturer, the oil and/or refrigerant must be replaced or returned to the manufacturer's original specification at no cost to the owner.

3. Shell Pressurization System
   a. The manufacturer shall include a factory-installed and wired system that will enable service personnel to readily elevate the vessel pressure during shutdown to facilitate leak testing.
   b. A shell pressurization system shall be provided to keep air out of the chiller when the unit is not in service. Electric blanket or hot water circulation system are both acceptable.

C. Performance: Refer to chiller performance rating.
D. Acoustics: Sound pressure for the unit shall not exceed the following specified levels. Provide the necessary acoustic treatment to chiller as required. Sound data shall be measured in dB according to AHRI Standard 575 and shall include overall dBA. Data shall be the highest levels recorded at all load points. (Sound Pressure (dB) measured in accordance with ANSI/AHRI Standard 575-2008 (A-weighted))

<table>
<thead>
<tr>
<th>Load</th>
<th>Overall (A Weighted)</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1000Hz</th>
<th>2000Hz</th>
<th>4000Hz</th>
<th>8000Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>80.5</td>
<td>37.5</td>
<td>51.5</td>
<td>59.5</td>
<td>72.0</td>
<td>75.0</td>
<td>72.5</td>
<td>76.5</td>
<td>75.0</td>
</tr>
<tr>
<td>75</td>
<td>78.0</td>
<td>37.0</td>
<td>50.5</td>
<td>62.5</td>
<td>66.5</td>
<td>70.0</td>
<td>69.5</td>
<td>74.0</td>
<td>70.5</td>
</tr>
<tr>
<td>50</td>
<td>75.0</td>
<td>37.5</td>
<td>50.0</td>
<td>60.0</td>
<td>65.0</td>
<td>65.5</td>
<td>66.0</td>
<td>71.5</td>
<td>66.0</td>
</tr>
<tr>
<td>20</td>
<td>73.5</td>
<td>37.5</td>
<td>49.0</td>
<td>59.0</td>
<td>63.0</td>
<td>65.0</td>
<td>66.0</td>
<td>69.5</td>
<td>64.0</td>
</tr>
</tbody>
</table>

2.04 CHILLER COMPONENTS

A. Compressors:

1. The unit shall utilize magnetic bearing, oil-free, semi-hermetic centrifugal compressors. The levitated shaft position shall be digitally controlled and shall be monitored by X-axis position sensor, Y-axis position sensor, and Z-axis position sensor. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure by diverting stored power to the magnetic bearing control system.

2. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be compatible with variable frequency drive operation.

3. If unit contains an atmospheric shaft seal, the manufacturer shall provide the following at no additional charge:
   a. 20 year warranty and all preventive maintenance required to maintain the shaft seal including appropriate disposal of all oil lost through the shaft seal. Such disposal shall be done in a manner consistent with all Federal, state, and local laws pertaining to disposal and documentation of appropriate disposal shall be provided.
   b. Replacement and re-charging on a semi-annual basis, or more often if required, of all oil lost through the shaft seal.
   c. 20 year refrigerant replacement warranty for any loss of refrigerant that can be directly attributable to the failure of the atmospheric shaft seal.

4. If the compressor drive motor is an open design the chiller manufacturer shall provide at no additional charge a self contained air conditioning system in the mechanical space sized to handle the maximum heat output the open drive motor. The energy required to operate this air conditioning system shall be added to the chiller power at all rating points for energy evaluation purposes.

5. If the compressor drive motor uses any form of antifriction bearings (roller, ball, etc) the chiller manufacturer shall provide the following at no additional charge:
   a. A 20 year motor bearing warranty and all preventative maintenance, including lubrication, required to maintain the bearings as specified in the manufacturer's operating and maintenance instructions
   b. At start up a three axis vibration analysis and written report which establishes a baseline of motor bearing condition.
   c. An annual three axis vibration analysis and written report to indicate the trend of bearing wear.

6. The chiller shall be equipped with an integrated Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. Movably inlet guide vanes and variable compressor speed acting together, shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.

7. Each compressor circuit shall be equipped with a 5% rated line reactor to help protect against incoming power surges and help reduce harmonic distortion.
8. The unit shall have a minimum of a 0.90 power factor at compressor full load.

B. Evaporator and Condenser:
1. The evaporator and condenser shall be separate vessels of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII. Regardless of the operating pressure, the refrigerant side of each vessel will bear the ASME stamp indicating compliance with the code and indicating a test pressure of 1.1 times the working pressure, but not less than 100 psig. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required.

2. The evaporator shall be flooded type with 0.025 in. wall copper internally and externally enhanced tubes rolled into carbon steel tubeshells. The water side shall be designed for a minimum of 150 psig. The refrigerant side shall be designed for a minimum of 200 psi. Provide intermediate tube supports at a maximum of 18 inch spacing. The heads shall be carbon steel and the tubeshells shall be carbon steel. Water connections shall be grooved suitable for Victaulic couplings. The evaporator shall have dished heads with valved drain and vent connections. The evaporator shall have left-hand connections when looking at the unit control panel.

3. The condenser shall have 0.025 in. wall copper internally and externally enhanced tubes rolled into carbon steel. Water connections shall be grooved suitable for Victaulic couplings. The water side shall be designed for a minimum of 150 psig and the refrigerant side shall be designed for a minimum of 200 psi. Provide intermediate tube supports at a maximum of 18 inch spacing. The condenser shall have dished heads with valved drain and vent connections. The heads shall be carbon steel and the tubeshells shall be carbon steel. The condenser shall have left-hand connections when looking at the unit control panel.

4. Provide sufficient isolation valves and condenser volume to hold the full unit refrigerant charge in the condenser at 90°F in accordance with ANSI/ASHRAE 15.4 during servicing or provide a storage tank sufficient to hold the charge of the largest unit being furnished.

5. An electronic expansion valve shall control refrigerant flow to the evaporator. Fixed orifice devices or float controls with hot gas bypass are not acceptable because of inefficient control at low load conditions. The liquid line shall have moisture indicating sight glass.

6. Re-seating type spring loaded pressure relief valves according to ASHRAE-15 safety code shall be furnished. The evaporator shall be provided with single or multiple valves. The condenser shall be provided with dual relief valves equipped with a transfer valve so one relief valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the condenser. Rupture disks are not acceptable. If rupture disks are required on negative pressure units to prevent air and moisture ingress, then factory mounted spring loaded pressure relief valves shall be provided in series with the rupture disks to contain the remaining refrigerant in the event of vessel over-pressurization. The space between the rupture disk and the relief valve shall include a suitable telltale indicator integrated into the chiller control system to alert the operator that a potential safety issue exists in the pressure relief system.

7. The evaporator, including water heads, suction line, and any other component or part of a component subject to condensing moisture shall be insulated with UL recognized 3/4 inch closed cell insulation. All joints and seams shall be carefully sealed to form a vapor barrier.

8. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow. Paddle and pressure differential type switches are not acceptable due to high rates of failure and false indications from these types of flow indicators.

C. Long Term Reliability:
1. All compressor/motor designs that require oil to lubricate their respective roller/ball bearing system must denote exactly how many gallons of oil are required for safe operation. The manufacturer must then provide the engineer and owner with a real world energy analysis showing the energy degradation over time due oil contamination of heat transfer surfaces.
2. Chillers containing oil shall include a 10 year parts and labor warranty on all oil system components including:
   a. Pumps
   b. Starter
   c. Piping
   d. Tank
   e. Heater
   f. Cooler
   g. Controls
   h. Valves
3. Manufacturer shall be responsible for covering all costs associated with annual oil and oil filter changes plus oil analysis as required.

D. Vibration Isolation
   1. Provide neoprene waffle-type vibration isolators for each corner of the unit.

E. Power Connections
   1. Power connection shall be single point to a factory-mounted disconnect switch.

F. Chiller Control
   1. The unit shall have a microprocessor-based control system consisting of a 15-inch VGA touch-screen operator interface and a unit controller.
   2. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:
      a. Entering and leaving chilled water temperatures
      b. Entering and leaving condenser water temperatures
      c. Evaporator saturated refrigerant pressure
      d. Condenser saturated refrigerant pressure
      e. Percent of 100\% speed (per compressor)
      f. % of rated load amps for entire unit
   3. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following critical areas must be monitored:
      a. Compressor actual speed, maximum speed, percent speed
      b. Liquid line temperature
      c. Chilled water setpoint
      d. Compressor and unit state and input and output digital and analog values
   4. A fault history shall be displayed using an easy to decipher, color coded set of messages that are date and time stamped. Time interval scale shall be user selectable as 20 mins, 2 hours, or 8 hours. The alarm history shall be downloadable from the unit’s USB port. An operating and maintenance manual specific for the unit shall be viewable on the screen.
   5. All setpoints shall be viewable and changeable (multi-level password protected) on the touch screen and include setpoint description and range of set values.
   6. Automatic corrective action to reduce unnecessary cycling shall be accomplished through preemptive control of low evaporator or high discharge pressure conditions to keep the unit operating through abnormal transient conditions.
   7. Chiller plant optimization software for multiple chillers shall be provided including automatic control of at least two (2) chillers, evaporator and condenser pumps (primary and standby), up to 3 stages of cooling tower fan cycling control and a tower modulating bypass valve or cooling tower fan variable frequency drives.
   8. The factory mounted controller(s) shall support operation on a BACnet® network via one of the data link / physical layers as specified by the successful Building Automation System (BAS) supplier. BACnet MS/TP master (Clause 9).
9. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

10. Energy saving software logic shall at a minimum offer the following
   a. User programmable compressor soft loading
   b. Chilled water reset
   c. Demand limit control
   d. Staging options lead lag between multiple compressors on a single chiller or on multiple chillers
   e. Plotting of historic trends for optimizing efficiency

G. Insulation
   1. Insulation shall be factory installed to reduce heat loss and prevent condensation from forming. Insulation should cover:
      a. The evaporator barrel, tube sheet, and water heads.
      b. The suction line from the top of the evaporator to the compressor inlet flange.
      c. The compressor support brackets welded to the evaporator
      d. The liquid line from the expansion valve outlet to the evaporator inlet.

   2. Insulation shall be UL recognized (File # E55475), 3/4" thick ABS/PVC flexible foam with a skin. The K factor shall be 0.28 at 75°F. Sheet insulation shall be fitted and cemented in place forming a vapor barrier, then painted with a resilient epoxy finish that resists cracking.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer’s instructions.
   B. Provide for connection to electrical service.
   C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
   D. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.
   E. Arrange piping for easy dismantling to permit tube cleaning.
   F. Provide piping from chiller relief valves to outdoors. Size as recommended by manufacturer.
   G. Arrange piping to allow for dismantling to permit head removal and tube cleaning.
   H. Coordinate electrical installation with electrical contractor.
   I. Coordinate controls with controls contractor.
   J. Provide material required for a fully operational and functional chiller.

3.02 SYSTEM STARTUP
   A. Factory Start-up Services: Provide for as long a time is necessary to ensure proper operation of the unit, but in no case for less than two full working days. During the period of start-up, the start-up technician shall instruct the owner’s representative in proper care and operation of the unit.
   B. Interconnection of the RS485 wiring interconnecting between each chiller with the addition of the communication isolation boards 485OPDR shall be made.
   C. Supply initial charge of refrigerant and oil.
   D. Demonstrate system operation and verify specified performance.

END OF SECTION
SECTION 23 65 13
INDUCED DRAFT COOLING TOWERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Cooling tower.
B. Centrifugal Separator

1.02 REFERENCE STANDARDS
A. CTI ATC-105 - Acceptance Test Code; Cooling Technology Institute; 2000.
C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.
C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.
D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
E. Manufacturer's Certificate: Certify that cooling tower performance, based on CTI ATC-105 or CTI STD-201 meet or exceed specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.
F. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories.
G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in District's name and registered with manufacturer.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 10 years of experience and approved by manufacturer.

1.05 REGULATORY REQUIREMENTS
A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.
B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide a five year warranty to include coverage for corrosion resistance of cooling tower structure labor only.
PART 2 PRODUCTS

2.01 MANUFACTURERS

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COOLING TOWER

A. 1500 SERIES

1. General: Furnish and install, as shown on plans, factory-assembled, induced draft, crossflow cooling tower(s) with vertical air discharge conforming in all aspects to the specifications, schedules and as shown on the plans.

2. Thermal Capacity: The cooling tower(s) shall be warranted by the manufacturer to meet performance as shown on plans. Additionally, the thermal performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201. Lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC-105, by the Cooling Technology Institute or other qualified independent third party testing agency. Manufacturer's performance guarantees or performance bonds without CTI Certification or independent field thermal performance test shall not be accepted. The cooling tower shall comply with the energy efficiency requirements of ASHRAE Standard 90.1.

3. Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel panels and structural members must be protected with the BALTIBOND® Corrosion Protection System. The system shall consist of G-235 (Z700 metric) hot-dip galvanized steel prepared in a four-step (clean, pretreat, rinse, dry) process with an electrostatically sprayed, thermosetting hybrid polymer fuse-bonded to the substrate during a thermally activated curing stage and monitored by a 23-step quality assurance program. Coatings other than the BALTIBOND® Corrosion Protection System must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, resulting in the following results as a minimum:

a. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of 5% salt spray per ASTM B117 without blistering, chipping, or loss of adhesion;

b. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95°F (35°C) without signs of chemical attack;

4. Shall withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer;

5. Shall withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties;

6. Shall withstand 200 thermal shock cycles between -25°F and +180°F (-32°C and 82°C) and without loss of adhesion or other deterioration;

a. Shall withstand 6000 hours of exposure to 60 psi (42184.2 kg/m2) water jet without signs of wear or erosion.

B. CONSTRUCTION DETAILS

1. Cold Water Basin: The cold water basin shall be constructed of heavy-gauge Type 304 stainless steel panels and structural members. All factory seams shall be welded to ensure watertight construction and welded seams shall be warranted against leaks for a period of five (5) years from date of shipment. Stainless steel basins with bolted seams are not acceptable. Basin shall include a depressed section with drain/clean-out connection. The basin area under the fill shall be sloped toward the depressed center section to facilitate cleaning. Standard basin accessories shall include a corrosion resistant make-up valve with large diameter plastic float for easy adjustment of the operating water level.

2. Water Outlet: The water outlet connection shall be beveled for welding and grooved for mechanical coupling or bolt hole circle designed to accept an ASME Class 150 flat face flange. The outlet shall be provided with large area lift out strainers with perforated openings sized smaller than the water nozzles and an anti-vortexing device to prevent air

DSA Re-submittal 6/21/2012
entainment. The strainer and vortex device shall be constructed of the same materials as the cold water basin to prevent dissimilar metal corrosion.

3. Water Distribution System: The distribution system shall be furnished with a single water inlet. The pipe stub connection shall be beveled for welding and grooved for mechanical coupling. The hot water distribution system shall consist of an integral strainer that feeds to an open gravity type basin, for easy cleaning, and constructed of heavy-gauge G-235 (Z700 metric) hot-dip galvanized steel. The basins must be accessible from outside the unit and serviceable during tower operation. Basin weirs and plastic metering orifices shall be provided to assure even distribution of the water over the fill. Lift-off distribution covers shall be constructed of heavy-gauge G-235 (Z700) hot-dip galvanized steel. Gravity flow nozzles shall be snap-in type for easy removal. Should pressurized nozzles be used, they shall utilize grommets, which ensure easy removal.

C. MECHANICAL EQUIPMENT
1. Fan(s): Fan(s) shall be axial flow with aluminum alloy blades selected to provide optimum cooling tower thermal performance with minimal sound levels. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum tip clearance for maximum fan efficiency. The top of the fan cylinder shall be equipped with a conical, non-sagging removable fan guard.
2. Bearings: Fan(s) and shaft(s) shall be supported by heavy-duty, self-aligning, grease packed ball bearings with moisture proof seals and integral slinger collars, designed for a minimum L10 life of 40,000 hours (280,000 Hr. Avg. Life).
3. Fan Drive: The fan(s) shall be driven by a one-piece, multi-groove, solid back V-type powerband with taper lock sheaves designed for 150% of the motor nameplate horsepower. The powerband shall be constructed of neoprene reinforced polyester cord and be specifically designed for cooling tower service.
4. Sheaves: Fan and motor sheave(s) shall be fabricated from corrosion-resistant materials to minimize maintenance and ensure maximum drive and powerband operating life.
5. Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type designed specifically for cooling tower service. The motor shall be furnished with special moisture protection on winding, shafts, and bearings and appropriately labeled for “cooling tower duty.” Fan motors shall be inverter duty type designed per NEMA Standard MG1, Section IV Part 31.
6. Mechanical Equipment Warranty: The fan(s), fan shaft(s), bearings, mechanical equipment support, and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

D. FILL AND DRIFT ELIMINATORS
1. Fill and Drift Eliminators: The fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM 588) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The fill shall be suitable for entering water temperatures up to and including 120°F (48.9°C). The fill shall be manufactured, tested and rated by the cooling tower manufacturer and shall be elevated above the cold water basin to facilitate cleaning.

E. AIR INLET LOUVERS
1. Air Inlet Louvers: Air inlet louvers shall be separate from the fill and be removable to provide easy access for inspection of the air/water interface at the louver surface. Louvers shall prevent water splash-out during fan cycling and be constructed of maintenance free, corrosion resistant, UV protected, fiberglass reinforced polyester (FRP).

F. ACCESS
1. Plenum Access: Hinged access doors shall be provided on two sides of the tower for access into plenum section.

G. ACCESSORIES
1. Vibration Cutout Switch: Provide local mechanical reset style, one pole, double throw, contacts rated for 15 amps 125 vac or 480 vac. Switch shall not require external power source, and shall be connected to fan controls by installing contractor.
2. Basin Sweeper Piping: The cold water basin of the cooling tower shall be equipped with PVC basin sweeper piping with plastic eductor nozzles. The piping should create a grid under the fill section and force all dirt and debris to the depressed section of the cold water basin.


4. Internal Platform: An internal platform shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf (244 kg/m²) live load or 200 pound (90.7 kg) concentrated load. Other components of the cooling tower, i.e. basin floor and fill/drift eliminators, shall not be considered an internal working surface. Cooling tower manufacturers that require that these surfaces be used as a working platform shall provide a 5-year extended warranty to the Owner to repair any damage to these surfaces caused by routine maintenance.

5. Provide extended tube lines to facilitate lubrication from outside of cooling tower.

2.03 CENTRIFUGAL SEPARATOR

A. MANUFACTURER
   1. LAKOS Filtration Systems

B. PERFORMANCE
   1. Flow Capacity -- Unit shall have a flow capacity as scheduled. Shall be between 3-12 psi (.2 to .8 bar) remaining constant, varying only when the flow rate changes.
   2. Solids Removal Effectiveness
      a. All Systems - In a single pass through the separator, given solids with a specific gravity of 2.5 and water at 1.0, performance is expected to be 98% of 74 microns and larger. Additionally, particles finer in size, heavier by specific gravity and some lighter by specific gravity will also be removed, resulting in an appreciable aggregate removal of particles (up to 75%) as fine as 5 microns.
      b. In Recirculating Systems -- 98% performance is predictable to as fine as 40 microns (given solids with a specific gravity of 2.6), with correspondingly higher aggregate performance percentages (up to 90%) of solids as fine as 5 microns.
   3. Maximum working pressure: 150 psi (10.3 bar); Maximum operating temperature: 100°F (38°C).

C. CONSTRUCTION
   1. The separator package -- Shall provide for initial pre-straining prior to pump suction, followed by direct pumping through a specific centrifugal-action solids-from-liquid separator and immediate return of flow to the HydroBoosters. Separated solids shall be continuously bled from the separator's collection chamber into the package's integral solids recovery vessel and solids collection bag. Excess liquid shall pass through the bag and return to system flow via piping connected to the package's pump suction line. The separated solids shall be purged periodically to desired disposal with an automatic purge valve.
   2. Strainer -- Cast-iron housing; manual-cleaning; 9/32-inch (7 mm) minimum mesh rating; stainless steel basket.
   3. Pump -- End-suction, single stage; cast iron housing; iron impeller; bronze shaft sleeve; silicon carbide mechanical shaft seal; flooded suction required.
   4. Separator -- Centrifugal-action design, incorporating a true tangential inlet and mutually tangential Swirlux internal accelerating slots, employed to promote the proper velocity necessary for the removal of the separable solids. The internal accelerating slots shall be spiral-cut for optimum flow transfer, laminar action and particle influence into the separation barrel. The separator's internal vortex shall allow this process to occur without wear to the accelerating slots. Separated particle matter shall spiral downward along the perimeter of the inner separation barrel, in a manner which does not promote wear of the separation barrel, and into the solids collection chamber, located below the vortex deflector.
plate. The separator shall be of unishell construction with SA-36, SA-53B or equivalent quality carbon steel, minimum thickness of .25 inches (6.35 mm).

5. Automatic Purge Valve — In place of the solids recovery vessel, an electrically-actuated valve shall be programmed at appropriate intervals and duration in order to efficiently and regularly purge solids from the separator's collection chamber. Valve body shall be bronze (optional stainless steel also available). Valve ball shall be stainless steel with Teflon seat.

6. Inlet and Outlet - Shall be grooved couplings, size 3” inlet & 3” outlet.

7. Purge Outlet - Shall be threaded with a screw-on flange, size 3/4”.

8. Piping — Schedule 40 galvanized carbon steel; reinforced rubber hose to solids recovery vessel.

9. Electrical Control — IEC starter with overload module; HOA selector switch; NEMA-4x enclosure; re-set/disconnect/trip switch; 120 volt, single phase control voltage; CSA-approved. Power requirement: 208/230/460/575 volt, 3 phase, 60 Hz; or 380/415 volt, 3 phase, 50 Hz.

10. Valves — Ball valves on purge line for isolation of solids-handling/purging equipment. Provide inlet/outlet valve kit.

11. Paint Coating - Shall be oil-based enamel.

D. Purging and Solids Handling

1. Evacuation of separated solids shall be accomplished automatically, employing a motorized ball valve with integrally-equipped programming for controlling the frequency and duration of solids purging.

E. Piping between Lakos and Cooling Tower

1. PVC Pipe: ASTM D1785 or ASTM D2241, Schedule 80, coat with UV resistant coating suitable for outdoor use.
   a. Fittings: ASTM D2666, PVC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Provide the services of the manufacturer’s field representative to supervise rigging, hoisting, and installation, allowing for minimum of one eight hour day per tower.

C. Install tower on structural concrete curbs.

D. Connect condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

E. Connect make-up water piping with flanged or union connections to tower. Pitch to tower.

F. Connect overflow, bleed, and drain, to floor drain.

G. Connect vibration switch to fan controls to provide shut down upon trip. Adjust vibration switch per manufacturer’s instructions.

H. Provide factory-designed configuration of HydroBoosters for maximum efficiency and effectiveness.

3.02 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer’s field representative to inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer’s recommendations.

3.03 SYSTEM STARTUP

A. Start-up tower in presence of and instruct District’s operating personnel.

END OF SECTION
SECTION 26 05 01
MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify field measurements and circuiting arrangements are as shown on Drawings.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition drawings are based on casual field observation and existing record documents.
   D. Report discrepancies to Engineer before disturbing existing installation.
   E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   B. Coordinate utility service outages with utility company and Merritt College Campus.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized (480 volts or less) equipment or circuits, use personnel experienced in such operations.
   D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
   A. Remove, relocate, and extend existing installations to accommodate new construction.
   B. Remove abandoned wiring to source of supply.
   C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Remove electrical devices made abandoned by removal of mechanical equipment. Cut conduit flush with walls and floors, and patch surfaces.
   D. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
   E. Repair adjacent construction and finishes damaged during demolition and extension work.
   F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR
   A. Clean and repair existing materials and equipment that remain or that are to be reused.
   B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION
SECTION 26 05 10
ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working electrical installation, as shown on the drawings or described in these specifications.

1.02 REFERENCES

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean the latest edition of such publications adopted and published prior to submittal of the bid proposed. Such codes or standards shall be considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc., allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the drawings and specifications.

C. FM P7825 - Approval Guide; Factory Mutual

D. NEMA MG 1 - Motors and Generators

E. California Code of Regulations (CCR) Title 24, Part 3, Basic Electrical Requirements, State Building Standards Electrical Code

F. National Fire Protection Association (NFPA).


I. Equipment and materials specified under this Division shall conform to the following standards where applicable:
   1. UL Underwriters' Laboratories
   2. ASTM American Society for Testing Materials
   3. CMB Certified Ballast Manufacturers
   4. IPCEA Insulated Power Cable Engineer Assoc.
   5. NEMA National Electrical Manufacturer's Assn.
   6. ANSI American National Standards Institute
   7. ETL Electrical Testing Laboratories

J. All base material shall be ASTM and/or ANSI standards.

K. All electrical apparatus furnished under this Section shall conform to National Electrical Manufacturers Association (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

L. NECA (INST) Standard of Installation; National Electrical Contractors Association.

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Where items are noted as "or equal" a product of equal design, construction and performance will be considered. Contractor must submit all pertinent test data, catalog cuts and product information required to substantiate that the product is in fact equal. Refer to Division 1, General Requirement for additional requirements. Only ONE substitution will be considered for each product specified.

C. Submittals shall consist of detailed shop drawings, specifications, "catalog cuts" and data sheets containing physical and dimensioned information, performance data, electrical characteristics, material used in fabrication, material finish and shall clearly indicate those optional accessories which are included and those which are excluded. Furnish one reproducible and 4 prints of each shop drawing.
1.04 CUTTING, PAINTING AND PATCHING
   A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Engineer.
   B. Cutting and digging shall be under the direct supervision of the General Contractor. Include as necessary for the work in this section.
   C. The contractor shall be responsible for returning any surface from which he has removed equipment or devices to the condition and finish of the adjacent surfaces.

1.05 SUPERVISION
   A. Contractor shall personally or through an authorized and competent representative constantly supervise the work from beginning to completion and, within reason, keep the same workmen and foreman on the project throughout the project duration.

1.06 PROTECTION
   A. Keep conduits, junction boxes, and outlet boxes, and other openings closed to prevent entry of foreign matter; cover fixtures, equipment, and apparatus and protect against dirt, paint, water, chemical, or mechanical damage, before and during construction period. Restore to original condition any fixture, apparatus, or equipment damaged prior to final acceptance, including restoration of damaged shop coats of paint, before final acceptance. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

1.07 EXAMINATION OF SITE
   A. The Contractor shall visit the site prior to submitting bid, and determine the locale, working conditions, conflicting utilities, and the conditions in which the electrical work will take place. No allowances will be made subsequently for any costs which may be incurred because of any error or omission due to failure to examine the site and to notify the Engineer of any discrepancies between drawings and specifications and actual site conditions. Schedule visits at least 1 week in advance with District’s Maintenance staff.

1.08 PROJECT CONDITIONS
   A. Coordinate new 15 KV substation installation with size, location and installation of service utilities.
   B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.09 ENVIRONMENTAL REQUIREMENTS
   A. After other work such as sanding, painting etc. has been completed, clean lighting fixtures, panelboards, switchboards, and other electrical equipment to remove dust, dirt, and grease, or other marks, and leave work in clean condition.

1.10 VOLTAGE CHECK
   A. At the start and completion of job, check voltage at several points of utilization on the system which has been installed and reinstalled under this contract. During test, energize all loads installed. Measure 3-Phase voltages and note percentage differences. Verify phase rotation at the start and completion of job and prior to re-energizing electrical systems and before and after shutdowns. Submit report to Engineer. Include copy in O&M Manual.

1.11 WARRANTY
   A. See Division 1 - Closeout Submittals, for additional warranty requirements.
   B. Correct defective Work within a five year period after Date of Substantial Completion.

1.12 TESTS
   A. Perform tests as specified to prove installation is in accordance with contract requirements. Perform tests in the presence of the Engineer and furnish test equipment, facilities, and technical personnel required to perform tests. Tests shall be conducted during the construction
period and at completion to determine conformity with applicable codes and with these Specifications. Tests, in addition to specific system test described elsewhere, shall include:

1. Insulation Resistance: All 600 volt insulation shall be tested at 1,000 volts D.C for one minute on all feeder and branch circuit conductors including the neutral, and make a typed record of all readings to be included in the maintenance instructions. The direct current amperes shall be recorded at start and at one minute. The value shall be declining and not more than one microampere. All 15KV insulation shall be tested at 5,000 volts D.C. for 15 minutes, under IEEE 400.3 Acceptance Test Standard.

2. Circuit Continuity: Test all feeder and branch circuits for continuity. Test all neutrals for improper ground.

B. Equipment Operations: Test motors for correct operation and rotation.

C. Product Failure: Any products which fail during the tests or are ruled unsatisfactory by the Engineer shall be replaced, repaired, or corrected as prescribed by the Engineer at the expense of the Contractor. Tests shall be performed after repairs, replacements, or corrections until satisfactory performance is demonstrated.

D. Miscellaneous: Include all test results in the maintenance manual. Cost, if any, for all tests shall be paid by the Contractor.

1.13 DRAWINGS

A. Layout: General layout shown on the drawing shall be followed except where other work may conflict with the drawings.

B. Accuracy:

1. Drawings for the work under this section are diagrammatic.

2. Contractor shall verify lines, levels, and dimensions shown on the drawings and shall be responsible for the accuracy of the setting out of work and for its strict conformance with existing conditions at the site.

3. Contractor shall insure reconnection of existing equipment and circuits affected by contract demolition whether or not reconnection is specifically shown on the contract documents.

1.14 PROJECT RECORD DRAWINGS

A. Refer to General Conditions for contractual requirements. Provide project record drawings as required by the General Provisions of the specifications and as required herein. Such drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit and wire sizing as well as routing, revised fixture schedule listing the manufacturer and products actually installed and revised panel schedule. All changes to drawings shall be made by qualified draftspersons to match existing linework and lettering as close as possible. When all the changes have been made to the trade drawings, contractor shall produce one (1) full size (E-Size) updated set of trade drawing(s) utilizing AutoCad 2008 or newer and supply one (1) set of Compact Discs (CD's) reflecting same.

1.15 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Furnish to the Engineer four (4) hard back 3-ring binders containing all bulletins, operating and maintenance instructions and part lists and other pertinent information for each and every piece of equipment furnished under this specification. Include service telephone numbers. Each binder shall be indexed into sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

B. At the time of completion, a period of not less than eight hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with manufacturer's representative. The equipment manufacturer shall be requested to provide product literature and application guides for the user's reference. Costs, if any for the above services shall be paid by the Contractor.
1.16 Warranties

A. Furnish to the Campus three (3) and to the Engineer one (1) hard back 3-ring binders containing all warranties of every piece of equipment furnished under this specification. Include terms and limitations of warranties, contact names, addresses, and telephone numbers of manufacturer. Each binder shall be indexed into sections and labeled for easy reference for each equipment warranty.

1.17 Extra Materials

A. See Division 1 - Product Requirements, for additional provisions.

B. All special tools for proper operation and maintenance of the equipment provided under this Section shall be delivered to the District's representative.

Part 2 Products - Not Used

Part 3 Execution

3.01 Workmanship

A. Preparation, handling, and installation shall be in accordance with manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Coordinate work and cooperate with others in furnishing and placing this work. Work to reviewed shop drawings for work done by others and to field measurements as necessary to properly fit the work.

B. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

3.02 Installation

A. Install in accordance with manufacturer's instructions.

3.03 Starting Equipment and Systems

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Campus's designated representative.

END OF SECTION
SECTION 26 05 12
BASIC MATERIAL AND METHODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit, raceways and fittings.
B. Wires and Cables for 600 Volts and less.
C. Wire connections.
D. Wire devices.
E. Outlet boxes.
F. Pull and junction boxes.
G. Disconnect Switches.
H. Fuses.
I. Supporting Devices.
J. Identifying Devices.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Division 1 the following items:
B. A list of conduit types indicating where each type of conduit will be used. Indicate conduit manufacturers and fittings to be used.
C. Wires and Cables.
D. Wiring Devices and Plates
E. Nameplates, including engraving schedules where engraved plates are specified.

1.03 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.04 REFERENCES

B. ANSI C80.3 - American National Standard for Steel; Electrical Metallic Tubing, Zinc Coated - latest edition.
C. ANSI C80.5 - Rigid Aluminum Conduit - latest edition.
D. NECA (INST) - National Electrical Contractors Association; Standard for Installing Steel (Rigid, IMC, EMT) - latest edition.
E. NEMA FB 1 - National Electrical Manufacturers Association; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable Assemblies; latest edition.
F. NECA 1 - National Electrical Contractor Association; Standard Practices for Good Workmanship in Electrical Contracting; 2006
G. NEMA RN 1 - National Electrical Manufacturer Association; Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit - latest edition.
I. NEMA 3R - National electrical manufacturer Association; Indoor and Outdoor Protected Enclosure; 2005
PART 2 PRODUCTS

2.01 CONDUIT, RACEWAYS AND FITTINGS

A. Rigid Steel Conduit
1. Rigid steel conduit shall be full weight, pipe size, finished inside and out by hot-dip galvanizing after fabrication, and shall conform with ANSI C80.1 and UL.
2. Couplings shall be electroplated steel.
3. Insulating Bushings: Threaded polypropylene or thermo-setting phenolic rated 150°C minimum.
4. Insulated grounding Bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
5. Insulated Metallic Bushings: Threaded cast malleable iron body with plastic insulated throat rated 150°C.
6. Running threads are not acceptable.

B. Electrical Metallic Tubing (EMT):
1. Conduit: Conduit shall be formed of cold rolled strip steel, and shall comply with ANSI C80.3 and UL requirements.
2. Couplings: Electroplated steel, UL listed rain and concrete tight through 1-1/4" trade size.
   All EMT fittings shall be compression type.
3. Connectors: Steel, gland compression type with insulated plastic throat, 150°C temperature rated. All EMT fittings shall be compression type.

C. Liquid Tight Flexible Metal Conduit:
1. Conduit: Conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound. Flexible conduit, except where installed in concealed dry locations, shall be liquid tight with plastic jacket extruded over the outer zinc coating. No aluminum substitute will be accepted.
2. Fittings: Connectors shall be the screw clamp on screw-in (Jake) variety with cast malleable iron bodies and threaded male hubs with insulated throat or insulated bushings. Set screw type connectors are not acceptable. Liquid tight fittings shall be of cadmium plated cast malleable iron, with insulated throat.

D. Rigid Non-Metallic Conduit:
1. Conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could damage conductors or cables.

2.02 WIRING AND CABLES

A. Acceptable manufacturers: Cerro Wire Inc, Southwire, Industrial Wire & Cable or approved equal.

B. Conductor material: All wire and cable shall be insulated, stranded copper conductors. Soft drawn annealed copper wire 98% conductivity, bearing the UL label.

C. Minimum conductor size: AWG No. 12 for all power and lighting branch circuits. AWG No. 14 for all signal and control circuits.

D. Color Coding: System conductors shall be identified as to voltage and phase connections by means of color impregnated insulation or approved colored marking tape as follows:

E. For 120/240 volt, single phase, 3 wire system.
1. Phase A - Black
2. Phase B - Red
3. Phase C - Orange for High Leg (208v to neutral)
4. Neutral - White
5. Ground - Green

DSA Re-submittal 6/21/2012
F. For 120/208 volt, 3 phase, 4 wire systems.
   1. Phase A - Black
   2. Phase B - Red
   3. Phase C - Blue
   4. Neutral - White
   5. Ground - Green

G. for 277/480 Volt, 3 phase, 4 wire system
   1. Phase A - Brown
   2. Phase B - Orange
   3. Phase C - Yellow
   4. Neutral - Grey
   5. Ground - Green

H. Secondary Wire and Cable, 0 to 600 Volts;
   1. NEC Type THWN, or Type XHHW for feeders and branch circuits in wet or dry locations.
   NEC type THHN for branch circuits in dry locations.

2.03 WIRE CONNECTION

A. Wire Joints: Wires in sizes from #18 to #8 AWG, stranded conductor, with insulation rated 105 degrees C, or less shall be joined with electrical spring connectors of three part construction incorporating a non-restricted, zinc coated steel spring enclosed in a steel shell with an outer jacket of vinyl plastic with a flexible insulating skirt.

B. Mechanical Compression Connectors and Taps: Stranded conductors from #6 AWG to 750 Kcmil shall be joined or tapped using bolted pressure connectors having cast bronze compression bolts. Fittings shall be wide range-taking and designed to facilitate the making of parallel taps, tees, crosses or end-to-end connections. Split-bolt connectors will not be acceptable.

C. Fixture Connections: Splice fixture wire to circuit wiring with solderless connectors as specified above in paragraph A.

D. Terminating Lugs: Conductors from size No. 6 AWG to 750 Kcmil, copper, shall be terminated using tin plated hydraulically operated crimping tools and dies as stipulated by the lug manufacturer. Lugs shall be 3M "Scotchlok" series 30000, Burndy Type Ya-L series, or equal.

E. Splicing and Insulating Tape (600 volts and below): General purpose electrical tape shall be suitable for temperatures from minus 18 degrees C to 105 degrees C, shall be black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl with a dielectric strength of 10,000 volts. Apply 4 layers half-lap with 2" over-lay on each conductor.

F. Insulating Putty (600 volts and below): Pads or rolls of non-corrosive, self-fusing, one eighth inch thick rubber putty with PVC backing sheet. Putty shall be suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C and shall have a dielectric strength of 570 volts/mil minimum.

G. Insulating Resin: Two Part liquid epoxy resin with resin and catalyst in pre measured, sealed mixing pouch. Resin shall have a set up time of approximately 30 minutes at 21.1 degrees C, and shall have thermal and dielectric properties equal to the insulation properties of the cables immersed in the resin.

H. Terminal Strip Connectors: Terminate wire in locking tongue style, pressure type, solderless lug where applicable.

2.04 WIRING DEVICES

A. Switches: Specification grade, flush mounting, quiet operating AC type, with toggle operator, heat resistant plastic housing and self grounding metal strap. Silver or silver alloy contact. Rated 20A at 120-277V and capable of full capacity on tungsten or fluorescent lamp load. Design for up to #10 wire. Use single pole, double pole, three-way, four-way, lighted, pilot, or keyed type, as indicated on drawings or required. Provide ivory color unless otherwise noted. Manufacturer: Leviton, Arrow Hart, or Hubbell.

DSA Re-submittal 8/21/2012
26 05 12 - 3
B. Receptacles: Specification grade, flush mounting receptacles with nylon face. High grade brass allow triple wipe contacts. Provide 2 pole, 3 wire grounding type with a green colored brass hexagonal equipment grounding screw. Grounding shall be rivetless, single piece brass with no mechanical connections in the primary path between point of ground wire termination and ground blades. Use 20A rated receptacles, ivory in color, unless otherwise noted. Manufacturer: Leviton, Arrow Hart, or Hubbell.
   1. Isolated Ground - Provide separate path to ground, with orange faceplate or triangle to indicated isolated ground
   2. GFCI - Equipped with diagnostic indicator for miswiring.
   3. Weatherproof - GFCI type, outdoor rated, with metal lockable while in use cover

C. Faceplates: Provide nylon cover faceplates for wall receptacles, outlets, and switches. Include thermal mounting screws that match plate and device color. Manufacturer: Leviton, Arrow Hart, or Hubbell.

2.05 OUTLET BOXES
A. Standard outlet boxes: Galvanized, die formed or drawn steel, knock-out type of size and configuration best suited to the application indicated on the plans. Minimum box size, 4 inch square by 1-1/2 inch deep, indoor use. FS cast boxes are required for outdoor use.
B. Cast Metal Outlet Boxes: FS/FD cast boxes are required for outdoor use. Malleable iron alloy with threaded hubs and mounting lugs as required. Boxes shall be furnished with cast cover plates of the same material as the box and neoprene cover gaskets. Thomas and Betts, Crouse-Hinds, Appleton or equal.
C. Conduit Outlet Bodies: Cadmium plated, cast iron alloy. Ovoid conduit outlet bodies with threaded conduit hubs and neoprene gasketed, cast iron covers. Outlet bodies shall be used to facilitate pulling of conductors or to make changes in conduit direction only. Splices are not permitted in conduit outlet bodies. Thomas and Betts, Crouse Hinds Form 8 Condulets, Appleton form 35 Unilets, or equal.

2.06 PULL AND JUNCTION
A. Sheet Metal Boxes: Use standard outlet or concrete ring boxes wherever possible; otherwise use minimum 15 gauge get metal, NEMA 1 boxes, sized to code requirements with covers secured by cadmium plated machine screws located 6 inches on centers. Circle AW Products, Hoffman Engineering Co., or equal.
B. Cast Metal Boxes: Use standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron junction boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets. Appleton FS/FD series; Crouse Hinds FS/FD series, or equal.

2.07 DISCONNECT SWITCHES
A. All disconnect switches shall be heavy-duty type and have the number of poles, voltage rating, and horsepower rating as required by the motor or equipment. Disconnect switches shall be in enclosures to suit conditions, NEMA 1 for indoor and NEMA 3R for outdoor. Disconnect switches shall be fused unless otherwise noted on the drawings. As manufactured by: Eaton Cutler-Hammer, Square D - Class 3110, or equal.

2.08 COMBINATION MOTOR STARTER DISCONNECTS
A. NEMA 1, for indoors, sized per motor name plate. Minimum size 1
B. NEMA 3R, for outdoors, sized per motor nameplate. Minimum size 1
C. Furnish with Hand Off Auto (HOA) with indicator lights and disconnect handle switch

2.09 FUSES
A. Dual Element, Time Delay, UL Class RK5. Rejection type. Size and Voltage as indicated on equipment. Bussman, Little Fuse, or approved equal.
2.10 ELECTRICAL SUPPORTING DEVICES

A. Concrete Fasteners: Phillips "Red-Head" or equal, self drilling expansion type concrete anchor.

B. Conduit Straps: Hot-dip galvanized, cast malleable iron, two hole type strap with cast clamp-backs and spacers as required. OZ/Gedney No. 14-50G strap and #141G spacer; Efcor No. 231 strap, and No. 131 spacer; or approved equal.

C. Construction Channel: 1-1/2 inch by 1-1/2 inch 12 gauge galvanized steel channel with 9/16 inch diameter bolt holes, 1-1/2 inch on center, in the base of the channel. Kindorf 905 series, Unistrut P-1000-HS or equal.

D. Cable Ties and Clamps: Thomas and Betts Co. "Ty-Raps" Panduit "Pan-Ty" or equal one piece, nylon, reusable type lashing ties.

E. Fasteners (General): Wood screws for fastening to wood. Machine screws for fastening to steel. Toggle bolts for fastening to hollow concrete block, gypsum board, or plaster walls. Expansion anchors for attachments to pre-poured concrete.

2.11 IDENTIFYING DEVICES

A. Nameplates: Type NP: Engraved black bakelite, 1 inch by 3-1/2 inch, 1/8 inch high white letters, machine screw retained. For permanent identification of all switchboards, panelboards, circuit breakers in separate enclosures, motor starters, relays, time switches, disconnect switches and other cabinet-enclosed apparatus including terminal cabinets or match existing as closely as possible.

B. Legend Plates: Type LP: Die-stamped metal legend plate with mounting hole and positioning key for attachment to panel mounted operators' devices. Engraved paint-filled characters as specified.

C. Wire & Terminal Markers: Self-adhering, pre-printed vinyl with self-laminating wrap around strip. Markers shall be legible after termination. Brady B191 series, Thomas & Betts WSL series or equal.

D. Conductor Phase Markers: Thomas & Betts WCPHAS series or similar in addition to colored marking as specified under this section of the specifications.

PART 3 EXECUTION

3.01 CONDUIT AND RACEWAY APPLICATIONS

A. Rigid Steel Conduit: Use rigid steel conduit for the following locations or conditions:
   1. All exterior applications
   2. All conduits larger than 2" trade diameter.
   3. All conduits indoor below eight (8) feet above finished floor.

B. Electrical Metallic Tubing (EMT): EMT is allowed for the following conditions:
   1. Interior only and above eight (8) feet from finished floor.
   2. Interior only and when entering a panel from above.

C. Liquidtight Flexible Metallic Conduit: Use Liquidtight for the following conditions:
   1. In damp and wet locations for connections to motors, transformers, vibrating equipment and machinery.
   2. Connections to all pump motors, flow switches, and similar devices.

D. Rigid Non-Metallic Conduit, Polyvinyl Chloride (PVC) Schedule 40:
   1. Underground installation.

3.02 CONDUIT INSTALLATION

A. General
   1. All conduit runs shown on the plans are sized based on the use of rigid steel conduit and THWN copper conductors. If conductor type is changed the contractor shall be responsible for resizing conduits to meet code. In no case is conduit to be sized smaller than 3/4" trade diameter.
   2. Low voltage wiring shall be installed in conduit, minimum 3/4" trade diameter.
3. Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.
4. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading.
5. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field threaded joints to prevent corrosion.
6. In all empty conduits or ducts, install an 1100 pound tensile strength polyethylene pulling rope.
7. Conduit systems shall be electrically continuous throughout. Install code size, uninsulated, copper grounding conductors in all conduit runs. Grounding conductor shall be bonded to conduit, equipment frames and properly grounded.

B. Layout:
1. All new conduits shall be concealed. Any field conditions that does not allow concealment of conduits shall be reviewed with the Engineer prior to rough-in.
2. Locations of conduit runs shall be planned in advance of the installation and coordinated with concrete work, plumbing and framing.
3. Where practical install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary off-sets.
4. Low voltage conduit shall be grouped separately and labeled every 10 ft interval as to system (i.e., fire, control, etc)
5. Exposed conduit shall be run parallel or at right angles to the centerlines of the columns and beams.
6. Conduits shall not be placed closer than 12 inches from a parallel hot water or steam line or three inches from such lines crossing perpendicular to the runs.
7. In long runs of conduit, provide sufficient pull boxes per NEC inside buildings to facilitate pulling wires and cables. Support pull boxes from structure independent of conduit supports. These pull boxes are not shown on the plans.

C. Supports:
1. All raceway systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to Code.
2. Support single runs of conduit using two hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp blocks" to space conduit off the surface.
3. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from 3/8 inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard two hole pipe clamps. Provide lateral seismic bracing for hangers.
4. Installation
   a. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
      1) Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
      2) Do not drill or cut structural members.
   b. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
   c. Install surface-mounted cabinets and panelboards with minimum of four anchors.
   d. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
   e. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

D. Terminations and Joints:
1. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
2. Rigid conduit connection to enclosures shall be made by Myers type grounding hubs only. EMT connections to enclosures shall be made with compression connector with grounding lock-nuts or bushings.
3. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using appropriate connectors and hubs.
4. Install expansion couplings where any conduit crosses a building separation or expansion joint.
5. Install cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or caulking conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.

E. Penetrations:
1. Furnish and install metal sleeves for all exposed interior conduit runs passing through concrete floors or walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack, grouting compound.
2. Install specified watertight conduit entrance seals and membrane clamps at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be insulated rigid steel.
3. Conduits penetrating rated walls, floors, etc. shall be fireproofed.

3.03 CABLE AND WIRE INSTALLATION

A. Examination
1. Verify that interior of building has been protected from weather.
2. Verify that mechanical work likely to damage wire and cable has been completed.
3. Verify that raceway installation is complete and supported.
4. Verify that field measurements are as indicated.

B. Preparation
1. In existing conduits that will be reused, pull out existing conductors.
2. Completely and thoroughly swab raceway before installing wire.
3. Use 50/50 solution of Simple Green. Use CO2 to blow water and soap into conduit - let soak to break up dried out pulling compounds, then pull conductors. Pull one conductor at a time if will not pull all out together.

C. General:
1. Conductors shall not be in conduit until all work of any nature that may cause injury is completed. Care should be taken in pulling conductors that insulation is not damaged. U.L. approved non-petroleum base and insulating type pulling compound shall be used as needed.
2. All cables shall be installed and tested in accordance with manufacturer's requirements and warranty.
3. Block and tackle, power driven winch or other mechanical means shall not be used in pulling conductors of size smaller than AWG # 1.

D. Splicing and Terminating:
1. All aspects of splicing and terminating shall be in accordance with cable manufacturer's published procedures.
2. Make up all splices in outlet boxes with connectors as specified herein with separate tails of correct color to be made up to splice. Provide at least six (6) inches of tails packed in box after splice is made up.
3. All wire and cable in panels, control centers and equipment enclosures shall be bundled and clamped.
4. Encapsulate splices in exterior outlet, junction and pull boxes using insulating resin kits. All splices for exterior equipment in pump rooms shall be made up watertight.
5. Insulate mechanical compression taps AWG # 1/0 and larger using pre-molded, snap-on insulating boots or specified conformable insulating putty overwrapped with two half-lapped layers of insulating tape.

E. Identification:
1. Securely tag all branch circuits, noting the purpose of each. Mark conductors with vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each circuit with the corresponding circuit number at the panelboard.

2. Color code conductors size #6 and larger using specified phase color markers and identification tags.

3. All terminal strips are to have each individual terminal identified with specified vinyl markers.

4. All identification shall be legible and readable after completion of installation.

3.04 INSTALLATION:

A. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
   3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

B. Install wire and cable in accordance with the NECA "Standard of Installation."

C. Use wiring methods indicated.

D. Pull all conductors into raceway at same time.

E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

F. Protect exposed cable from damage.

G. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

H. Use suitable cable fittings and connectors.

I. Neatly train and lace wiring inside boxes, equipment, and panelboards.

J. Clean conductor surfaces before installing lugs and connectors.

K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

L. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.

M. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Q. Trench and backfill for direct burial cable installation as specified in Underground Structure Section. Install warning tape along entire length of direct burial cable.

3.05 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.
E. Provide cord and cap where field-supplied attachment plug is required.
F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
H. Install terminal block jumpers to complete equipment wiring requirements.
I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.06 INSTALLATION OF BOXES
A. General:
   1. Leave no un-used openings in any box. Install close-up plugs as required to seal openings.
   2. Exposed outlet boxes and boxes in damp or wet locations shall be cast metal with gasketed cast metal cover plates.
B. Box Layout:
   1. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
   2. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Consult wire and cable manufacturer.

3.07 INSTALLATION OF WIRING DEVICES
A. General
   1. Install all devices flushmounted unless otherwise noted on the drawings. Comply with layout drawings for general locations. Consult Engineer or District's Representative for locations that have conflict with other devices or manner not suitable for installation. Avoid placing devices behind open doors.
   2. Align devices horizontally and vertically. Device plates shall be aligned vertically with tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
   3. Mounting height as indicated on the drawings and according to ADA requirements.
   4. Install device plates on all outlet boxes. Provide blank plates for all empty, spare, and boxes for future use.
   5. Securely fasten devices into boxes and attach appropriate cover plates.
   6. Caulk around edges or outdoor device plates and boxes when rough wall surfaces prevent rain tight seal. Use caulking materials approved by Engineer. Fireproof around opening of devices located or penetrating fire rated construction assemblies.
   7. Fireproof around opening of devices located or penetrating firerated construction assemblies.
B. Switches
   1. Where switches are indicated to be installed near doors, corner walls, etc. mount not less than 2 inches and not more than 18" from trim. Verify exact location with Architect or Engineer prior to rough-in.
   2. Coordinate the location of switches to insure locations at the strike side of doors.
   3. Furnish and install engraved legend of each switch that controls exhaust fans, motors, equipment systems, etc. not located within sight of the controlling switch.
   4. Ganging of Switches - provide barriers for switches of different phases and voltages. Otherwise switches shall be gauged in one faceplate.
C. Receptacles
   1. Mount receptacles vertically with U-shaped ground position on bottom.
   2. Do not combine GFCI protected circuits with other circuits in the same raceway. Limit number of GFI protect circuits in any one raceway to a maximum of one (1) circuit.
D. Identification
   1. Label all outlets and switches. Mark each wiring device where circuits and panel supply is derived from.
   2. All identification shall be legible and readable after completion of installation

3.08 INSTALLATION OF FUSES AND DISCONNECT SWITCHES
   A. Fuses shall be installed where noted on plans. Sizes are based on design data provided by equipment mfg. Listed or labeled equipment must be in accordance with instructions included in the listing or labelling. Be sure to observe maximum branch circuit fuse size labels.
   B. Disconnect switches shall be mounted on the equipment, where possible. Coordinate with mechanical contractor to ensure switches are not mounted on a removable access panel.
   C. Label each disconnect fuse with equipment tag as indicated in the single line diagram, or as directed.

3.09 WORKMANSHIP
   A. Preparation, handling, and installation shall be in accordance with manufacturer’s written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Coordinate work and cooperate with others in furnishing and placing this work. Work to reviewed shop drawings for work done by others and to field measurements as necessary to properly fit the work.
   B. Conform to the National Electrical Contractor’s Association “Standard of Installation” for general installation practice.

3.10 INSTALLATION
   A. Install in accordance with manufacturer’s instructions.
   B. Coordinate with all other trades before installation. Notify engineer of any discrepancies immediately.
   C. Perform field inspection prior to installation of any equipment or devices.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Medium voltage cable.
B. Cable terminations

1.02 REFERENCE STANDARDS
B. IEEE 386 - Separable Insulated Connectors for Power Distribution Systems above 600 volts.
C. IEEE 404 - Power Cable Joints
D. IEEE 592 - Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.
E. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
G. AEIC CS-6 - Association Electric Illuminating Company
H. ICEA S-68-516 - Insulated Cable Electric Association
I. UL MV-105 - Underwriter's Lab
J. NFPA 70 - National Electrical Code; 2008. Article 310 - Type MV-90-UL

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Product Data: Provide for cable, terminations, and accessories.
C. Samples: Submit two samples of each size cable, 24 inches in length.
   1. Select each length to include complete set of manufacturer markings.
   2. Attach tag indicating cable size and application information.
D. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage. Submit six (6) copies of certified factory test reports and four (4) copies of field test reports.
   1. Perform Factory high voltage AC and DC corona level tests per NEMA WC-AEIC Standards on each length of cable. Submit certified reports of the factory tests, together with all data necessary to determine that cable is as specified, including type of conductor, AWG size and stranding; type and thickness of insulation and jacket; type of shielding; insulation resistance constant corrected to standard temperature; voltage rating. Use standard ICEA terminology in reports.
   2. Perform field tests as noted in these specifications and per NETA Standard Acceptance Testing.
E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Project Record Documents: Record actual sizes and locations of cables.
G. Certificate of Compliance: Indicate approval of installation by Campus Facilities electrical department.
H. Warranty: Cables shall be warranted for 40 years minimum.
I. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

DSA Re-submittal 6/21/2012
J. Prior to installation, submit for approval calculated allowable pulling tensions and projected tensions. Measure pulling tensions and submit for approval. State allowable sidewall pressure in pounds and calculated values. State and provide jam ratio calculations.

1.04 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
C. Each reel shall have printed on reel or a weather-proof (metal or plastic) tag firmly attached indicating: Manufacturer’s Name, Conductor Material, Conductor Size, Insulation type and thickness, Jacket thickness, Temperature rating, Length of cable, Manufacturer’s type, Voltage class, PO Number, Cable weight, Reel weight, and if shielded or non-shielded.
D. Each reel shall be lagged with suitable lagging to protect cable from damage during shipping. Cable ends shall be sealed to prevent the entrance of water.
E. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.
1. Submit medium voltage cable splicer/terminator certification of competency and experience 20 days before splices or terminations are made in medium voltage cables. Splicer/terminator experience during the immediate past 3 years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.
2. Utilize companies regularly engaged in cable splicing; California Splicing (Pleasanton, CA); High Voltage Splicing (Danville, CA); PCS Corp (Concord, CA), and STT.
F. Acceptance Testing: Contractor shall hire an independent testing agency experienced in high voltage testing to test medium voltage cable. Testing agency qualification shall be submitted to Engineer for review and approval. Acceptable testing agencies shall be as specified in section 26-08-02 - Electrical Acceptance Testing.
G. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS
2.01 CABLE
A. Manufacturer: Okonite or approved equal
B. General: Furnish, install and test cable manufactured per latest applicable requirements of ASTM, ICEA, UL, and AEIC for service specified.
1. All cable must have been manufactured within one year of purchase.
2. The Engineer may require that adequate service records be submitted to prove competence of cable manufacturer.
C. The cable shall be suitable for use in wet and dry locations in conduit, underground duct systems, direct burial, an aerial installation. The cable shall be rated 105 degree C for normal operation, 130 degree C for emergency overload operation and 250 degree C for short circuit conditions. Emergency overload operation may occur for periods up to 1500 hours cumulative during the life of the cable.
D. Technical Requirements
1. Voltage and Gauge: As per Construction Drawings
2. Conductor: Uncoated soft copper compact stranded.
3. Conductor shield: Extruded layer of semiconducting EPR thermosetting compound.
4. Insulation: The insulation shall be EPR. The ethylene content in the elastomer used shall not exceed 72% by weight of ethylene nor shall the insulation contain any polyethylene, both features to limit the degree of susceptibility to treeing experienced by highly crystalline materials. The minimum average insulation thickness shall be 220 mils (133% insulation level). The insulation shall be compounded by the cable manufacturer in its own facility.
using a closed system to insure maximum cleanliness. The EPR insulation system shall be triple tandem extruded with the EPR conductor and insulation shields to prevent intersurface contamination. The extrusion operation shall be performed by three separate in line extruder heads thereby permitting the measurement and accurate individual control of the wall thickness of each layer of compound as the cable is being manufactured.

5. Insulation shield: Extruded layer of semiconducting EPR thermosetting compound.
6. Metallic shield: Bare 5 mil copper tape helically applied.
7. Jacket: Black flame retardant PVC.

E. Cable Test: Cable shall be tested in accordance with AEIC CS-8

2.02 CONDUCTOR PULLING LUBRICANT:
A. Manufacturer: General Machine Products Inc., Tevose, PA or equal.
B. Winter grade lubricant, suitable for use at all temperatures down to 9 degrees F (-18C).
C. Slip X-300 compound available from the American Colloid Co. of Skokie, Illinois, or Winter Grade No. 7438-PC.

2.03 SPLICES
A. Manufacturer: Hubbel Power Systems, 3M, Elastimold, or Raychem.
B. The materials shall be compatible with the conductors, insulations and protective jackets on the cables and wires and as recommended by cable manufacturer. Submit vendor data of splicing material and obtain approval before proceeding with splicing operations.
C. The splices shall insulate and protect the conductors not less than the insulation and protective jackets on the cables and wires which protect the conductors. In locations where moisture might be present, the splices shall be watertight. In manholes, the splices shall be submersible.
D. Splicing and Terminating Fittings:
1. Shall be heavy duty, pressure type fittings which will assure satisfactory performance of the connections under conditions of temperature cycling and magnetic forces from available short circuit currents.
2. The fittings shall be suitably designed and the proper size for the cables and wires being splices and terminated.
3. Where the Engineer determines that unsatisfactory fittings have been installed, remove the unsatisfactory installations and install approved fittings at no additional cost to the Owner.

2.04 TERMINATIONS
A. Manufacturer: Hubbel Power Systems, 3M, Elastimold, or approved equal.
B. Type: Class 1 terminations in accordance with IEEE Standard 48.
C. Ratings:
1. Maximum Voltage: 15kV
2. Continuous Current: 200A LoadBreak and 600A Non-LoadBreak
3. BIL Rating: 95kV BIL
4. AC Withstand Voltage: 34kV
5. DC Withstand Voltage: 53 kV
D. Terminations:
1. 2 Hole NEMA Pad Type Termination: Typical for Switchgear, Cold or Heat Shrink
E. Terminating Kits
1. General:
   a. Shall be assembled by the manufacturer or supplier of the materials and shall be packaged for individual terminations.
   b. Shall consist of materials designed for the cables being terminated and shall be suitable for the prevailing environmental conditions.
c. Shall include detail drawings and printed instructions for each type of termination being installed, as prepared by the manufacturers.

d. Detail drawings and printed instructions shall indicate the cable type, voltage rating, manufacturer's name and catalog numbers for the materials indicated.

e. Cold Shrink Terminations shall be used from dry indoor type of terminations. Heat Shrink Terminations shall be used for damped, outdoor type of terminations.

2. Taped Terminations:
   a. Insulating and semi-conducting rubber tapes shall withstand 200 percent elongation without cracking, rupturing or reducing their electrical and self-bonding characteristics by more than 5 percent.

3. Stress Cone: Stress cones shall be either of wrapped tape construction or preformed rubber cone with the semiconducting inlay for shield termination and shall be Class 1 terminations in accordance with IEEE Standard 48. Materials, procedures, and dimensions shall only be as supplied by 3M, Elastimold, or equal, for specific cable and size and type used. Finished termination shall be rated 95kV BIL minimum. Stress cones shall be provided with #8 AWG minimum, stranded copper, 24 inch length grounding lead clamped to cable shield with strap type clamp at base of stress cone. The entire outer surface of each stress cone projecting cable insulation and base of cable lug shall be taped and sealed to prevent intrusion of moisture into cable laminations.

4. Live End Seals: Heat shrink live end seals, for use with 5kV VCL cable and 15kV EPR cable, Raychem HVEC, Scotch 3M or equal.

F. Premolded Rubber Terminations
   1. Shall be used to sectionalize cables or as feedthrus for making lateral taps. Each tap/junction works independently of the others contained on the same unit. Number of junctions as specified in the drawings.

   2. Material: All Copper designed

   3. Mounting: Corrosion-resistant stainless steel mounting bracket. Provide for backplate mounting angles of 30, 45, or 60 degrees, and adjustable for horizontal mounting to a flat surface.

   4. Terminations shall be in accordance with IEEE 48, 386, 404, and 592.

   5. Premolded rubber devices shall have a minimum of 0.125 inch semi-conductive shield material covering the entire housing. Test each rubber part prior to shipment from the factory.

   6. Grounding of metallic shields shall be accomplished by a solderless connector enclosed in a watertight rubber housing covering the entire assembly. The grounding device and splice or terminator shall be of same manufacturer to insure electrical integrity of the shielded parts.

   7. The premolded parts shall be suitable for indoor, outdoor or submersible applications.

G. Elbow Connectors
   1. Elbow Type: 600A Non-Load Break, as noted in plans.

   2. Material: All Copper designed

   3. Molded external shield-conductive, abrasion resistant 1/8-inch thick shield of peroxide cured EPDM

   4. Cable entrance - has conductive rubber stress relief area which contacts extruded cable. Compression Connector - Sized for the specific conductor size. Crimped with standard tools and dies.

   5. Test Point - Designed to allow voltage indication when readout is made with suitable high impedance measuring devices.

   6. Grounding Tab - Designed to accept a single #14 awg copper wire that can be inserted into the eye. Provides a static ground to ensure personnel safety.

   7. Elastimold 160 series equipment with stick operable connectors, or RTE, no substitutions. All equipment numbers are Elastimold:

      a. Elbow connectors with voltage test point, 200A: #166LR.

      b. Grounding devices: 20MA.

      c. Load break operating kit.
1) Carry Case #1BG-1.
2) Test rod #370TR.
3) Grounding Elbow #160GLR (3).
4) Insulated Cap with Ground #160DRG (6).
5) Feed Thru #163FT (3).
6) Lubricant #SG-5.
7) Stand off Plug #600SOP (3).

8. System shall be rated: 15kV, BIL-95kV impulse voltage, 1.2 x 50 microsecond wave; AC withstand 34kV, 60Hz, 1 minute, DC withstand 53kV, 15 minutes: Corona extinction voltage 11kV; 900 amp continuous; 25,000 amp rms sym .17 sec.; reduction test Corona extinction voltage: 19kV minimum, (test at 3 pc. sensitivity), and either impulse or AC withstand to meet ratings above.

2.05 FIREPROOFING TAPE
A. Manufacturers Scotch 3M, Permacel or equal.
B. The tape shall consist of a flexible, conformable fabric coated on one side with flame-retardant flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick and shall weigh not less than 2.5 pounds per square yard.
C. The tape shall be noncorrosive to cable sheath, shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.
D. The tape shall not deteriorate when subjected to water, oil, gasses, salt water, sewage, or fungus. It shall be resistant to sunlight and ultraviolet light.
E. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.
F. Securing tape: Shall be glass cloth electrical tape not less than 7 mils thick, and 3/4 inch wide.

2.06 ACCESSORIES
A. Wire Tags: Identify cables by engraved or embossed tags. Tags shall be minimum 3/4 inch wide, length as required by inscription. Manufacturer: Tech Products Inc. or Seton Nameplate Corp.
B. Markers: Pre-marked Self-Ahesive Tags. Thomas and Betts, W.H. Brady, or E-Z Code.
C. Cable Racks and Supports: Cable racks, supports, and fittings for use in corrosive underground location and shall be provided with a factory applied PVC coating of at least 20 mils thick. All racks, supports and fittings shall be UL listed heavy duty, non-metallic, and UL listed.
D. Fireproofing Tape:
   1. Product: The tape shall consist of a flexible, conformable fabric coated on one side with flame retardant flexible, polymeric coating and/or chlorinated elastomer not less than 0.050 inch thick and shall weight not less 2.5 pounds per square yard.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that conduit, duct, trench, or manholes are ready to receive cable.
B. Verify that field measurements are as indicated.
C. Verify routing and termination locations of cable bank prior to rough-in.
D. Observe all National Electric Code rules regarding installation. Check the conduit and wire sizes and actual overall diameters to be sure the approved conduit fill will not be exceeded.
E. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

DSA Re-submittal 6/21/2012
26 05 13 - 5
MEDIUM-VOLTAGE CABLE
3.02 PREPARATION
A. Pull a short mandrel or plug closely approximating the diameter of the conduit through to loosen any burrs, and check obstructions. Follow it up with a swab to clean out any remaining dirt or foreign matter.
B. Do not pull cable into duct or conduit until factory test reports of cable have been approved.
C. Use swab to clean conduits and ducts before pulling cables.
D. Verify and match existing system phase and rotation at each interface with existing cables or equipment. Provide the appropriate equipment to properly install cables.

3.03 INSTALLATION
A. Cable Installation
1. Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling-in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.
2. Avoid abrasion and other damage to cables during installation. Pull in cable from the end having the sharpest bend; i.e., bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, hand turning reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.
3. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.003 lbs. per circular mil of conductor cross-section area.
4. Pulling shall be stopped immediately with any indication of binding or obstruction and shall not be resumed until such difficulty is corrected. Sufficient slack shall be provided for free movement of cable due to expansion or contraction.
5. Sustain cable pulling tensions and bending radii below recommended limits. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
6. Ground cable shield at each termination and splice.
7. Install cables in manholes along wall providing longest route, with a minimum of one full loop around the perimeter of the manhole.
8. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable outside diameter. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
9. Arrange cable in manholes to avoid interference with duct entrances.
10. Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture with heat-shrinkable molded cable end caps.
11. Cable splices made up in manholes shall be firmly supported on cable racks as indicated. No cable splices shall be pulled in ducts. Cable ends shall overlap at the ends of a section to provide sufficient undamaged cable for splicing. Cables to be spliced in manholes shall overlap the centerline of the proposed joint by not less than 2 feet.
12. In manholes, underground raceways and other outdoor locations:
   a. Seal the cable ends prior to pulling them in to prevent the entry of moisture.
   b. For ethylene propylene rubber cables, use cabs of epoxy resin which are not less than 1/4 inch larger in diameter than the overall diameter of the cable. Clean each end of each cable before installing the epoxy resin over it.
13. Where cable exits ducts in manholes, add cable restraints to keep cables from creeping. Secure restraints to concrete wall with drilled inserts and turnbuckle.
14. Ground cable metallic shield to grounding system.

B. Fireproofing Tape Installation

DSA Re-submittal 6/21/2012
26 05 13 - 6
1. Strips of fireproofing tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in half-lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts. To prevent unraveling, the fireproofing tape shall be random wrapped the entire length of the fireproofing with pressure sensitive glass cloth tape.

2. All medium voltage cables in manholes and inside electric rooms shall be taped as specified above.

C. Splices and Terminations
1. Splices shall not be made unless specified or approved by the electrical engineer. Splices shall be made in manholes except where cable terminations are specifically indicated. Splicing and terminating of cables shall be expedited to minimize exposure and cable deterioration.

2. Install the materials as recommended by their manufacturer, including special precautions pertaining to air temperature during installation.

3. All termination and splices shall be supported in such manner so as to minimize physical stress on the splice connections. Each cable and termination shall be supported using a pair of saddle type supports under the cable end termination and/or cable with a minimum 12 inches and a maximum 30 inches separation between the supports. Cable end termination and cable shall be secured to the supports in such a manner as to prevent movement of termination or cable at the support. Saddle type supports shall be installed on galvanized steel framing channel anchored to the wall or securely fastened to the cable tray or installed by other approved methods.

4. Ethylene Propylene Rubber and Polyethylene Insulated Cables:
   a. Cables rated more than 8000 volts: Install terminations of premolded rubber splices and terminations.

D. Connector Installation
1. Use tools which are designed for the connectors being installed.

2. Round and smooth the installed connectors to minimize localized voltage stressing of the insulating materials.

3. Remove contaminants from all surfaces within the splices and terminations before installing the insulating materials.

4. Use mirrors to observe the installation of materials on the back sides of the splices and terminations.

5. Eliminate air voids throughout the splices and terminations.

3.04 FEEDER IDENTIFICATION

A. In each manhole, pullhole, pullbox, cable tray, switchgear, and switch, install permanent tags on each circuit's cables and wires to clearly designate their circuit identification, voltage and phase. The tags shall be the embossed type and shall also show the cable type, size, and voltage rating.

B. Position the tags so they will be easy to read, attach with #14 TW wire, tie snug, do not crimp or dent conductor insulation. See drawings for description and coding.

3.05 GROUNDING

A. Ground all non-current carrying hardwares and metals. Include racks, supports, mounting hardwares, cable metallic shield, ladder, and metallic conduits. Bond to grounding electrode.

3.06 FIELD TESTS

A. General:
   1. Test all cable per ICEA Standards for high-voltage DC test. Notify Owner of proposed date of test sufficiently in advance so that arrangements can be made to witness test.
   2. For all new cable installation, perform test after all splices, terminations and connections are complete, except at point where cable under this Subcontract is to be connected to existing system. Disconnect all equipment from cable system during test.
3. Test voltage for 15kV cable shall be 80% of original factory test voltage, sustained for 15 minutes.
4. Test cable jackets from shield to ground in manholes at 7 kVDC for 1 minute after pulling. The electrical resistance factor or constant shall be higher than 30 mego-ohms per 1000 linear feet. Submit results for approval.
5. Submit copies of tests, properly labeled, to the Engineer for review. Include all necessary test information such as ambient temperature, weather conditions, current, voltage, cable length, size, etc.

B. High Potential Test:
1. Prior to high potential test, test the cable and shields for continuity, shorts, and grounds.
2. High potential test shall measure the leakage current from each conductor to the insulation shield. Use corona shields, guard rings, taping, mason jars, or plastic bags to prevent corona current from influencing the readings. Unprepared cable shield ends shall be trimmed back one inch or more for each 10kv of test voltage.
3. Use DC tester specifically designed for the purpose, with overload or current-limiting devices to limit short circuit current. Raise voltage gradually in 10 percent steps to 80 percent of final voltage, then in 5 percent steps to final test voltage, which shall be left on for 5 minutes. Take current readings at each step after current has been established. Plot readings on graph paper. If breakdown is indicated during test by sudden increase in current, discontinue test, locate and remedy trouble, and repeat test. If breakdown is indicated, replace cable. Current reading shall be declining after 15 minute test and insulation factor shall exceed 20,000 mego-ohms per 1000 feet.

C. Safety Precautions:
1. Exercise suitable and adequate safety measures prior to, during, and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltages.
2. Provide surge protection at end of cable at 10% above DC test voltage to prevent cable damage due to surge voltages.

D. Test Voltages:
1. New shielded EPR cable D.C. voltages shall be 65kV insulation level, 15kV rated cable; do not exceed manufacturer’s rated voltages for cable with connectors.

E. High Potential Test Method:
1. Apply voltage in approximately 8 to 10 equal steps.
2. Raise the voltage slowly between steps.
3. At the end of each step, allow the charging currents to decay, and time the interval of decay.
4. Read the leakage current and plot a curve of leakage current versus test voltage on graph paper as the test progresses. Read the leakage current at the same time interval for each voltage step.
5. Stop the test if leakage currents increase excessively or a “knee” appears in the curve before maximum test voltage is reached.
   a. For new cable, repair or replace the cable and repeat the test.
   b. For existing cable interconnected to new cable, notify the Engineer for further instructions.
6. Upon reaching maximum test voltage, hold the voltage for five minutes. Read the leakage current at 30 second intervals and plot a curve of leakage current versus time on the same graph paper as the step voltage curve.
   a. Stop the test if leakage current starts to rise, or decreases and again starts to rise. Leakage current should decrease and stabilize for good cable.
7. Terminate test and allow sufficient discharge time before testing the next conductor.

3.07 FIELD QUALITY CONTROL
A. Inspect exposed cable sections for physical damage.
B. Inspect cable for proper connections as indicated.

DSA Re-submittal 6/21/2012

26 05 13 - 8

MEDIUM-VOLTAGE CABLE
C. Inspect shield grounding, cable supports, and terminations for proper installation.
D. Inspect and test in accordance with NETA STD ATS, except Section 4.
E. Perform inspections and tests listed in NETA STD ATS, Section 7.3.3.

3.08 PROTECTION
A. Protect installed cables from entrance of moisture.

END OF SECTION
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding components for 600V and below include:
   1. Grounding and bonding components includes grounding electrodes and conductors, equipment grounding conductors, and bonding.

B. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal underground water pipe.
   3. Metal frame of the building.
   4. Rod electrodes.
   5. Grounding Electrode Conductors
   6. Equipment grounding conductors
   7. Bonding Conductors
   8. Concrete-encased electrode.
   9. Rod electrodes.

C. Grounding and bonding components for 1kV systems and above include:
   1. Metal frame of the building.
   2. Rod electrodes.
   3. Grounding Electrode Conductors
   4. Grounding Well
   5. Chain link fence

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.


D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 PERFORMANCE REQUIREMENTS

A. Measure the resistance to ground of each ground rod before connection to the other ground rods. The resistance shall not exceed 25 ohms.

B. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 5 ohms.

1.04 SUBMITTALS

A. Division 1 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for grounding electrodes and connections.

C. Test Reports: Provide typed complete report indicating overall resistance to ground and resistance of each electrode.

D. Project Record Documents: Record actual locations of components and grounding electrodes.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled by Underwriter’s Laboratories Inc. (UL) as suitable for the purpose indicated.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

2.03 ELECTRODES

A. Manufacturers: Cooper Power Systems, CadWeld, Erico, or approved equal for rod electrode.
   1. Rod Electrode: Cooper Power Systems, CadWeld, Erico, or approved equal.
B. Rod Electrodes: Copper-clad steel.
   2. Length: 10 feet.
   3. Installed where indicated on drawings.
   4. Shape: Straight.
C. Foundation Electrodes: 2/0 AWG.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.
B. Exothermic Connections:
C. All electrical connections should be welded with the CADWELD copper-based exothermic welding process.
D. Exothermic Connections: (ERICO Cadweld)
   1. Cable to Ground Rod: Type NC
   2. Cable to Cable: Type XA, TA, PT
   3. Cable to Building Steel: Type DF (Column Bonding Bar), VV
   4. Cable to Rebar: Type RD, RC
   5. Cable to Equipment: Type LA, NEMA Lugs Connections
   6. Cable to Steel Pipes: Type HA
   7. Cable to Metallic Conduit: Pipe Clamp with Flexible Grounding Braids and Lug Connection
E. Wire: Bare, stranded copper.
F. Grounding Electrode Conductor: Bare, stranded copper. Size as per drawings. Minimum size to meet NFPA 70 requirements.
G. Grounding Well:
   1. Well Box: Christy G5 Traffic Valve Box with hold down bolts
   2. Well Cover: Cast iron ring with legend “GROUND” embossed on cover.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify existing conditions and resistivity prior to beginning work.

C. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

E. Provide grounding well at power transformer, main switchboard, and at rod locations where indicated. Install well pipe top flush with finished grade.

F. Install 2/0 AWG bare copper wire in foundation footing.

G. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.

H. For distribution transformers located away from main service entrance, provide and connect to grounding electrode conductor to a ground rod and building steel.

I. Equipment Grounding Conductor:
   1. Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
   2. Grounding conductors shall be identified with green insulation, except where a bare ground conductor is specified. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure. Install a ground conductor in each raceway system in addition to conductors shown.
   3. Equipment ground conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per NEC 250 unless larger conductors are shown on the drawings.

J. Equipment Grounding:
   1. Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide insulated grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure and at concentric knock-outs.
   2. Motors shall be connected to equipment ground conductors with a conduit grounding bushing and with a bolted solderless lug connection on the metal frame.
3. Conduit terminating in concentric knockouts at panelboards, cabinets and gutters shall have insulated grounding bushings and bonding jumpers installed interconnecting all such conduits and the panelboard cabinet, gutter, etc.

K. Ground all non-current carrying hardwares and metals. Include racks, supports, mounting hardwares, cable metallic shield, ladder, underfloor raceways, metal siding, metallic conduits, etc. Bond to grounding electrode.

L. Provide ground connection at all signal and data enclosures, lines, and data/telcom room.

M. Bonding:
   1. Bonding shall be provided to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.
   2. Bonding shall be in accordance with NEC Article 250, Part V.
   3. Bond together metal siding not attached to grounded structure; bond to ground.

N. Interface grounding and bonding provided under Section 3379 00 - Site Grounding

3.03 FIELD QUALITY CONTROL

A. Campus will provide field inspection in accordance with Division 1

B. Provide field inspection, testing, and adjusting in accordance with Division 1

C. Inspect and test in accordance with NETA STD ATS except Section 4.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION
SECTION 26 05 73
POWER SYSTEM STUDY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Short circuit study.
B. Protective device coordination study and analysis.
C. Arc flash hazard study.

1.02 SCOPE OF STUDIES
A. Short Circuit Study: The study shall begin at the utility service and shall include all new electrical distribution equipment shown on the single line drawings. Refer to project single line diagram for exact equipment to be included in the study. This includes switchgear, switchboards, panelboards, ATS’s, transformer primary and secondary terminals, and other significant overcurrent protective device locations throughout the system.
B. Protective Device Coordination Study: The study shall include all new protective relays and circuit breakers associated with the distribution system in this project and as shown on the contract single line diagram. The study shall allow for optimum selective coordination of proper breakers, fuses, and current transformers and shall begin with the utility company’s feeder protective device and include all of the electrical protective devices down to and include the largest protective device of the new equipment. If a standby source is available, the study shall include both the normal and standby sources.
C. Arc Flash Study: The study shall include all new electrical distribution equipment shown on the single line diagram. This includes all switchgear, switchboards, panelboards, motor control centers, ATS’s, and transformers. The ARC Flash Hazard Analysis shall be as per NFPA 70E.

1.03 DATA COLLECTION FOR THE STUDY
A. The contractor shall provide the required data for the preparation of the studies, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.
B. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

1.04 REFERENCE STANDARDS
E. IEEE 1015 - IEEE Recommended Practice for Applying Low-Voltage Circuit Breaker used in Industrial and Commercial Power Systems
F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Study Preparer's Qualifications.

DSA Re-submittal 6/21/2012

POWER SYSTEM STUDY 26 05 73 - 1
C. Study Report:
1. Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
2. The result of the power system study shall be summarized in a final report. Three (3) bound copies and one electronic copy, CD with system model/data base files from the software used in the study.
3. Evaluation of product data submittals by Engineer will not commence until acceptable studies have been submitted.
4. Submit arc flash hazard study and a list of arc flash warning labels at least 30 days prior to energizing the electrical equipment.
5. Include stamp or seal and signature of preparing registered professional electrical engineer.

D. Product Data: In addition to submittals specified elsewhere, submit manufacturer's time-current curves for all protective devices.

E. Field Inspection Report: Show final adjusted settings of protective devices.

F. Certificates: Prior to final inspection, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

G. Project Record Documents: Revise protective device study as required to show as-built conditions.
1. Submit not less than 60 days prior to final inspection of electrical system.
2. Include hard copies in operation and maintenance data submittals.
3. Include all files prepared using software packages, on CD-ROM, with file name cross-references to specific pieces of equipment and systems.

1.06 SHORT CIRCUIT STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on NFPA or IEEE Standards.

B. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
1. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
2. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

C. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
2. Breaker and fuse ratings.
3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
4. Identification of each bus, with voltage.
5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

D. Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
3. Primary Fault Level Assumptions: Obtain data from utility company.
4. Report: Include all pertinent data used in calculations and for each device include:
   a. Device identification.
   b. Operating voltage.
   c. Protective device.
   d. Device rating.
   e. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

1.07 PROTECTION DEVICE COORDINATION STUDY

A. Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions.
   1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
   2. Plot the specific time-current characteristics of each protective device on log-log paper.
   3. Organize plots so that all upstream devices are clearly depicted on one sheet.
   4. Also show the following on curve plot sheets:
      a. Device identification.
      b. Voltage and current transformer ratios for curves.
      c. 3-phase and 1-phase ANSI damage curves for each transformer.
      d. No-damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum short circuit cutoff point.
      h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
      i. Software report for each curve plot, labeled for identification.

5. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
   a. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
   b. Identify any equipment that is underrated as specified.
   c. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
   d. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Campus and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in the same frame, time curve characteristics of induction relays, CT ranges, etc.
   e. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
   f. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Campus, provide a discussion of alternatives and logical compromises for best achievable coordination.
   g. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.

6. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
   a. Device identification.
   b. Relay CT ratios, tap, time dial, and instantaneous pickup.
   c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   d. Fuse rating and type.
e. Ground fault pickup and time delay.
f. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
g. Highlight all devices that as furnished by Contractor will not achieve required protection.

1.08 ARC FLASH STUDY

A. Provide an Arc Flash Hazard Study for all new electrical distribution system shown on the single line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the single line drawing. This includes switchgear, switchboards, panelboards, motor control centers, PDU's, UPS, ATS's, and transformers. The study shall include creation of Arc Flash Hazard Warning Labels.

B. The arc flash hazard study shall include the electrical distribution system equipment shown on the single line drawing. Use the data from the Fault/Coordination Study to perform the Arc Flash Study. The arc flash hazard study shall consider operation during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum arc flash hazard.

C. Arc flash hazard study shall be performed in accordance with NFPA - 70E, NEC 110.16, and IEEE 1584. Study shall include the following:
   1. Indicate arc flash boundaries.
   2. Incident energies.
   3. PPE (Personal Protective Equipment) requirements.
   4. Shock hazard voltage level.
   5. Approach distances; limited, restricted, and prohibited.

D. Produce an Arc Flash Warning label stating "DANGER, ARC FLASH HAZARD" and shall list the above items. Also include the bus name and voltage. Labels shall be printed in color on 3 inch x 5 inch, self adhesive backed Avery or DuraLabel labels. Electrical contractor shall furnish install the labels based on the study.

E. Produce an Arc Flash Evaluation Summary Sheet listing the following additional items:
   1. Bus name.
   2. Upstream Protective Device Name, Type, and Settings.
   5. Protective Device Bolted Fault Current.
   9. Equipment Type.
   11. Arc Flash Boundary.
   12. Working Distance.
   13. Incident Energy.
   14. Required Protective Fire Rated Clothing Type and Class.

1.09 QUALITY ASSURANCE

A. Study Preparer Qualifications: Registered professional electrical engineer licensed in the State in which the Project is located and not a full time employed of the equipment manufacturer.
   1. A minimum of (5) years experience in preparation of studies of similar type and magnitude.
   2. Familiar with the software analysis products specified.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Acceptable Software Products:
PART 2 PRODUCTS

2.01 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.

B. Replace existing protective devices to achieve specified performance.

C. The specified equipment has been designed and selected to achieve the specified performance; ensure that equipment actually installed provides that performance.

D. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to requirements determined by the coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

C. Submit report showing final adjusted settings of all protective devices.

3.02 ARC FLASH TRAINING

A. The testing agency shall train personnel of potential arc flash hazards associated with working on energized equipment (minimum 4 hours). Maintenance procedures in accordance with the requirements on NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided by the testing company.

END OF SECTION
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY
A. Section Includes:
   1. System specific commissioning for all electrical equipment.

1.02 DESCRIPTION OF WORK
A. The electrical equipment and conductors to be tested are specified herein and shown on the electrical drawings of the Contract Documents. Refer to Division 1.
B. The Contractor shall retain an independent InterNational Electrical Testing Association (NETA) member Engineering and Testing Firm (Testing Firm) for specified on-site acceptance testing of the project electrical power distribution system and utilization equipment covered by this contract.
C. The Testing Firm shall verify the protective device settings are implemented in accordance with approved Power System Study as specified in Section 26 05 73.
D. Tests performed by the Testing Firm shall be witnessed by the Engineer and/or Campus Representative. Provide Engineer and Campus Representative 30-day advanced notice for Testing Firm tests. Insulation tests by the Contractor typically will not be witnessed. Critical equipment witness testing may be requested by the Engineer and/or Campus Representative.
E. The manufacturer of the electrical equipment supplied for the project shall complete their on-site factory inspection, testing, and setup prior to the Testing Firm’s Acceptance Testing and subsequent Protective Device setting verification work. The power monitors shall be set up by the factory representatives and power monitor readings and settings verified by the Testing Firm. Manufacturer work is specified in the respective equipment sections.
F. The Installation Contractor shall perform pretesting of motors, conductors, and equipment as specified and shown, prior to any testing performed by the Testing Firm. Contractor shall provide the labor, tools, material, including quality power sources required to test equipment and other services necessary to provide specified tests and retesting.
G. Submit proposed electrical test procedures for tests to be performed by the Installing Contractor and proposed test procedures for tests to be performed by the Testing Firm.
H. Contractor shall coordinate and schedule Campus Personnel training of electrical equipment with manufacturer.

1.03 REFERENCES
A. This section contains references to the latest published version of the InterNational Electrical Testing Association’s (NETA) Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (ATS).
B. The NETA acceptance testing specification (NETA ATS) including procedures and test forms is part of this section as specified and modified for this project. In case of conflict between the requirements of this section and NETA ATS document, the requirements of this section shall prevail. Request clarification from the Engineer for document conflict resolution of the testing requirements.

1.04 TESTING APPLICATION
A. Calibrated test equipment with calibration stickers are required for electrical acceptance tests. The required tests, including correction of defects where found, and subsequent retesting, shall be completed prior to energizing electrical distribution system, utilization systems, and conductors. Tests shall be completed prior to functional testing. The installation of protective devices, breakers, and relay setting shall be completed and verified prior to testing.
1.05 TESTING FIRM QUALIFICATIONS

A. The Testing Firm and their proposed project team shall possess the following minimum qualifications:

1. Testing Firm shall be an independent testing organization providing unbiased testing authority, professionally independent of the manufacturer, suppliers, and installers of equipment or systems to be evaluated by the Testing Firm.

2. Testing Firm shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.

3. Testing Firm shall be a member company of the InterNational Electrical Testing Association (NETA) providing testing in accordance with NETA ATS published specifications or the pre-approve firms that use the NETA methods and published testing specifications.

4. If Firm’s own published testing specifications are proposed, then submit a copy to the Engineer for acceptance and submit the qualifications of the testing staff.

5. Testing Firm’s lead technical person shall be currently certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution systems testing. Submit proof of technical training and certification for performing testing work.

6. Testing Firm’s technicians shall be regularly employed, qualified testing staff.

PART 2 – PRODUCTS

2.01 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology.

B. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall submit a schedule for the Testing Firm work and notify the Engineer and Campus Representative 30 days prior to commencement of any witnessed testing.

3.02 INSTALLATION CONTRACTOR TESTING

A. Testing as required by Section 26 08 02

3.03 DOCUMENTATION

A. ACCEPTANCE TEST REPORTS:

1. The Contractor shall maintain a written record of all inspection and test results and, upon completion of the project, shall assemble and certify a final test report.

2. A copy of the preliminary test results shall be provided to the Engineer and Campus Representative at the end of each day of testing. Scanned PDF copies of preliminary test results are acceptable.

3. For final report Acceptance Testing Report Requirements, refer to Section 26 08 02

B. TEST DOCUMENTATION

1. The Contractor shall submit test documentation forms and a detailed description of the proposed inspection and test procedures to be performed by the Testing Firm. Testing shall not commence until the Engineer has approved the proposed forms and procedures.

2. The Contractor shall keep record of all deficiencies or non-conformance issues and shall be noted and reported to the Engineer and Campus Representative. Any equipment with deficiencies shall be corrected. Contractor shall have Testing Firm retest equipment to confirm that deficiency has been corrected.
3.04 STARTUP TRAINING

A. The Contractor shall coordinate training for Campus Personnel for use of electrical equipment. Contractor shall set up a training session with the manufacturer. Manufacturer shall instruct Personnel train necessary scheduled maintenance and testing, installation of replacement parts, use and programming of customer metering, and proper operation and use of electrical equipment.

B. Provide O&M Manuals for Campus Personnel to use during training session.

C. Training shall be for up to five (5) owner's representative. Startup and training can be conducted on the same day. Include one (1) normal workday at the job site location determined by the owner.

D. Include training for Unit Substation, Air Interrupter Switches, Switchboards, and Panelboards.

END OF SECTION
PART 1 - GENERAL

1.01 OVERVIEW

A. The purpose of these specifications is to assure that all tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are installed in accordance with design specifications.

B. The work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety problems associated with their use. It is the responsibility of the independent testing agency to review all applicable regulatory limitations prior to the use of these specifications.

C. Perform the visual inspections, manual operations and tests on systems and equipment as described in Part 3, "Execution".

D. Tests shall be performed and documented by an independent testing agency.

E. Perform these tests in addition to other electrical tests delineated in other Sections. Testing specified in other Sections shall be considered to be a part of this Section, therefore shall comply with the requirements described herein.

1.02 REFERENCES

A. All inspections and field tests shall be in accordance with the latest edition of the following codes, standards, and specifications except as provided otherwise herein.

1. American National Standards Institute - ANSI
3. Institute of Electrical and Electronic Engineers - IEEE
4. Insulated Cable Engineers Association - ICEA
5. InterNational Electrical Testing Association - NETA
6. National Electrical Manufacturer's Association - NEMA
7. National Fire Protection Association - NFPA
8. Occupational Safety and Health Administration - OSHA
9. State and local codes and ordinances
10. Underwriters Laboratories, Inc. - UL

1.03 SUBMITTAL

A. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with the following. An organization having a "Full Membership" classification issued by the InterNational Electrical Testing Association meets this criteria.

1. The testing organization shall be an independent, third party, testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing organization.

2. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

B. The testing organization shall utilize technicians who are regularly employed for testing services.

C. Each on-site crew leader shall hold a current registered certification in electrical testing applicable to each type of apparatus to be inspected or tested. The certification in electrical testing shall be issued by an independent, nationally-recognized, technician certification agency. The following entities shall qualify as independent, nationally-recognized, technician certification agencies:

1. InterNational Electrical Testing Association (NETA)
2. Accepted certifications:
3. Certified Technician/Level III
4. Certified Senior Technician/Level IV
1.04 TEST REPORTS

A. Provide written test reports, signed and dated, for all tests prior to acceptance of the tested equipment by the Owner. Test reports on megger, dielectric absorption and high potential tests shall include the ambient temperature and relative humidity existing at the time of the tests. All tests including those listed in other sections shall be submitted in a single bound report. Report shall also demonstrate compliance with Specification, NETA ATS, and industry standards.

B. The Test Documentation shall include a description that identifies the test equipment required for each specified test to be performed. Test Report Forms shall include the following information:
   1. Electrical equipment description.
   2. Electrical equipment identification number.
   3. Electrical equipment nameplate data.
   4. Electrical equipment settings.
   5. Time and date of test.
   6. Ambient conditions at time of test.
   7. Inspection checklist and results.
   8. Test results.
   9. Test equipment used with manufacture, model number, and calibration date.
   10. Remarks about test procedures, results, and suggestions.
   11. Name and signature of testing personnel.
   12. Name and signature of test witness.

1.05 TESTING APPLICATIONS

A. Calibrated test equipment with calibration stickers are required for electrical acceptance tests. The required tests, including correction of defects where found, and subsequent retesting, shall be completed prior to energizing electrical distribution system, utilization systems, and conductors. Tests shall be completed prior to functional testing. The installation of protective devices, breakers, and relay setting shall be completed and verified prior to testing.

PART 2 - PART 2 -PRODUCTS

2.01 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology.

B. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

PART 3 - EXECUTION

3.01 VISUAL INSPECTIONS

A. Prior to any testing, perform visual inspections to verify the following:
   1. The equipment is completely and properly installed
   2. The equipment is free from damage and defects
   3. Shipping blocks and restraints have been removed
   4. Electrical terminations have been properly tightened
   5. The equipment has been properly aligned
   6. The equipment has been properly lubricated
   7. The ventilation louvers are open and unobstructed
   8. The equipment is ready to be tested

3.02 MANUAL OPERATION

A. Prior to any testing, mechanical devices shall be exercised or rotated manually to verify that they operate properly and freely.
3.03 PRIMARY CABLE TESTS
A. New Primary Cable provided under this contract shall be tested as indicated in Section 26-05-13 after installation and before splicing.
B. When New Primary Cable (15kV) is provided under this contract and spliced to existing Primary Cable on this project, the complete New Primary Cable and existing Primary Cable shall be given a complete Partial Discharge Test after all splices are completed and tested as indicated below.
C. After splices are complete they shall be given a DC Hi Pot test before the Partial Discharge Test.
D. Hi Pot test shall be a 37 kV test in 1kV increments holding for two minutes up to the 37 kV max. At the 37 kV the cable shall be soaked for 10 minutes with no appreciable loss of leakage current. Test results shall be approved by the Engineer in charge before proceeding with the Partial Discharge Testing.
E. Perform a continuity test, 2,500-volt DC megger test, AC high potential test, and a second 2,500-volt DC megger test on primary cables. The high potential test shall be performed at 45kV for new cable installations, and at 30kV when new cable has been spliced to existing cable.

3.04 POWER CABLE TESTS
A. Perform a continuity check and a 1,000 volt DC megger test on 600 volt power cables No. 4 AWG and larger.
   1. The megger test shall be performed between each pair of conductors and from each conductor to ground.
   2. The megger test shall be performed for 15 seconds or until the insulation resistance value stabilizes.
   3. The insulation resistance between conductors and from each conductor to ground shall be 100 megohms minimum in one minute or less. In addition, the lowest insulation resistance value shall not differ from the highest value by more than 20 percent.

3.05 CONTROL CABLE TESTS
A. Perform a continuity check on control and instrumentation wiring.

3.06 SECONDARY SWITCHGEAR AND SWITCHBOARD TESTS
A. Perform a continuity check and 1,000 volt DC megger test on buses, and on main and feeder breakers.
B. Perform a primary current injection test and a 'Ducter' (contact resistance) test on main breakers.
C. Perform a 1,000-volt DC megger test and a turns-ratio test on CT's and PT's.
D. Calibrate the metering.

3.07 SERVICE, DISTRIBUTION AND MOTOR CONTROL EQUIPMENT TESTS
A. Perform a 1,000-volt megger test on buses, motor starters and disconnect switches. This test may be combined with the feeder cable megger test by testing the devices and terminated cables together.
B. Perform a continuity check on motor control circuits and control panel internal wiring.
C. Perform an operational test on the controls.
D. Perform a continuity check and a 1,000-volt DC megger test on 3 phase distribution and isolation transformers.

3.08 GROUNDING TESTS
A. Measure the resistance to ground of each ground rod before connection to the other ground rods. The resistance shall not exceed 25 ohms.
B. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 5 ohms.
C. Tests of the resistance to ground shall be made using either the three point method or the fall-of-potential method.

D. Perform a continuity check from equipment ground bus bars and ground lugs to the ground system.

END OF SECTION
SECTION 26 11 16
SECONDARY UNIT SUBSTATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Unit substation.

1.02 REFERENCE STANDARDS
D. IEEE C37.20.2 - IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear; Institute of Electrical and Electronic Engineers; 1999 (R 2005).
E. IEEE C37.20.3 - IEEE Standard for Metal-Enclosed Interrupter Switchgear; Institute of Electrical and Electronic Engineers; 2001.
I. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; Institute of Electrical and Electronic Engineers; 1982 (R2006)
K. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
L. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
M. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2008.
P. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Q. UL Standard 891
R. This unit substation shall be listed by Underwriter's Laboratories. Transformer shall be listed by Factory Mutual.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials. Include nameplate data, schematic diagrams, and bill of materials.
C. Product Data: Provide electrical characteristics and connection requirements, circuit breaker data, fuse data, standard model design tests, and options that are included.

D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

E. Manufacturer's Installation Instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

H. Project Record Documents: Include copy of manufacturer's certified drawings.

I. Operation Data: Include operating instructions for manually and electrically opening and closing circuit breakers.

J. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication; procedures for sampling and maintaining fluid.

K. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. Extra Fuses: Two of each type and size.
   2. Tools: Two each of every special tool required to operate and maintain unit substation.

L. Equipment operation and maintenance instructions shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect products from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; www.eaton.com or approved equal.

2.02 UNIT SUBSTATIONS

A. Description: Secondary unit substation shall consist of primary equipment, transformer and secondary equipment as specified. The manufacturer of the unit substation shall furnish and coordinate all major components of the substations, including incoming primary equipment section, transformer and low-voltage section, as well as circuit breakers, fusible switches, and metering components. Provide a single warranty covering all substation assemblies, transformers and components.

B. Connections between the primary device and transformer shall be copper bussing, and between the transformer and sectionary shall be copper bussing.

C. Outdoor primary and secondary equipment where specified shall be of weatherproof construction, rodent proof and shall contain 277-volt space heaters.

2.03 PRIMARY LOAD INTERRUPTER SWITCH

A. Refer to Section 261321, AIR INTERRUPTER SWITCHES for requirements.
2.04 LIQUID FILLED SUBSTATION TRANSFORMER

A. RATINGS
1. Capacity: as per contract plan drawings.
2. Primary Voltage: 12 kV delta connected.
3. Primary Taps: 2-2 1/2% above and below nominal.
5. Impedance: 5.75 percent.
6. Primary Basic Impulse Level: 95 kV
7. Secondary Basic Impulse Level: 30 kV.
8. Frequency: 60 Hertz.

B. CONSTRUCTION
1. Liquid-Filled Transformers: IEEE C57.12.00, three phase, pad mounted, self-cooled transformer unit, FM Rated.
2. Cooling and Temperature Rise: IEEE C57.12.00; Class OA. 55 degrees C, self-cooled.
3. Insulating Liquid: Less Flammable, biodegradable electrical insulating fluid from high fire point oleic vegetable oil sources and shall be in accordance with the latest edition of NEC. High fire point fluid shall be Factory Mutual and UL listed.
4. Primary Overcurrent Protection: Fuse. Size as per plans.
5. High Voltage and Low Voltage Coils: Wound copper.
6. Monitoring Devices:
   a. Temperature Indicator, Dial Type Thermometer
   b. Liquid Level Gauge.
   c. Pressure Vacuum Gauge
   d. Cover mounted pressure relief device (Self Sealing with indicator)
7. Transformer Tank: Designed to withstand pressures 25% or greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel plate reinforced with external sidewall breaces. All seams and joints shall be continuously welded.
8. Each radiator assembly shall be individually welded and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before core and coil are tanked. A final six-hour leak test shall be performed after the transformer is tanked, welded and completed to ensure that there are no leaks before shipment.

C. ACCESSORIES
1. Tap Chager with externally operated, Kirk Keyed handle.
2. Combination drain and filter valve and sampling device.
3. Ground Pad - Copper.
4. Stainless Steel Nameplate.
5. Filling plug and filter press connection in cover.

2.05 OUTGOING DISTRIBUTION SWITCHBOARD

A. Ratings
1. Amperage Size: As per contract plan drawings.
2. Voltage: 480/277 volts, 3 Phase, 4 Wire.
3. Amps Interrupting Capacity: As per contract plan drawings.
4. Switchboard shall be fully rated.

B. Construction
1. Description: Switchboard manufactured to NEMA PB 2.
2. Line and Load Terminations: Accessible from the front only, suitable for the conductor materials used.
3. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers.
All edges of front connected covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

4. All sections shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

5. Fully equip spaces for future devices with bussing and bus connections suitable insulated and braced for short circuit currents. Provide continuous current rating as indicated.

C. Bussing
2. Current Density Rating: 1000 amps per square inch.
4. Insulated Ground Bus: Copper ground bus extending the length of switchboard. Minimum 1/4 inch thick by 2" height.

D. Wiring and Terminations
1. Furnish necessary wiring, fuse blocks, and terminal blocks for control components. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked with appropriate designations that correspond to manufacturer's wiring diagrams.
2. Provide mechanical type terminals for line and load terminations suitable for copper rated for 75 degrees C. Coordinate sizes with conductors.
3. Provide 2-hole long barrel lugs with inspection window for incoming line section for connection of the main grounding conductors.

E. Insulated Case Circuit breakers:
1. All switchboard breakers shall be fixed low-voltage air-circuit breakers, Eaton type Magnum DS or approved equal.
2. Size as indicated on contract plan drawings.
3. Breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set at the that level.
4. Provide breaker with a Digitrip 520 RMS-advanced protection trip unit. Trip unit must be provided with adjustable long-time pickup and delay, adjustable short-time pickup and delay, and adjustable instantaneous settings. Provide adjustable ground fault pickup and delay settings where indicated on drawings.
5. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be 'Connect' (red) and 'Disconnect' (green).
6. Provide auxiliary contacts, (4) normally open, (4) normally closed.

F. Accessories:
1. Provide a weatherproof light (fluorescent) and switch and weatherproof GFCI receptacle in each structure. Include all necessary power transformers, wiring and connections.

2.06 PROTECTIVE RELAYS AND INSTRUMENTS

A. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.

B. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

C. Customer Power Meter: Eaton Power XPERT as specified on single line diagram.

2.07 ACCESSORIES

A. Incoming Cable Terminations: Clamp-type.

B. Accessories: IEEE C57.12.00 standard accessories.
C. Tap Changer: Externally-operated type.
D. Space Heaters: Provide a control power transformer for space heater in low voltage and medium voltage sections. Power transformer and heater shall be sized by Substation manufacturer.
E. Safety Nameplate: NEMA 260.

2.08 FACTORY FINISHES
A. Clean surfaces before applying paint.
B. Apply corrosion-resisting primer to all surfaces.
C. Apply finish coat of baked enamel paint to 4 mils thick.
D. Finish Color: Manufacturer's standard gray finish.

2.09 SOURCE QUALITY CONTROL
A. Provide factory tests to IEEE C57.12.90 and IEEE C57.12.00. Include the routine tests as defined in the standards and the following other tests:
   1. Impedance voltage and load loss.
   2. Dielectric tests.
   3. Audible sound level.
   4. Short circuit capability.
   5. Telephone influence factor (TIF).
   7. Temperature rise.
B. Test insulating liquid samples in accordance with IEEE C57.111.
C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify District at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION
A. Install in accordance with IEEE C57.94 and manufacturers instructions.
B. Install substation plumb and level and with each section aligned properly. Include all necessary shim and grout.
C. Make electrical connections between equipment sections using connectors furnished by manufacturer.

3.03 FIELD QUALITY CONTROL
A. Inspect and test in accordance with NETA STD ATS, except Section 4.
B. Primary Switch: Perform inspections and tests listed in NETA STD ATS, Section 7.5
C. Transformer: Perform inspections and tests listed in NEMA ATS, Section 7.2. Include the following optional tests:
   1. Verify that control and alarm settings on temperature indicators are as specified.
   2. Power factor or dissipation-factor tests in accordance with manufacturer's instructions.
   3. Winding-resistance tests for each winding at nominal tap setting.
   4. Perform an applied voltage test on all high- and low-voltage windings-to-ground.
   5. Individual excitation current tests on each phase.
   6. If ground strap is accessible, remove and measure core insulation resistance at 500 volts dc.
   7. Insulating liquid specific gravity.
   8. Operational test and adjustments on fan and pump controls and alarm functions.
D. Secondary Equipment: Perform inspections and tests listed in NETA STD ATS, Section 7.1 and 7.6.

3.04 STARTUP TRAINING
   A: Refer to Commissioning of Electrical Systems - Section 26 08 00

3.05 ADJUSTING
   A. Adjust protective relays in accordance with recommendations in the final Power System Study Report.

END OF SECTION
SECTION 26 13 21
AIR INTERRUPTER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Medium-voltage air interrupter switches.
B. Medium-voltage fuses.

1.02 REFERENCE STANDARDS
B. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. Shop Drawings: Indicate outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, bill of materials, and equipment electrical ratings.
B. Product Data: Provide data for components and accessories including fuse product data.
C. Seismic certification.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements
E. Test Reports: Indicate findings of field quality control procedures.
F. Submit manufacturer's installation instructions.
G. Maintenance Data: Fuse replacement, adjustment and lubrication instructions.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Protect interrupter switches from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Eaton Corporation; www.eaton.com or approved equal.

2.02 AIR INTERRUPTER SWITCHES
A. Description: IEEE C37.20.3, switchgear assembly of individual air interrupter switches in free-standing cubicles, securely bolted together to form an integrated structure, suitable for installation where accessible by general public.
B. Ratings:
1. System Voltage: 12 kV, three phase, three wire, 60 Hz.
2. Maximum Design Voltage: 15 kV.
3. System Grounding: Solid
4. Basic Impulse Level: 95 kV.
5. Main Bus Ampacity: 600 amperes, continuous.
6. Main Cross Bus Momentary Current: 61kA RMS Asymmetrical (10 cycle)
7. 2-Second Current: 38 kA RMS Symmetrical
8. Fused Switched Rating: 15kV Fuse Ampere. Sized as per contract plan documents.
9. Fuse Type: CLE
10. Fuse Interrupting Rating: 63 kA Sym RMS
11. Fused Switch Fault Close Rating: 101kA Asym RMS.

C. Construction
1. Enclosure: Weatherproof, metal-enclosed interupter switchgear shall consist of
deadfront, completely metal-enclosed vertical sections containing load interupter switches
and fuses (where shown) of the number, rating and type noted on the drawings or
specified herein.
2. Vertical section construction shall be of universal frame type using die-formed and bolted
parts. All enclosing covers and doors shall be fabricated from steel with thickness greater
than that specified in ANSI/IEEE C37.20.3.
3. Every vertical section shall contain:
   a. A three-pole, two-position, open-closed switch.
   b. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the
      position of the three switch blades through the closed door. The window shall not be
      more that 56" above the switch pad level.
   c. Hinged Inspection Metal Barrier: A hinged grounded metal barrier that is bolted
      closed in front of switch to prevent inadvertent contact with any live part, yet allows for
      a full-view inspection on the switch blade position.
   d. Operating Handle: Permanently mounted, padlockable in both positions and
      interlocked:
      1) To prevent opening fuse compartment door with switch in CLOSED position.
      2) So that door must be in the CLOSED position before the switch can be closed.
   e. Hinged Cover for Operating Handle: Hinged cover with rustproof quarter turn nylon
      latches over the switch operation mechanism to discourage casual tampering.
   f. Green OPEN, Red CLOSED switch position indicators with the works 'Open' and
      'Closed'.
4. Provide sloped drip-proof roof and door in door construction.
5. Include continuous ground bus through switchgear assembly, securely connected to frame
   of each cubicle.

D. Bussing:
1. Phase bus conductors shall be silver plated Copper.
2. Ground Bus shall be silver-plated copper and be directly fastened to a galvanized metal
   surface of each vertical section. Sixed sufficiently to carry the rated (2-second) current of
   the switchgear assembly.
   a. Provide lugs for incoming feeder in cubicle.
      1) Finish: Manufacturer's standard baked enamel paint 4 mils thick.
      2) Clean surfaces before applying paint.
      3) Apply corrosion-resisting primer to all surfaces.
      4) Finish Color: Manufacturer's standard gray finish.

2.03 ACCESSORIES
A. Incoming Cable Terminations: Clamp-type.
B. Space Heaters: Provide space heaters. Include all necessary power transformer and wiring.
Heater and power transformers shall be sized by switchgear manufacturer.
2.04 SOURCE QUALITY CONTROL
   A. Provide factory inspection and testing in accordance with IEEE C37.20.3.
   B. Make completed switch assemblies available for inspection at manufacturer's factory prior to packaging for shipment. Notify District at least 7 days before inspection is allowed.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install on concrete pad as indicated on Drawings.

3.02 TRAINING
   A. Provide a training session for up to (5) owner's representatives for one (1) normal workday at the job site location at a time determined by the owner.
   B. Training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly, switches and major components.

3.03 FIELD QUALITY CONTROL
   A. Inspect and test in accordance with NETA STD ATS, except Section 4.
   B. Perform inspections and tests listed in NETA STD ATS, Sections 7.5.1.1., 7.5.1.2., and 7.5.1.3.

END OF SECTION
SECTION 26 24 13
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Switchboards.
B. Switchboard accessories.

1.02 REFERENCE STANDARDS
D. NECA 400 - Standard for Installing and Maintaining Switchboards (ANSI); National Electrical Contractors Association; 2007.
E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
F. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2006.
I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components, and all options that are included.
C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; electrical characteristics, size and number of bus bars per phase; neutral, and ground; and switchboard instrument details; connection and support points; weight; specified ratings and materials. Include nameplate data, schematic diagrams, and bill of materials.
D. Test Reports: Indicate procedures and results of factory and field testing and inspection. Provide (2) certified copies.
E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation of product, and operating instructions for manually and electrically opening and closing circuit breakers.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
G. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.
H. Project Record Documents: Record actual locations of switchboards. Include a copy of manufacturer's certified drawing.
10200 - Merritt College CHW Infrastructure

I. Maintenance Data:
1. Include maintenance instructions for cleaning methods; cleaning materials; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication.
2. Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Campus’s use in maintenance of project.
1. See Division 1 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.

K. Equipment operation and maintenance instructions shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and within 100 miles of the project.
C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle in accordance with NEMA PB 2.1 and manufacturer’s written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com or approved equal.

2.02 SWITCHBOARDS
A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
B. Ratings:
   1. Amperage size: As per contract plan drawings.
   3. Amps interrupting Capacity: As per contract plan drawings.
   5. Switchboard shall be fully rated.

2.03 CONSTRUCTION
A. Description: Switchboard manufactured to NEMA PB 2.
B. Line and Load Terminations: Accessible from the front only, suitable for the conductor materials used.
C. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front connected covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
D. All sections shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible. Rear access shall be provided.

E. Fully equip spaces for future devices with busing and bus connections suitable insulated and braced for short circuit currents. Provide continuous current rating as indicated.

F. Bussing
2. Copper bus bars shall be of sufficient size to provide a current density of not more than 1000 amperes per square inch of cross section, and not more than 200 amperes per square inch at bolted connections.
4. Insulated Ground Bus: Copper ground bus extending the length of the switchboard. Minimum 1/4" thick by 2" height.
5. Neutral Bus: Full capacity

G. Wiring and Terminations
1. Furnish necessary wiring, fuse blocks, and terminal blocks for control components. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked with appropriate designations that correspond to manufacturer’s wiring diagrams.
2. Provide mechanical type terminals for line and load terminations suitable for copper rated for 75 degrees C. Coordinate sizes with conductors.
3. Provide 2-hole long barrel lugs with inspection windows for incoming line section for connection of the main grounding conductors.

H. Insulated Case Circuit breakers:
1. Main switchboard breaker shall be fixed low-voltage air-circuit breakers, Eaton type Magnum DS or approved equal.
2. Size as indicated on contract plan drawings.
3. Breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set at the that level.
4. Provide breaker with a Digitrip 520 RMS-advanced protection trip unit. Trip unit must be provided with adjustable long-time pickup and delay, adjustable short-time pickup and delay, and adjustable instantaneous settings. Provide adjustable ground fault pickup and delay settings where indicated on drawings.
5. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be 'Connect' (red) and 'Disconnect' (green).
6. Provide auxiliary contacts, (4) normally open, (4) normally closed.

I. Molded Case Circuit Breakers:
1. All breakers downstream from main circuit breaker shall be molded case circuit breakers with inverse time tripping characteristics.
2. Circuit breaker shall be operated by toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breakers shall provide a local manual means to exercise the trip mechanism.
3. Circuit breakers shall be thermal magnetic trip. Ground fault protection shall be provided where indicated.
4. Provide auxiliary contacts, (2) normally open, (2) normally closed.

J. Pull Section: Size as indicated on drawings.
1. Size as shown on Drawings.

K. Enclosure: Type 1 for indoor, Type 2 (NEMA 3R) for outdoors.
1. Align sections at front and rear.

DSA Re-submittal 6/21/2012

26 24 13 - 3

SWITCHBOARDS
2. Factory Finish: Manufacturer's standard light gray enamel over external surfaces. Clean surfaces before applying paint. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
3. Provide enclosure doors with provisions for padlocking.

2.04 ACCESSORIES
A. Safety Nameplate: NEMA 260

2.05 PROTECTIVE RELAYS AND INSTRUMENTS
A. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.
B. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
C. Customer Power Meter: Eaton Power XPERT as and where specified on single line diagram.

2.06 SOURCE QUALITY CONTROL
A. Shop inspect and test switchboard according to NEMA PB 2.
B. Provide factory tests according the latest version of ANSI and NEMA Standards. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard test for simulated service condition to ensure accuracy of wiring and functionality. Provide main circuits with dielectric test of 2200 volts for (1) minute between live parts and ground and between opposite polarities. Provide wiring and control circuits with dielectric test of 1500 vts for (1) minute between live parts and ground.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION
A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
B. Install in a neat and workmanlike manner, as specified in NECA 400.
C. Install switchboard plumb and level and with each section aligned properly. Include all necessary shim and grout.
D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL AND ACCEPTANCE TESTING
A. Inspect and test in accordance with NETA STD ATS, except Section 4.
B. Perform inspections and tests listed in NETA STD ATS, Section 7.1. and 7.6

3.04 ADJUSTING
A. Adjust all operating mechanisms for free mechanical movement.
B. Tighten bolted bus connections in accordance with manufacturer's instructions.
C. Adjust circuit breaker trip and time delay settings to values indicated in Power System Study.

3.05 CLEANING
A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards. Wall Mounted
B. Lighting and appliance panelboards. Wall Mounted

1.02 REFERENCE STANDARDS

B. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
D. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches; National Electrical Manufacturers Association; 1993.
E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
F. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2006.
G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
K. UL 67 - Panelboards; Current Edition, Including All Revisions.
M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and arrangement and sizes.
C. Test Reports. Indicate procedures and results of factory and field testing and inspection. Provide (2) certified copies.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.
F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
H. Maintenance Data:
1. Include maintenance instructions for cleaning methods; cleaning materials; instructions for
circuit breaker removal, replacement, testing and adjustment, and lubrication.
2. Include spare parts listing; source and current prices of replacement parts and supplies;
and recommended maintenance procedures and intervals.
I. Maintenance Materials: Furnish the following for Campus's use in maintenance of project.
1. See Division 1 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.
J. Equipment operation and maintenance instructions shall be provided with each assembly
shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where
applicable, for the complete assembly and each major component.

1.04 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose
specified and indicated.

1.05 MAINTENANCE MATERIALS
A. See Division 1 - Product Requirements, for additional provisions.
B. Furnish two of each panelboard key.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions
and NECA 407.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or
heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to
panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Eaton Corporation; Cutler-Hammer Products; www.eaton.com or approved equal.

2.02 ALL PANELBOARDS
A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
B. Panels 225A or less shall be lighting style panelboards. Panels above 225A shall be power
panelboards. Any distribution board 800A and above shall be a switchboard per 'Switchboard'
specifications.
C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
E. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each
feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for
each feeder and branch circuit equipment grounding conductor.
F. Conductor Terminations: Suitable for use with the conductors to be installed.
G. Enclosures: Surface mounted. Comply with NEMA 250, and list and label as complying with
UL 50 and UL 60E.
1. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter
taps, or oversized lugs are provided.
2. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

DSA Re-submittal 6/21/2012
b. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

3. Lockable Doors: All locks keyed alike unless otherwise indicated.

4. Door-in-Door construction: The front trim shall have full-length hinged outer door designed to expose the wiring raceways and breakers when open. Another, inner hinged door shall expose breakers only, when open, making this a door-in-door construction. Both doors shall open to the right. When the outer door is open, all gutter space shall be exposed.

H. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

I. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper.
   2. Main and Neutral Lug Type: Compression.

C. Bussing:
   1. Copper, ratings as indicated. Provide full size copper ground and neutral bus in each panelboard.
   2. Copper bus bars shall be of sufficient size to provide a current density of not more than 1000 amperes per square inch of cross section, and not more than 200 amperes per square inch at bolted connections.

D. Minimum integrated short circuit rating: As indicated on drawings.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt on type circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

G. Provide and install all mounting hardware in spaces for future circuit breaker.

H. Each circuit shall be permanently numbered to agree with the panel schedule, using plastic or metal buttons mounted adjacent to the breaker and secured by rivets or grommets with an engraved or depressed number. Adhesive numbering tape, painted numbers, or use of more than one number per breaker is not acceptable.

I. Enclosure: Indoor Units shall be NEMA PB 1.

J. Enclosure: Outdoor Units shall be NEMA 3R suitable for Outdoor Application.

K. A sturdy metal frame, with a clear plastic cover shall be welded to the inside of the panel door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper.
   2. Main and Neutral Lug Type: Compression.

C. Bussing: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus as scheduled.

D. Minimum Integrated Short Circuit Rating: As indicated on contract drawings.

E. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Do not use tandem circuit breakers.

F. Enclosure: Indoor Units shall be NEMA PB 1, Type 1, 5-3/4 inches deep, 20 inches wide, cabinet box.

2.05 SOURCE QUALITY CONTROL
A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as shown on the drawings.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
D. Provide filler plates for unused spaces in panelboards.
E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
F. Provide engraved plastic nameplate.
G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.
H. Ground and bond panelboard enclosure according to NEC.
I. Arrange equipment to provide minimum clearances in accordance with manufacturer’s instructions and NFPA 70.
J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.03 FIELD QUALITY CONTROL
A. Perform field inspection and testing in accordance with other sections of these specifications.
B. Inspect and test in accordance with NETA STD ATS, except Section 4.
C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.
D. Ground Fault Protection Systems: Test in accordance with manufacturer’s instructions as required by NFPA 70.
E. Test GFCI circuit breakers to verify proper operation.
F. Test AFCI circuit breakers to verify proper operation.
G. Test shunt trips to verify proper operation.
H. Correct deficiencies and replace damaged or defective panelboards or associated components.
3.04 ADJUSTING
A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
C. Adjust alignment of panelboard fronts.
D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING
A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.
B. Emergency lighting units.
C. Exit signs.
D. Ballasts.
E. Fluorescent dimming ballasts and controls.
F. Fluorescent emergency power supply units.
G. Lamps.
H. Luminaire accessories.

1.02 REFERENCE STANDARDS

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
F. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

DSA Re-submittal 6/21/2012

INTERIOR LIGHTING
B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1588, where applicable.

C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.02 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.03 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.
2.04 BALLASTS
A. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.05 FLUORESCENT EMERGENCY POWER SUPPLY UNITS
A. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
B. Compatibility:
   1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.
C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 60 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
D. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
E. Fluorescent Ballasts: shall be electronic, high power factor, parallel wired and certified to be designed and constructed by Certified Ballast Manufacturers, Inc.
F. Ballasts shall be suitable for lamp used. Provide certification to Engineer.

2.06 LAMPS
A. Manufacturers shall be GE, Phillip Lighting, Sylvania, or approved equal.
B. Lamp shall all be from the same manufacturer.
   1. Lamps shall manufactured within 60 days of delivery.
   2. Lamps shall come in from the same Lot Number.
   3. Lamps shall be listed with ballasts installed in fixtures.
C. All Lamps:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.
D. Lamps shall at least "3rd generation", "high", or "super" T8, 32W Nominal, 4100K, 85 CRI min.

2.07 OCCUPANCY SENSORS
A. Occupancy Sensors shall be dual technology occupancy sensors.

2.08 ACCESSORIES

END OF SECTION
SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Exterior luminaires.
B. Lamps.

1.02 REFERENCE STANDARDS
A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 SUBMITTALS
A. See Division 1 for submittal procedures.
B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
C. Product Data: Provide manufacturer’s standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer’s written instructions.
B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Refer to contract drawings for specific manufacturer..

2.02 LUMINAIRE TYPES
A. Furnish and install products as indicated on the contract plan drawings.
2.03 LUMINAIRES
   A. Provide products that comply with requirements of NFPA 70.
   B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
   C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
   D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
   E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
   F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
   G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
   H. Exposed Hardware: Stainless steel.

2.04 LAMPS
   A. All Lamps:
      1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
      2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
      3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
      4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field measurements are as shown on the drawings.
   B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
   C. Verify that suitable support frames are installed where required.
   D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
   E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
   A. Provide extension rings to bring outlet boxes flush with finished surface.
   B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION
   A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.
   B. Install products according to manufacturer's instructions.
   C. Install luminaires securely, in a neat and workmanlike manner, as specified in NEC 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
   D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
   E. Pole-Mounted Luminaires:
      1. Grounding:
a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

F. Install accessories furnished with each luminaire.
G. Bond products and metal accessories to branch circuit equipment grounding conductor.
H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL
A. Inspect each product for damage and defects.
B. Operate each luminaire after installation and connection to verify proper operation.
C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING
A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Engineer.

3.06 CLEANING
A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION
A. Protect installed luminaires from subsequent construction operations.

END OF SECTION
SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fire alarm control panels.
B. Manual fire alarm stations.
C. Automatic smoke and heat detectors.
D. Fire alarm signaling appliances.
E. Auxiliary fire alarm equipment.

1.02 RELATED SECTIONS
A. Section 15820 - Duct Accessories: Smoke dampers.

1.03 REFERENCES

1.04 SYSTEM DESCRIPTION
A. Fire Alarm System is Simplex manual, addressable, Class B, Style B system

1.05 SUBMITTALS
A. Contractor shall within two weeks of Notice to Proceed submit the following for the Electrical Engineer's Review and Approval. Submittal shall be pre-reviewed by certified installer.
   1. Product Data: Provide data cut sheets showing electrical characteristics and connection requirements of fire alarm devices.
   3. Fire Alarm Wiring
   4. Installer National Institute for Certification in Engineering Technologies (NICET) Level II Certification
   5. Shop Drawings showing the following:
      a. Fire Alarm Riser Diagram showing each device, conduits, and wiring connection required.
      b. Fire Alarm Devices Zones and Addresses.
   6. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of products.

B. Contractor shall submit progress inspection reports signed by a Simplex Certified Installer. Inspection report shall indicate satisfactory installation of raceways, wiring, fire alarm devices, and equipment per Simplex installation standards. Inspection shall be submitted on a bi-weekly basis, or as requested by IOR, the District, or the Electrical Engineer. Contractor shall within 3 working days correct deficiencies noted on the inspection report. No additional contract time will be allotted for correction of deficiencies.

C. Contractor shall within two weeks of testing submit the following for the Electrical Engineer's Review and Approval.
   1. Test Reports: Indicate satisfactory completion of required tests and inspections.

D. Upon final acceptance of fire alarm system, Contractor shall submit the following documents to the District.
   1. Operation Data: Operating instructions.
3. As-built drawings: Drawings shall reflect actual locations of fire alarm devices, equipment, wire gauge, conduit, and routing. Voltages at EOL resistor shall also be reflected.

E. See Special Materials for additional submittals.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 72, NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Installer Qualifications: Company specializing in installing the products specified in this section.
   1. NICET Certification: The installing contractor shall employ at least one individual at the jobsite supporting this project that has attained NICET Level II Certification in Fire Alarm Systems. All submittals and drawings shall be approved, initialed and show the NICET Certification Number of the individual maintaining the certification and taking responsibility for the documentation.
   2. With minimum three years documented experience.
   3. Certified in the State in which the Project is located as fire alarm installer.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

E. Utilize companies regularly engaged in fire alarm system installation; RFI, Sound and Signal, or equal.

1.07 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.

1.08 SPECIAL TRAINING AND MATERIALS

A. Contractor shall arrange a special training (minimum of 8 hours) conducted to familiarize school maintenance personnel with the new fire alarm system. Training shall at a minimum cover the following
   1. Familiarization with the new fire alarm system, devices, identifying zones, coverage, and routing.
   2. Provide general guidelines on the proper maintenance and operation of the fire alarm system (i.e. battery, voltage check, alarm, and trouble mode, etc.)
   3. Provide instructions on how to operate fire alarm for fire drill purposes.

B. Fire Alarm Installer shall provide Owner with 8.5” x 11” sheets of floor plans showing all the fire alarm equipment and devices. Device addresses shall be reflected in these floor plans. Device addresses shall correspond with preprogrammed addresses in the fire alarm control panel.

C. Fire Alarm Installer shall provide and install a permanently engrave 8.5” x 11” metal plate showing fire alarm site plan. Install in front of the fire alarm panel. Submit fire alarm site plan to engineer for approval.

1.09 EXTRA MATERIALS

A. Provide ten manual station break-glass rods.

B. Provide six keys of each type.

C. Provide three of each type of automatic detectors with base.
PART 2 PRODUCTS

2.01 MANUFACTURERS: SIMPLEX

2.02 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

A. Control Panel: Modular construction with flush wall-mounted enclosure.

B. Power supply: Adequate to serve control panel modules, remote detectors, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

C. System Supervision: Component or power supply failure places system in trouble mode.

D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.

E. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.

F. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

H. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.

I. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
   1. Visual and audible trouble alarm indicated by zone at fire alarm control panel.
   2. Visual and audible trouble alarm indicated at remote annunciator panel.

J. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
   1. Sound and display local fire alarm signaling devices with temporal signal.
   2. Transmit non-coded signal to central station.

K. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.

2.03 INITIATING DEVICES


B. Spot Heat Detector: Fixed temperature, rated 135 degrees F and temperature rate of rise of 15 degrees F.

C. Ceiling Mounted Smoke Detector: NFPA 72, ionization type with adjustable sensitivity and visual indication of detector actuation, suitable for mounting on 4 inch outlet box. Provide two-wire detector with common with separate power supply and signal circuits.

D. Duct Mounted Smoke Detector: NFPA 72, ionization type with auxiliary SPDT relay contact key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common with separate power supply and signal circuits.

2.04 SIGNALING APPLIANCES

A. Alarm Lights: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens. Strobe rating as indicated in the drawings.

B. Alarm Horn: NFPA 72, surface type fire alarm horn.
   1. Sound Rating: 75 dB at 10 feet.
C. Remote Annunciatior: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush wall-mounted enclosure.

2.05 FIRE ALARM WIRE AND CABLE
A. Fire Alarm Power Branch Circuits: Building wire as specified in Division 16000.
B. Initiating Device Appliance Circuits: Twisted Pair #12, minimum. Refer to Manufacturer for additional requirements.
C. Signaling Device Appliance Circuits: THWN #12 AWG minimum. Refer to Manufacturer for additional requirements.
D. Color code
   1. Provide fire alarm circuit conductors with insulation color coded as follows, or using colored tape at each conductor termination and in each junction box.
   2. Power Branch Circuit Conductors: Black, red, white.
   3. Initiating Device Circuit: Black, red.
   5. Signal Device Circuit: Blue (positive), white (negative).

PART 3 EXECUTION
3.01 EXAMINATION
A. For existing systems that will be modified, contractor shall perform a pre-test. Pre-test shall indicative of extent of fire alarm system and test results shall verify following:
   1. Number of initiation and signaling zones, addresses, etc.
   2. Interconnection of equipment and devices to fire alarm control panel.
   3. EOL device locations and voltage drop measurements.
   4. General routing of fire alarm wiring
   5. Other information that may be necessary to modify existing system
B. Coordinate location of fire alarm devices with Architect prior to rough-in. Device locations in floor plans has bee designed to meet strobe and sound coverage. Deviations from locations in floor plans must be approved prior to installation. Contractor shall be responsible for providing additional devices if strobe and sound coverage requirements are not met due to changes in device locations.
C. All fire alarm conduits shall be concealed. If site conditions do not allow for concealment of conduits, installer shall coordinate routing of exposed conduits with Architect prior to rough in.

3.02 INSTALLATION
A. Install products in accordance with NEC, NFPA 72, CBC, and manufacturer’s instructions.
B. Install manual stations with 48 inches to centerline of device above finished floor.
C. Install audible devices 90 inches to top of device above finished floor, not less than 6 inches from ceiling
D. Install visual or audible/visual devices 80 inches to bottom of device, not greater than 96 inches above finished floor but not less than 6 inches from ceiling.
E. Install fire alarm wiring in 3/4 inch minimum conduit.
F. Mount outlet box for electric door holder/release to withstand 80 pounds pulling force.
G. Automatic Detector Installation: Conform to NFPA 72.
H. Junction boxes shall be installed and painted Red.

3.03 FIELD QUALITY CONTROL
A. Perform field inspection and testing in as specified in the contract specifications and drawings.
B. Testing shall include the testing of the following:
   1. New Fire Alarm System
2. Sound Levels
3. Strobe Flash Rate for Multiple Strobes in Single Location
5. Testing of connection and communication with remote unit, and central station.

C. Test in accordance with NFPA 72, Chapter 7.

D. Conduct tests in the presence of the owner's representative, the local fire authority, and the DSA Inspector of Record.

E. Provide a signed and completed certificate of completion to DSA upon completion of project in accordance with NFPA 72, Chapter 4. This form shall be signed by DSA IOR.

3.04 DEMONSTRATION

A. Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Refrigerant Monitoring Systems (RMS).

1.02 REFERENCES
   A. ASHRAE Standard 15/34 - 2007
   B. EPA Standard 608 CFR
   C. NFPA 70 - National Electrical Code.
   D. NFPA 72 - National Fire Alarm Code
   E. 2010 California Mechanical Code, Chapter 11
   F. 2010 California Fire Code, Section 606
   G. California Air Resources Board Section 95385

1.03 SUBMITTALS
   A. Provide catalog cut sheets describing system, indicating accuracies, minimum detectable quantities of various refrigerants, data outputs, dimensions, contact ratings, capabilities.
   B. Provide catalog cut sheets of components for use in the RMS, UPS, General Alarm Panel and EF Emergency Control Panel. These would include the enclosures, pushbuttons, indicating lamps, relays and terminal strips. Clearly indicate all optional or ‘extra’ items/features to be included (expansion modules, communication modules, battery modules, etc.)
   C. Provide complete shop drawings for the RMS, UPS, General Alarm Panel, Batteries, and EF Emergency Control Panel, indicating point to point wiring diagrams, component layout and lettering to be provided. Include in shop drawings all interface connections to building control system (EMS, BAS, etc), as well as all connections to building Fire Alarm panel.
   D. Provide Electrical Specification for RMS Panel, General Alarm Panel, UPS and batteries, and EF Emergency Control Panels. At a minimum, provide input power, voltage, and loads under standby and alarm conditions. Provide sizing calculations for UPS, UPS supplemental batteries and General Alarm Panel batteries.
   E. Provide cutsheets for horns, strobes, and breakglass pullstations. Submit nameplate list and breakglass pullstation labeling for review.

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION
   A. In accordance with SECTION 01 60 00, PRODUCT REQUIREMENTS.
   B. Deliver All products under this Section to project site in sealed protective packaging.
   C. Store all products under this Section under cover and elevated above grade.

1.06 WARRANTY
   A. Correct defective Work within a one year period after Date of Substantial Completion.

1.07 EXTRA MATERIALS
   A. Supply three zero air filters and pickup filter (for each location) elements for Owner’s use in maintenance of project.
   B. Supply six replacement breakglass rods for each pullstation installed.
1.08 INSTRUCTION

A. Contractor shall furnish and coordinate instruction for the Owner's Maintenance personnel. Provide a minimum of 4 hours training for 5 operators. Provide instruction on normal operation and maintenance, including zero filter replacement. Provide instruction for alarm functions, silence, reset and fault sequences. Provide instruction on EF emergency control panel. Provide instructions for fault diagnostics. Provide instructions for periodic testing requirements as required by the manufacturer and code.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. ALARM HORN: Remote signaling devices shall be suitable for flush or surface mounting to standard outlet or junction boxes. Provide nameplate "R-134a - REFRIGERANT ALARM". Engraved lamicoid signs shall be posted at all horn locations. " - REFRIGERANT ALARM". Outside chiller room: "DO NOT ENTER WHEN HORN IS SOUNDING"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN HORN IS SOUNDING". Letters shall be a minimum of 1 inches high, white, with red background. Horns shall be have variable tone settings. Device color shall not be red. Provide weatherproof backbox for exterior installation. Horns shall have silenceable feature or be wired so that horns may be silenced. As specified on drawings.

B. ALARM STROBE: Remote signaling devices shall be suitable for flush or surface mounting to standard outlet or junction boxes. Engraved lamicoid signs shall be posted at all strobe locations. " - REFRIGERANT ALARM". Outside chiller room: "DO NOT ENTER WHEN LIGHT IS ON"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN LIGHT IS ON". Letters shall be a minimum of 1 inches high, white, with red background. Device color shall not be red. Provide weatherproof backbox for exterior installation. As specified on drawings.

C. ALARM HORN/STROBE: Remote signaling devices shall be weatherproof and suitable for flush or surface mounting to standard outlet or junction boxes. Provide nameplate "REFRIGERANT ALARM". Engraved lamicoid signs shall be posted at all horn/strobe alarm locations. Outside chiller room: "DO NOT ENTER WHEN LIGHT IS ON"; inside the chiller room: "LEAVE AREA IMMEDIATELY WHEN LIGHT IS ON". Letters shall be a minimum of 1 inches high, white, with red background. Horns and horn/strobes shall be as further specified on Drawings. Color shall not be red and shall be distinct from facility fire alarm horn/strobes.

D. BREAKGLASS PUSHBUTTONS: For manual initialization of emergency shutdown of equipment and for manual initiation of fan purge sequence. Pushbuttons shall be as specified on the Drawings. Color shall not be red and shall be distinct from facility fire alarm pull stations.

E. REFRIGERANT MONITORING SYSTEM GENERAL ALARM PANEL: General alarm panel shall be utilized to power horns and strobes and shall have battery backup 24 VDC, with accessories and modules as specified on the drawings. Panel shall provide full supervision of signaling devices and refrigerant monitoring system and shall provide "trouble" inputs to the facility fire alarm system for remote monitoring. Units specified on drawings are typical small fire alarm panels and shall be repainted a color other than red prior to installation.

F. UPS and BATTERIES: APC or approved equal, shall provide continuous AC power to the refrigerant monitor. Provide the unit with the capacity and extra batteries as specified on the drawings. Batteries & UPS sized for 24 hours of monitoring, and 5 minutes of alarming. Mount equipment off of the floor.

G. FAN EMERGENCY CONTROL: Contractor fabricated NEMA IV, painted enclosure with break glass front and locking hinged cover. Provide oil tight pushbuttons for emergency control of exhaust fans. Provide indicating lights as shown and mount in panel. Label all components.

H. SAMPLE TUBING: The tubing shall be refrigerant-grade copper, 1/4" O.D. seamless Type ACR (hard or annealed) complying with ASTM-B280 or seamless Type K, L, or M (drawn or

DSA Re-submittal 6/21/2012

28 35 00 - 2

REFRIGERANT MONITORING SYSTEM
annealed) in accordance with ASTM-B88, with compression fittings. Soldered or brazed connections are not acceptable due to foreign gases and contaminants. Poly tubing and other gas absorbing/leaching types are unacceptable due to sample corruption. Nylon nonplasticized ¼" O.D. tubing, similar to Parker Hannifin, may be used if preapproved, and installed or bundled in ¾" EMT conduit, or larger, 80% free area. The tubing shall be shipped sealed to the site.

PART 3 EXECUTION

3.01 CALIBRATION
A. Unit shall be factory calibrated. This includes a zero calibration, as well as a minimum of two additional points using calibration gases of known concentrations.

3.02 MANUFACTURERS DIRECTIONS
A. Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown. Equipment which is required to be field assembled shall be assembled under the direct supervision of the manufacturer.

3.03 EQUIPMENT
A. Accurately set and leveled with supports neatly placed and properly fastened. Properly fasten equipment in place with bolts or clips or as shown on drawings to prevent movement in earthquake. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in or installing equipment into position in or on the building and for adequate anchoring of equipment.
B. Mount monitor panel and refrigerant monitoring pick ups outside of any directed airstream from air outlets or inlets, motor vents, etc.
C. Refrigerant Sensing Piping: Install ¼" O.D. tubing to each monitored zone. Connections shall be mechanical compression fittings. Pressure test installed tubing with 15 psig air. Tubing shall be worked into a complete, integrated arrangement with like elements to make work neat appearing, and finished. Where exposed, parallel with walls or structural elements; vertical runs plumb; horizontal runs level, parallel with structure or uniformly pitched as appropriate. Terminate in utility box and provide particulate filter on end of line. Mount pick ups within 10" of floor. Provide support at less than six foot intervals and at all bends.
D. Zero and Pick Up Filters: Assemble and install zero and pick up filters as per manufacturer's instructions.
E. Exhaust port: Field route exhaust port a minimum of five feet from zero filter.
F. UPS: Mount UPS System and Batteries on concrete housekeeping pad (4" min) or mount to wall with appropriate shelves and seismic restraints.
G. Horns: Set horn tone to be distinct from fire alarm horns. Set 15 dBA above ambient sound levels. Install horns as shown on drawings.
H. Strobes: Coordinate flash rate of refrigerant strobes with fire alarm strobes if any. Total flash rate shall not exceed 300 flashes per minute. Install strobes as shown on drawings.
I. Horn/Strobes: Combination units shall be as per individual units described above. Install as shown on drawings.
J. Breakglass: Install breakglass at 48" above finish floor to the centerline of the device.
K. EF Emergency Control Panel: Wall or pedestal mount securely to resist seismic forces. Mount at 48" above floor to centerline of panel, unless otherwise noted.

3.04 SYSTEM SET UP AND PROGRAMMING
A. Coordinate with Controls Contractor for scaling and setpoints programming, relay contact normal position and interconnections to reset pushbuttons, horn silence, EF Emergency Control Panel, BAS and building Fire Alarm Control Panel. Provide latching alarm action, normally open relay contact positions, 0 2000 ppm scaling for analog outputs, and alarm levels as described in this section and as shown on the drawings. Provide written start up report.

DSA Re-submittal 6/21/2012

28 35 00 - 3

REFRIGERANT MONITORING SYSTEM
verifying that all sequences and operations are as specified and required for proper operation of complete system.

3.05 SIGNS, LABELS AND IDENTIFICATION OF EQUIPMENT

A. Post warning signs at each alarm horn/strobe location. Properly identify each piece of equipment and its controls using engraved laminated plastic descriptive nameplates, black on white, fastened to equipment and controls using round head brass machine screws, pop rivets, contact cement or chain to equipment. Cardholders in any form are not acceptable.

B. Provide and post code required sign indicating installing contractor, and type and quantity of refrigerant in system as described on the drawings.

3.06 TESTING AND DEMONSTRATION:

A. Complete Refrigerant Monitoring System shall be tested and demonstrated in the presence of the Owner and Engineer to verify correct operation for all aspects of the installed system to meet the sequences and operation as specified herein and on the drawings and as required to meet code requirements.

B. Installing Contractor shall provide test gases for use in demonstration operation of all alarm functions (lo, med and high, each refrigerant required). Installing Contractor shall provide replacement breakglass rods for replacement at the end of testing and demonstration. Demonstration shall include, but not necessarily limited to, the following:
   1. Purge fan pullstation operation.
   2. Emergency Power Off pullstation operation.
   3. Low, Medium and High Level alarm operation
   4. Horn Silence (local and remote from EF Emergency Control Panel).
   5. System reset
   6. Communication of alarms to Fire Alarm System and BAS system printer
   7. Disconnecting alarm devices to verify annunciation to Fire Alarm
   8. Disconnect power to verify battery backup operation
   10. Operation of room temperature sensor/thermostat.

C. Controls Contractor representative shall also be present during demonstration.

END OF SECTION
SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 DEFINITIONS
A. Finish Grade Elevations: Indicated on drawings.
B. Subgrade Elevations: 6 inches below finish grade elevations indicated on drawings, unless otherwise indicated.

1.03 REFERENCES
A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010
B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2009.
F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005
G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 SUBMITTALS
A. See Section Division 1 for submittal procedures.
B. Materials Sources: Submit name of imported materials source.
C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING
A. When necessary, store materials on site in advance of need.
B. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.
   4. Protect stockpiles from excessive moisture that would negatively impact compaction requirements.

PART 2 PRODUCTS

2.01 FILL MATERIALS
A. General Fill: Subsoil excavated on-site.
   1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
B. Concrete for Fill: Lean concrete.
C. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter. Quarry fines also acceptable in lieu of sand.
D. Topsoil: Topsoil excavated on-site.
   1. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL
A. See Division 01 - Quality Requirements, for general requirements for testing and analysis of soil material.
B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION
A. Identify required lines, levels, contours, and datum locations.
B. Locate, identify, and protect utilities that remain and protect from damage.
C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
D. Protect plants, lawns, rock outcroppings, and other features to remain.

3.03 TRENCHING
A. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
C. Do not interfere with 45 degree bearing splay of foundations.
D. Cut trenches wide enough to allow inspection of installed utilities.
E. Hand trim excavations. Remove loose matter.
F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
G. Remove excavated material that is unsuitable for re-use from site.
H. Stockpile excavated material to be re-used in area designated on site.
I. Remove excess excavated material from site.

3.04 REMOVAL OF SPOILS
A. Contractor shall be responsible for proper disposal of all excess spoils not required for backfilling operations.
B. Contractor shall be responsible to provide any testing required on spoils prior to delivery to disposal site. Remediation, if any shall be performed by the Campus.

3.05 PREPARATION FOR UTILITY PLACEMENT
A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.06 BACKFILLING
A. Backfill to contours and elevations indicated using unfrozen materials.
B. Fill up to subgrade elevations unless otherwise indicated.
C. Employ a placement method that does not disturb or damage other work.
D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
E. Maintain optimum moisture content of fill materials to attain required compaction density.
F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At landscaping: 90 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.07 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Utility Piping, Conduits, and Duct Bank:
   2. Cover with sand.
   3. Backfill with general fill.
   4. Compact in maximum 6 inch lifts to 95 percent of maximum dry density under paving, roads and sidewalks, 6 inch lifts to 90 percent of maximum dry density under landscaping.

3.08 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.09 FIELD QUALITY CONTROL

A. See Division 01 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D3017, or ASTM D2922.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: one test for every 100 feet of trench.

3.10 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Removal of discovered rock during excavation.

1.02 PRICE AND PAYMENT PROCEDURES
A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
B. Trench Rock Removal: By the cubic yard measured before disintegration. Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials. Rock Removal pricing also includes all necessary backfill and compaction where rock has been removed to provide a solid trench bottom and bearing surface for subsequent utility placement.

1.03 DEFINITIONS
A. Trench Rock: Solid mineral material with a volume in excess of 1/6 cubic yard or solid material that cannot be removed with a 1/3 cubic yard capacity power shovel without drilling.
B. Rock: Solid mineral material of a size that cannot be removed with a 1/2 cubic yard capacity power shovel.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Submit proposed method of rock removal and any products proposed for use.

PART 2 PRODUCTS

2.01 MATERIALS
A. Mechanical Disintegration Compound: Grout mix of non-toxic materials that expand on curing. Burstar Expansive Grout by Demolition Technologies Inc., or equal.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION
A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL
A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.
B. Mechanical Methods: Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
C. Form level bearing at bottom of excavations. Provide additional backfill as required to bring bottom up to required elevation.
D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
E. Remove excavated materials from site.
F. Correct unauthorized rock removal to directions of Engineer.

3.04 FIELD QUALITY CONTROL
A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

END OF SECTION
SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Aggregate base course.
   B. Single course bituminous concrete paving.
   C. Double course bituminous concrete paving.
   D. Surface sealer.

1.02 REFERENCE STANDARDS
   A. Al MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.

1.03 QUALITY ASSURANCE
   A. Perform Work in accordance with State of California Highways standard.
   B. Mixing Plant: Conform to State of California Highways standard.
   C. Obtain materials from same source throughout.

1.04 REGULATORY REQUIREMENTS
   A. Conform to applicable code for paving work on public property.

1.05 FIELD CONDITIONS
   A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
   B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Asphalt Cement: ASTM D 946.
   B. Aggregate for Base Course: In accordance with State of California Highways standards.
   C. Aggregate for Binder Course: In accordance with State of California Highways standards.
   D. Aggregate for Wearing Course: In accordance with State of California Highways standards.
   E. Fine Aggregate: In accordance with State of California Highways standards.
   F. Primer: In accordance with State of California Highways standards.
   G. Tack Coat: Homogeneous, medium curing, liquid asphalt.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN
   A. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with Al MS-2.
   B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with Al MS-2.
   C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with Al MS-2.

2.03 SOURCE QUALITY CONTROL
   A. Test mix design and samples in accordance with Al MS-2.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE
A. Place and compact base course.

3.03 PREPARATION - PRIMER
A. Apply primer in accordance with manufacturer’s instructions.
B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.
C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT
A. Apply tack coat in accordance with manufacturer’s instructions.
B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE
A. Install Work in accordance with State of California Highways standards.
B. Place asphalt within 24 hours of applying primer or tack coat.
C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE
A. Place asphalt binder course within 24 hours of applying primer or tack coat.
B. Place wearing course within two hours of placing and compacting binder course.
C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 SEAL COAT
A. Apply seal coat to surface course and asphalt curbs in accordance with Al MS-19.

3.08 TOLERANCES
A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
B. Variation from True Elevation: Within 1/2 inch.

3.09 FIELD QUALITY CONTROL
A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.
B. Provide field inspection and testing. Take samples and perform tests in accordance with Al MS-2.

3.10 PROTECTION
A. Immediately after placement, protect pavement from mechanical injury for 4 days or until surface temperature is less than 140 degrees F.

END OF SECTION
SECTION 32 13 13
CONCRETE PAVING

PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, roads, and inclined ramps.

1.02  REFERENCE STANDARDS
   A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
   B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
   C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
   D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
   E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
   F. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

1.03  SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on joint filler, admixtures, and curing compound.
   C. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

PART 2  PRODUCTS

2.01  PAVING ASSEMBLIES
   A. Comply with applicable requirements of ACI 301.
   B. Design paving for parking and residential streets.
   C. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, buff color Portland cement, exposed aggregate finish.
   D. Parking Area Pavement: 4,000 psi 28 day concrete, 5 inches thick, 6/6 - 6 x 6 inch mesh reinforcement, wood float finish.

2.02  FORM MATERIALS
   A. Form Materials: Conform to ACI 301.
   B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).
2.03 REINFORCEMENT
A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.
B. Dowels: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.04 CONCRETE MATERIALS
A. Obtain cementitious materials from same source throughout.
B. Concrete Materials: Provide in accordance with State of California Highways standards.

2.05 CONCRETE MIX DESIGN
A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

2.06 MIXING
A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.

3.02 SUBBASE
A. Prepare subbase in accordance with State of California Highways standards.

3.03 PREPARATION
A. Moist en base to minimize absorption of water from fresh concrete.

3.04 FORMING
A. Place and secure forms to correct location, dimension, profile, and gradient.
B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT
A. Place reinforcement as indicated.
B. Place dowels to achieve pavement and curb alignment as detailed.

3.06 COLD AND HOT WEATHER CONCRETING
A. Follow recommendations of ACI 305R when concreting during hot weather.
B. Follow recommendations of ACI 306R when concreting during cold weather.
C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE
A. Place concrete in accordance with ACI 304R.
B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
3.08 JOINTS
A. Align curb, gutter, and sidewalk joints.
B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
   1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
   2. Secure to resist movement by wet concrete.

3.09 FINISHING
A. Area Paving: Light broom, texture perpendicular to pavement direction.
B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

3.10 TOLERANCES
A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

3.11 FIELD QUALITY CONTROL
A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.

3.12 PROTECTION
A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION
SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fence framework, fabric, and accessories.
B. Excavation for post bases; concrete foundation for posts.
C. Manual gates and related hardware.

1.02 REFERENCE STANDARDS
C. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.

1.03 SUBMITTALS
A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Chain Link Fences and Gates:

2.02 MATERIALS AND COMPONENTS
A. Materials and Components: Conform to CLFMI Product Manual Unless otherwise noted.
B. Fabric Size: CLFMI Heavy Industrial service PVC coated over Zinc coated wire.
C. Intermediate Posts: Type I round. PVC coated over Zinc coated post.
D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round PVC coated or Zinc coated post and rails.
E. Gates: to match Fence, unless noted otherwise.

2.03 ACCESSORIES
A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
B. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
C. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

2.04 FINISHES
A. Components and Fabric: Vinyl coated over coating of 1.8 oz/sq ft galvanizing.
B. Accessories: Same finish as framing.
C. Color: Black.
PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F 567 unless noted otherwise.
B. Place fabric on outside of posts and rails.
C. Set all posts posts plumb, in concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff.
D. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
E. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
F. Install center brace rail on corner gate leaves.
G. Do not stretch fabric until concrete foundation has cured 28 days.
H. Position bottom of fabric 2 inches above finished grade.
I. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
J. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
K. Install bottom tension wire stretched taut between terminal posts, unless noted otherwise.
L. Do not attach the hinged side of gate to building wall; provide gate posts.
M. Install gate with fabric to match fence. Install hardware.
N. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
O. Ground fence in accordance with electrical drawings.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.
B. Maximum Offset From True Position: 1 inch.

END OF SECTION
SECTION 33 05 13
MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes. Shop drawings shall include calculations, reinforcements for pipe openings, and shall be stamped by a registered structural engineer.
C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.03 QUALITY ASSURANCE
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS
A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C476 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

2.02 PRECAST CONCRETE MANHOLES
A. Manufacturer:
   1. Utility Vault, a division of Oldcastle Precast;
   2. Jensen Precast;
   3. Substitutions: See Division 1 - Product Requirements.
B. Vault shall have flat sides, Sidewall flanges not acceptable.
C. Description: Precast manhole designed in accordance with ASTM C 858, comprising modular, interlocking sections complete with accessories.
D. Loading: ASTM C 857, Class [H-20].
E. Shape: As indicated.
F. Nominal Inside Dimensions: See drawings for dimensions.
G. Inside Depth: See drawing for dimension.
H. Wall Thickness: As indicated.
I. Outside Wall: Provide waterproofing.
J. Riser Casting: 12 inch, with manhole step cast into frame.
K. Frames and Covers: ASTM A 48; Class 30B gray cast iron, 27 inch size, machine finished with flat bearing surfaces. Provide cover marked [according to service "CHW" or "HHW"] to indicate utility.
L. Entry Provisions: [as indicated on the drawings].
M. Lid:
   1. Size: 36" Diameter
   2. Lid shall be water tight
   3. Provide welded ID#. See drawings for exact ID number.
N. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement.
O. Ladder: OSHA approved, aluminum, full length, with top hook to engage manhole step in riser casting. Provide one ladder for each manhole.
P. Pipe Entry: Provide openings as indicated. All openings shall be field coordinated.
Q. Sump Covers: ASTM A 48; Class 30B gray cast iron.
R. Source Quality Control: Inspect manholes in accordance with ASTM C 1037.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify items provided by other sections of Work are properly sized and located.
B. Verify that built-in items are in proper location, and ready for roughing into Work.
C. Verify excavation for manholes is correct.

3.02 MANHOLES
A. Place concrete base pad, minimum 6" Class II aggregate.
B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
C. Cut and fit for pipe.
D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
E. Set cover frames and covers level without tipping, to correct elevations.
F. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION
SECTION 33 61 13
UNDERGROUND HYDRONIC ENERGY DISTRIBUTION

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Pipe and pipe fittings for:
      1. Chilled water piping system.
   B. Valves:
      1. Ball valves.
      2. Butterfly valves.
      4. Strainers.

1.02 REFERENCE STANDARDS
   A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
   C. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

1.03 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Submit complete shop drawings for piping system showing all fittings, elevations, pipe accessories, hanger locations and all connected equipment. Submit on reproducible velum, and compact disk. Drawings shall be produced in AutoCad 2008 or later release.
   C. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
   D. Project Record Documents: Record actual locations of pipe routing, valve locations and unforeseen utilities.
   E. Piping Pressure Test Reports: Provide piping pressure test reports indicating:
      1. District
      2. Project Address
      3. Project Name
      4. Testing Contractor
      5. Pipe Segment Tested
      6. Pipe Size, Service and material (including wall thickness information (schedule, SDR, etc.)
      7. Test Medium
      8. Date and Time of Test Start
      9. Starting Pressure and Temperature of Test Medium
      10. Starting Ambient Temperature
      11. Date and Time of Test End
      12. Ending Pressure and Temperature of Test Medium
      13. Ending Ambient Temperature
      14. Observations and Conclusions
F. Prefabricated Piping Systems: Provide manufacturer's shop drawings with dimensioned piping layout and details of all expansion loops, elbows, anchor points, building and/or manhole entry points and all other pertinent information needed to verify that the type of materials being offered are in accordance with these specifications. Prefabricated pipe units are to be subsequently dimensioned and numbered to fit actual job conditions as field verified by the installing contractor prior to the start of factory fabrication work.

G. As-Built Drawings: At project closeout, provide as-built drawings of the piping systems installed. Drawings shall be prepared using AutoCad 2008 or later release. Where Contract Drawings were created in 3D, prepare as-builds using Autodesk Revit 2011 or later release. Submit two reproducible copies and two complete sets of drawing files on a compact disc.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS
2.01 HYDRONIC SYSTEM REQUIREMENTS
A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
B. Piping: Provide piping, bolsters, anchors and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized. Common anchors for chilled water and heating hot water are not allowed.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide temporary flanges/blinds, test connections as required to perform hydro testing of piping system, in segments as required to meet project requirements and time constraints. Remove flanges from all direct buried portions of piping at completion of testing.
C. Pipe-to-Valve Connections: Use flanges to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections. Flanges, unions or grooved couplings shall be used in accessible manholes or tunnels only, unless otherwise indicated or shown on contract drawings. Grooved fittings and couplings are not acceptable for use on systems conveying fluids in excess of 95 degrees F.
D. Valves: Provide valves where indicated.
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, and base of vertical risers. Use 1 inch valves with cap; pipe to nearest drain.

2.02 CHILLED WATER PIPING, BURIED
A. STEEL CARRIER, HDPE JACKET: Underground piping for lines shall consist of a factory prefabricated, pre insulated system suitable for direct burial, consisting of a carrier pipe, insulation, and a corrosion resistant outer casing. Prefabricated piping system shall be XtruTherm as manufactured by Perma Pipe, Ferro-Therm as manufactured by Thermacor Process, L.P., or approved equal. All straight sections, expansion loops, fittings, anchors and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds.
1. Carrier Pipe: ASTM A 53, Grade A or B, Schedule 40 for pipe sizes under 12", 0.375" wall for 12" and over, black, seamless or electric resistance welded.
4. Insulation: Polyurethane, spray applied, nominal density 2 pounds per cubic foot foam for straight sections and preformed foam for fittings - 1-1/2" thick. K = .16 BTU-in/hr-SF-F.
5. Casing: Jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12", 150 mils for jacket sizes larger than 12" to 24", and 175 mils for jacket sizes greater than 24".
6. Fittings: Fittings shall be factory fabricated and provide sufficient straight lengths of pipe on each end to allow for field joints in straight piping only. Insulation and casing shall be the same as for the straight piping system.
7. End Seals: Moisture barrier end seals shall be factory applied, sealed to the jacket and carrier pipe. Field applied end seals shall be installed at any field cut to the piping before continuing with the installation. End seals shall be:
8. Field Joints: Straight run joints shall be field-insulated per the manufacturer's instructions, using polyurethane foam poured in an HDPE sleeve and sealed with a heat shrink sleeve. (At the Engineer's option, a pressure testable joint closure may be specified.) All joint closures and insulation shall occur at straight sections of pipe. All insulation and jacketing materials shall be furnished by piping system manufacturer.
9. Piping system shall be capable of field modifications (cutting and joining), to allow for rerouting to avoid unforeseen obstructions without affecting system warranty.

B. STEEL PIPING IN MANHOLES: Steel piping inside manholes shall conform to the following:
1. Pipe: ASTM A 53, Grade A or B, Schedule 40 for pipe sizes under 12", 0.375" wall for 12" and over, black, electric resistance welded.
2. Fittings: ASTM A 234/A 234M, forged steel welding type, 150 lb flanged or 150 factory fabricated grooved joint.
3. Joints: Welded, or 150 lb flanged or 150 factory fabricated grooved joint.
4. Insulation: Polyurethane, nominal density 2 pounds per cubic foot foam and preformed foam for fittings - 1-1/2" thick or Cellular Glass, FOAMGLAS® by Pittsburgh Corning, preformed, 1-1/2" thick.
5. Jacketing: Pittsburgh Corning Pittwrap®, heat sealable, 125 mil modified bitumen jacketing for straight sections. Pittsburgh Corning Pittwrap® cut to shape, or Pittcote® 300 finish and PC® Fabric 79.

2.03 UNIONS, FLANGES, AND COUPLINGS - IN MANHOLES ONLY
A. Unions for Pipe 2 Inches and Under:
1. Ferrous Piping: 150 psig malleable iron, threaded.
B. Flanges for Pipe Over 2 Inches:
1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Gaskets: 1/16 inch thick preformed neoprene.

2.04 BALL VALVES
A. Manufacturers:
5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Up To and Including 2 Inches:
1. Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends.
2.05 BUTTERFLY VALVES - IN MANHOLES AND DIRECT BURIED

A. Manufacturers
   1. DeZurik Water Controls; Model AWWA Butterfly Valves (BAW): www.dezurikwater.com. or equal, no known equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. General: Butterfly valves shall meet the requirements of AWWA C504 standards. Butterfly Valve shall have offset disc design, corrosion resistant shaft, stainless steel disc edge, and self-compensating shaft seals. Molded-in body seat with disc locators provides positive sealing and longer seat life on sizes 3 - 20". Large valves, 24" and larger shall have adjustable, replaceable seat, non-hollow disc structure, and rubber seat retained within a dovetail groove in the valve body and locked in place by an epoxy wedge.
   1. Temperature Range: to 290°F
   2. AWWA Class: 150B
   3. Body Material: Cast iron ASTM A126 Class B
   4. Disc Material: 316 Stainless Steel ASTM A743 Type CF8M
   5. Shaft Material: 316 Stainless Steel ASTM A276 Type 316
   6. Seat Material: EPDM Terpolymer of Ethylene Propylene & a Diene (-20 to 290 F)
   7. Packing Material: EPDM Self adjusting (-20 to 290 F)
   8. Valve Style: Flanged joint
   9. Coating: Epoxy coated, minimum 8 mils dry finish

C. Actuator Type: Valves between 3"-36" shall have a scotch yoke mechanism that allows the actuators to provide a torque curve matching the torque required by the valve. The actuator shall have a steel threaded input shaft and ductile iron yoke nuts (traveling nut actuator). Valves between 30"-72" shall have a link-arm mechanism that will allow the actuator to provide characterized closure which slows valve travel as the disc comes into the seat. Provide handwheel for use in manholes and standard operating nut for buried service.

2.06 BALANCING VALVES

A. Manufacturers:

B. Construction:
   1. 2-1/2" to 12" Pipe Size
      a. Cast iron, flanged construction with 125 psig flanged connections suitable up to 175 psig working pressure at 250 F. Valves 2-1/2" - 3" shall have a brass ball with glass and carbon filled TFE seat rings. Valves 4" - 12" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves shall have memory stop feature and calibrated nameplate with position indication.

2.07 STRAINERS

A. Size 2-1/2 inch to 4 inch:
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Flanged carbon steel or cast iron body for 150 psig (WOG) working pressure, Y pattern with 1/16" stainless steel perforated screen.

2.08 PRECAST MANHOLES

A. See Section 330513 - Manholes and Structures.

PART 3 EXECUTION

3.01 PREPARATION

3.02 PREFABRICATED PIPING SYSTEM INSTALLATION

A. Follow manufacturer's written instructions for all installation procedures.
B. Coordinate with manufacturer for field inspection prior to testing or backfilling. To assure proper installation of the piping materials, a manufacturer's field service instructor who is technically qualified to determine whether or not the installation is being made in accordance with the manufacturer's recommendations shall be present during critical periods of the materials installation and testing.

C. Polyurethane insulation shall be poured in place into the field weld area. All field applied insulation shall be placed only on straight sections. The mold for the insulation shall be made of clear adhesive backed polyester film. Joint area shall be sealed with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory applied resin.

D. All insulation and coating materials for making the field joint shall be furnished by the prefabricated piping manufacturer.

E. Bedding and Backfilling:
   1. See also Section 31 23 16.13 Trenching for Site Utilities.
   2. Backfilling shall not begin until the heat shrink wrap has cooled, or until the FRP lay-up has fully cured.
   3. Install external bolstering material of the type and dimensions as recommended/required by the manufacturer for external expansion compensation.
   4. Provide 4 inch layer of sand or fine gravel, tamped in the trench for a uniform bedding.
   5. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 12 inches above the top of the piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil.

F. Field Modifications for rerouting
   1. Line and grade shall be modified in the field to avoid existing obstructions as required. Field modifications to slope and grade shall be as delineated on the Drawings. No increase in contract price will be permitted for piping installed within the defined tolerance.
   2. Modifications to pre-fabbed pipe shall be accomplished with pipe and fittings as specified for manhole applications, with preformed insulation and PittWrap® jacketing.
   3. Mitred joints will be allowed up to 22-1/2 degrees to avoid existing obstructions.

3.03 TESTING
A. Unless otherwise noted, hydrostatically test all piping installed under this contract to 1-1/2 times the normal working pressure or 150 psig, whichever is higher for a period of not less than 4 hours with no visible signs of leakage.

B. Provide necessary caps or blinds to protect equipment not rated for test pressure (safety valves, regulators, etc.).

C. Pressure test all buried piping prior to backfilling, unless otherwise noted.

D. Prefabricated/Preinsulated Piping Systems:
   1. Carrier piping shall be hydrostatically tested at 225 psig for a minimum of 4 hours. Test prior to backfilling/insulating/wrapping field joints.

E. Pneumatic Testing:
   1. Pneumatic testing is expressly prohibited on any non-metallic piping.
   2. Other than as excepted above, pneumatic testing will not be considered without written consent from District or Engineer, and substantiation as to why hydrotesting is inapplicable. Additional testing requirements and measures may be required for a pneumatic test and will be considered on a case-by-case basis.

F. Reports: Submit test reports for all pipeline sections tested per Submittals requirements in Part 1 of this specification.

END OF SECTION
SECTION 33 71 19
ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Nonmetallic duct.

1.02 REFERENCE STANDARDS
   B. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
   C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
   A. See Division 1 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide for nonmetallic conduit.
   C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.
   D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
   E. Field Samples: Provide sample of actual conduit delivered to site, two each 2 feet long.
   F. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.04 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
   C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS
2.01 CONDUIT AND DUCT
   A. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.02 ACCESSORIES
   A. Underground Warning Tape: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
   C. Verify locations of manholes prior to excavating for installation.
D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.
E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete duct bank system.
F. Contractor shall locate pullboxes, vaults, and manholes away from drainage path.

3.02 DUCT BANK INSTALLATION
A. Install duct to locate top of duct bank at depths as indicated on drawings.
B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.
C. Cut duct square using saw or pipe cutter; de-burr cut ends.
D. Insert duct to shoulder of fittings; fasten securely.
E. Join nonmetallic duct using adhesive as recommended by manufacturer.
F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
G. Install no more than equivalent of three 90-degree bends between pull points.
H. Provide suitable fittings to accommodate expansion and deflection where required.
I. Terminate duct at manhole entries using end bell.
J. Stagger duct joints vertically in concrete encasement 6 inches minimum.
K. Use suitable separators and chairs installed not greater than 4 feet on centers.
L. Band ducts together before backfilling.
M. Securely anchor duct to prevent movement during concrete placement.
N. Concrete backfill: Use mineral pigment to color concrete red.
O. Provide minimum 4 inch concrete cover at bottom, top, and sides of duct bank.
P. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
Q. Provide suitable pull string in each empty duct except sleeves and nipples.
R. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
S. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

END OF SECTION
SECTION 33 71 19
UNDERGROUND ELECTRICAL STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. PVC Non-metallic Conduit and Ducts
B. Underground pull boxes
C. Underground vaults
D. Manholes.
E. Accessories

1.02 REFERENCES
A. ASTM C 858 - Underground Precast Concrete Utility Structures.
D. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.
E. NEMA TC 9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
G. NEMA TC 14 - Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings.
H. UL 651A - Type EB and A PVC Conduit and HDPE Conduit.

1.03 SUBMITTALS
A. See Division 1 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for nonmetallic conduit and manhole accessories.
C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes, vaults, and pullboxes. Shop drawings shall include reinforcements for conduit openings and stamped by a registered structural engineer.
D. Field Samples: Provide sample of actual plastic duct delivered to site, two each 2 feet long.
E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.
F. Shop drawings of manhole, vault, and pullbox covers complete with nameplate schedule.

1.04 QUALITY ASSURANCE
A. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT
A. PVC Coated Rigid Steel Conduit: ANSI C80.1.
1. Product: Rigid Steel Conduit, corrosion-resistant, pvc coated. Shall be hot dip galvanized, to which a minimum 40-mil thick PVC coating has been bonded to the outside of the conduit. A 2-mil coat of urethane coating shall be bonded to the inside. Coating shall be free of pinholes. Elbows shall be factory made and coated.
B. Plastic Utilities Duct: NEMA TC 2; Polyvinyl Chloride (PVC) Schedule 80.
1. Duct Fittings: NEMA TC 3.
2. Product: Carlon or approved equal.
3. Plug fittings with pull tab.
4. Nominal size: As shown in drawings.

DSA Re-submittal 6/21/2012
5. Conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could damage conductors or cables.

C. Reinforced Resin Conduit and Fittings: NEMA TC 14, Type SW.

D. Concrete - Concrete for conduit encasement shall be Class C with 3/8" maximum aggregate and shall be red concrete (iron oxide) with 28-days compressive strength of 2,500 psi.

E. Concrete - Concrete for buried ducts shall be Class C with 1" maximum aggregate and shall be red concrete "slurry fill".

2.02 UNDERGROUND PULLBOXES

A. Manufacturers: Jensen Pre-cast, Christy Concrete Products, BES Concrete Products

B. Sizes: See Schedule on drawings.

C. Pullboxes shall be precast concrete as indicated on plans.

1. Traffic Box - High density reinforced concrete box with non-setting shoulders positioned to maintain grade and facilitate back filling. Utility boxes shall be used where shown on the drawings. Use steel checker plate, H/20 loading, bolt down. Provide 12" extension pieces.

2. General Utility Box - High density reinforced concrete box with non-setting shoulders positioned to maintain grade and facilitate back filling. Utility boxes shall be used where shown on the drawings. Use reinforced concrete lids on unfinished grades (i.e. grass, dirt, etc.), and steel checker plate lids on finished grades (i.e. concrete, asphalt, etc.) Provide 12" extension pieces.

2.03 UNDERGROUND VAULTS

A. Manufacturers: Utility Vault, or approved equal.

B. Sizes: 17" (width) x 30" (length) and 3' (width) x 5' (length), 2'-0" up to 4'-6" (Depth), (Maximum Dimensions)

C. Vaults shall be precast concrete as indicated on plans. Electrical vaults shall be without base. Telecommunication vaults shall be with base.

D. Telecommunication Vaults - High density reinforced concrete with 7/8" dia. pull irons, 12" dia. x 2" sump, 1/2" dia. plastic inserts. Utility Vault Company, Inc., Model #PTS-3660, or approved equal.

1. Cover: Traffic rated (H/20 minimum) with guard bars, height adjustment brackets and torsion assisted opening.

2. Ducts: 4" dia. "term-a-ducts" for minimum number of conduits, as shown on drawings.

3. Racks: package per most current Pac Bell specifications

4. Accessories: provide grade rings as appropriate to maintain grade and facilitate back filling.

E. Electrical Vaults - High density reinforced concrete with 7/8" diameter lifting inserts or pulling irons.

1. Covers
   a. Traffic - full traffic rated, with H/20 loading.
   b. Pedestrian - pedestrian, slip resistant

2. Types
   a. Nominal 17" x 30" Vaults - without base, minimum depth 24", mastic sealant for joints, and a term-a-duct per PG&E specifications. Utility Vault Model #04-3513
   b. Nominal 3' x 5' Vaults - with base, 14" diameter x 4" sump (2 each), 1" diameter ground rod knock-outs (2 each), term-a-ducts and knock-outs per conduit sizes in site plans, and per PG&E specifications. Utility Vault Model #04-3588.
   c. Cover - full traffic covers with H/20 loading
      1) Splice Vaults Utility Vault Model #04-1616
      2) Transformer Vaults - Utility Vault Model #04-1614
2.04 PRECAST CONCRETE MANHOLES

A. Manufacturers: Forni Corporation, Utility Vault, Associated Concrete Products.

B. Description: Precast manhole designed in accordance with ASTM C 858, comprising modular, interlocking sections complete with accessories.

C. Size and Shape: As indicated on plans. At least seven (7) feet high interior clearance.

D. Frames and Covers: ASTM A 48; Class B30 gray cast iron, 36 inch size, machine finished with flat bearing surfaces. Provide cover marked as scheduled to indicate utility. Cover and frame shall have provisions for bolting cover to manhole.

E. Duct Entry Provisions: Reinforced opening/windows with plastic duct terminators and diaphragms as indicated on plans.

F. Duct Entry Locations: As indicated.

G. Duct Entry Size: 4 inch for telecommunication manholes; 5 inch for electrical manholes.

H. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.

I. Cable Rack Inserts: Fiberglass. Minimum load rating of 800 pounds (365 kg). Locate at 3 feet on center.

J. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch steel channel, 48 inch length. Provide cable rack arm mounting slots on 1-1/2 inch centers.

K. Cable Supports: Porcelain clamps and saddles.

L. Ladder: Fiberglass, [12"+/- O.C.] rungs, with top hooks to engage manhole step in riser casting. Provide one ladder for each manhole.

M. Sump Covers: ASTM A 48; Class 30B gray cast iron.

N. Source Quality Control: Inspect manholes in accordance with ASTM C 1037.

2.05 ACCESSORIES

A. Underground Warning Tape: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines. Orange colored tape with suitable warning legend will describe buried telecommunications lines.

B. Duct spacers shall be Wunpeece, Carlon Snap-Loc or equal. Spacers shall be provided with rebar holder.

C. Ground Rod - 3/4" x 10' minimum, copper clad. Blackburn, Erico, or equal.

D. Grounding Electrode Conductor - 4/0 bare copper conductor

E. Pullrope - 3/16" dia. min., 150 lbs test, yellow nylon

F. Detectable muletape - All telecommunications conduits shall be equipped with 5/8" dia. min., 1800 lbs strength, flat woven polyester detectable muletape. Muletape shall be printed with sequential footage or meter markings and contain an corrosion-resistant 22awg conductor compatible with any standard transmitting/receiving equipment.

G. Duct Plugs - removable, reusable, plastic plugs. Watertight, airtight, and gastight with provisions for pullrope attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system. Verify routing and termination locations of duct bank prior to excavation for rough-in.

B. Pullboxes, Vaults and Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system. Verify locations of pullboxes, vaults and manholes prior to excavating for installation.
3.2 DUCT BANK INSTALLATION

A. Underground conduits shall be as specified PVC for electrical and telecommunications. PVC Coated rigid steel conduit shall be used in areas crossing steam piping, minimum 10 feet length on either side of steam piping. Do not run new conduits parallel to steam piping. Maintain a minimum of 5 feet clearance between steam or hot water piping and electrical conduits.

B. Layout
1. Duct bank routing shown in the drawings is approximate. Exact duct banks routing shall be determined with close coordination with Project Manager. Account for existing field conditions, and new field conditions in coordinating the final routing of duct banks.
2. Conduct exploratory excavation sufficiently ahead so that any obstacles can be determined pre-hand, and mediated sooner to make necessary offsets and bends around existing obstacles.

C. Depth and Clearances
1. Install power and communications duct to locate top of ductbank minimum 30 inches below finished grade.
2. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances and to manholes where possible.
3. Underground conduits shall be as specified PVC for electrical and telecommunications. PVC Coated rigid steel conduit shall be used in areas crossing steam piping, minimum 3 feet length on either side of steam piping. Maintain a minimum of 3 feet clearance between steam or hot water piping and electrical conduits.
4. Maintain the following clearances (minimum) between High Voltage (over 600 Volts) and
   a. Power Conduit - two (2) inches
   b. Gas Pipe - twelve (12) inches
   c. Telephone, Cable Conduit - twelve (12) inches
   d. Wet Utilities - 3' minimum from concrete encased High Voltage Lines.

D. All underground conduits not indicated otherwise on the drawings shall be concrete encased.

E. Installation
1. Install conduits as recommended by manufacturer using approved couplings, fittings, and cement.
2. Cut duct square using saw or pipe cutter; de-burr cut ends.
3. Insert duct to shoulder of fittings; fasten securely.
4. Join nonmetallic duct using adhesive as recommended by manufacturer.
5. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
6. Install no more than equivalent of four 90-degree bends between pull points for power.
7. Install no more than equivalent of two 90-degree bends between pull points for tel/com.
8. Provide suitable fittings to accommodate expansion and deflection where required.
9. Terminate duct at manhole entries using end bell.
10. Stagger duct joints vertically in concrete encasement 6 inches minimum.
11. Use suitable separators and chairs installed not greater than 4 feet on centers.
13. Securely anchor duct to prevent movement during concrete placement.
14. Provide minimum 4 inch concrete cover at bottom, top, and sides of ductbank.
15. Connect to existing concrete encasement using dowels.
16. Connect to manhole wall using dowels.
17. Provide suitable pull string in each empty duct except sleeves and nipples.
18. Provide detectable muletape in all empty telecommunications conduits.
19. Immediate after backfilling and compaction swab ducts. Draw a testing mandrel not less than 12 inches long with a diameter 1/4" less than the interior diameter of the conduit through each conduit. Then draw a stiff wire bristle brush and size to match conduit.
diameter until conduit is clear of all particles of earth, sand, and gravel. Use suitable duct plugs to protect installed duct against entrance of dirt and moisture.


3.03 PRE-CAST MANHOLE, VAULTS, AND UNDERGROUND PULLBOX INSTALLATION

A. Install and seal precast sections in accordance with ASTM C 891.
B. Install manholes plumb.
C. Use precast neck and shaft sections to bring manhole cover to finished elevation. Refer to grading plans for finished elevations.
D. Attach cable racks to inserts after manhole installation is complete.
E. Provide crushed rocks min 6" in bottom of manholes for proper drainage or install drains and connect to closest site drainage system.
F. Install two ground rods, one on each opposite corners. Ground rods shall project 6" above manhole floor.
G. Knock-out a 2" diameter hole in sump area of manhole.
H. Clean manhole of any debris prior to substantial completion. Drain manhole of water.

END OF SECTION
WATER VAULT

USING OLDCASTLE PRECAST BLOCKS:
1. All blocks are property of Oldcastle Precast and are provided for general use in customer drawings.
2. The Oldcastle Precast logo should not be obliterated.
3. Plans and elevations are dynamic blocks with scalable, re-sizing abilities. Simply click on the block and resize to our available standard sizes using the "sizing" tool.
4. The viability state of each dynamic block can be changed by clicking on each block to allow for easy editing.
5. Double-click on the block to edit dimensions, notes, etc.
7. Custom sizes are available. Contact Oldcastle Precast for more details.

SPECIFICATIONS:
1. Concrete: Design Strength of 4000 psi at 28 days
2. Steel Reinforcement: ASTM A-990 Grade 60 rebar, ASTM A-416 Grade 60 armco wire fabric
3. Live Load: AASHO HS-20
4. Soil Weight: 120 psf
5. Depth of Fill: 6’-6” to 5’
6. Lateral Soil Pressure: 60 psf
7. Water Table: 5 below grade

STANDARD COMPONENTS:
1. 12” Drainage Bump
2. Embossed Ledges & Pulling Frame
3. Manhole Cover & Frame

OPTIONS:
- Vaults can be customized with these options in locations requested by the customer.
  1. Cover Options: Galvanized cover, Hatch, Concrete Lid w/ Ring & Cover, Concrete Lid
  2. Grade Rings & Rim - Round or Rectangular
  3. Knockouts & Blockouts - Round or Rectangular
  4. Trench Ducts
  5. Rack & Hardware - Unistrut, Inserts
V687RVE Top
Weight: 13,250 lbs.
Item #: xxxxxxxxxxx

"Surface Design - Ten coats of penetrating epoxy shall be applied to the exterior. Epoxy should be placed with two coats of an approved white paint.

360° Access With Dovetail

V687RVE Base
Weight: 12,850 lbs.
Item #: xxxxxxxxxxx

Steel 4½" Octa (One Step Gap)

36" Long P-4000 Struts

12" Reed Shim

SPECIFICATIONS:
1. Concrete shall be 5000 psi at 28 day compressive strength.
2. Steel reinforcement: Rebar, ASTM A-415 Grade 60 or Mesh, A-185 Grade 85.
PLAN - RISER SECTION

BOTTOM SECTION FOR 8' x 10' x 6' VAULT
PPMH-20 STRUCTURAL DETAILS JENSEN PRECAST

ELEV. - RISER SIDEWALL SECTION

ELEV. - RISER ENDWALL SECTION

BAR DIMENSIONS ARE OUTSIDE TO OUTSIDE.
ALL BARS SHALL BE TRIMMED 1-1/2" CLEAR OF ALL OPENINGS

BAR SIZE | DIMENSIONS | NUMBER | WEIGHT (LBS) | TOTAL LENGTH (FT)
---|---|---|---|---
A | #5 | 80" | 38 | 674.03 | 897.09
B | #4 | 78" | 22 | 120.00 | 224.17
C | #4 | 78" | 18 | 124.75 | 198.75
D | #5 | 78" | 20 | 274.78 | 283.42
E | #5 | 78" | 8 | 92.48 | 88.57

ALL CONCRETE TO HAVE 28 DAY COMpressive
STRENGTH OF 4000 psi.
REINFORCING STEEL SHALL COMPLY WITH ASTM A915 GRADE 60
OR ASTM A706 GRADE 80. BAR BENDING AND PLACEMENT
SHALL COMPLY WITH THE LATEST ACI STANDARDS.
EQUIVALENT AREA Eq = 50000 psi ASTM A 166 OR A 467
REINFORCING CAGES MAY BE UTILIZED IN LIEU OF GRADE 60
REINFORCING BARS.
LIFTING INSERTS FOR HANDLING SHALL BE INSTALLED
PER MANUFACTURER'S REQUIREMENTS.
STRUCTURAL DESIGN IS BASED ON ASTM C650-06
(APIS A 23.4) LOADING
WATER TABLE AT 6'-0" BELOW FINISHED GRADE
SOIL WEIGHT DRY - 110 lbs/cf
SOIL WEIGHT WET - 120 lbs/cf
EQUIVALENT LATERAL PRESSURE DRY - 45 lbs/sf
EQUIVALENT LATERAL PRESSURE WET - 50 lbs/sf

THE VAULT IS DESIGNED BASED ON THE INSIDE FLOOR
AT 6'-0" TO 13'-0" BELOW FINISHED GRADE
REFERENCE STRUCTURAL CALCULATION NO. 1102-4461-S

Copyright Information 2001 Jensen Precast - All rights reserved.
All materials appearing on Jensen Precast diagrams are the proprietary work
product and are protected under U.S. copyright and other laws.
Jensen Precast, Inc. is not responsible for any use of the drawings by
third parties without written consent.

ELEV. - RISER SIDEWALL SECTION

BOTTOM MAT

ELEV. - RISER ENDWALL SECTION

11'-4" BARS (B) AT NOT MORE THAN 12" O.C. TOTAL
25-85 BARS (B) AT 4'-11/2" O.C.
8'-4" BARS (B) AT 12" O.C.
11'-4" BARS (B) AT NOT MORE THAN 12" O.C. TOTAL
8'-4" BARS (B) AT NOT MORE THAN 12" O.C. TOTAL

DATE: 04/05/11
CHECKED BY: NICK BINGHAM

SHEET 2 OF 2
CORPORATE ENGINEERING OFFICE
925 STENGH WAY
SPARROW, NEVADA 89431-6003
PHONE 775-353-2700
FAX 775-353-6304

rev. date description
04/05/11 NEW DRAWING

WEIGHTS lbs.
277.99
1241.26
5.00
04/05/11

REV. DATE DESCRIPTION
DESIGN LOAD: H-20 TRAFFIC LOADING WITH 1 TO 5 FEET SOIL COVER.
WATER TABLE ASSUMED TO BE 6 FEET BELOW FINISHED GRADE.
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.
A-1483
CAST IRON RING AND COVER
GRADE RINGS AS REQUIRED

PLAN VIEW

#36" ACCESS OPENING AND RING GROOVE CENTERED IN SLAB

COVER SLAB

GALVANIZED PULLING IRONS 4 TOTAL
#12" SUMP CENTERED IN FLOOR

11'-4"

9'-4"

5'-4"

VIEW A-A

VIEW B-B

VIEW C-C

VIEW D-D

DESIGN LOAD: H-20 TRAFFIC LOADING WITH 1 TO 5 FEET SOIL COVER.
WATER TABLE ASSUMED TO BE 6 FEET BELOW FINISHED GRADE.
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.
**JENSEN PRECAST COMPANY**

**FLOTATION CALCULATION PROGRAM VERSION 2.10**

8'-0"x10'-0"x8'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>EXTERIOR HEIGHT</td>
<td>9.42 FEET</td>
</tr>
<tr>
<td>EXTERIOR PERIMETER</td>
<td>41.33 FEET</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO WATER</td>
<td>6.00 FEET</td>
</tr>
</tbody>
</table>

**SOIL WT. DRY** 100.00 LBS/CU.FT.
**SOIL WT. SUBMERGED** 57.60 LBS/CU.FT.
**SOIL COHESION** 0.00 LBS/SQ.FT.
**INTER. FRICTION ANGLE** 20.00 DEGREES
**SOIL PRESS. COEFFICIENT -Ka-** 0.36

**DISPLACED VOLUME = 11.33 x 9.33 x 4.42 = 467.19 CUBIC FT.**

**UPLIFT FORCE = 62.4 LBS/CU.FT. x DISPLACED VOLUME = 29152.36 LBS.**

**TOP SLAB = 11.33x 9.33x 9.00/12.00 x 150 = 11900.00 LBS.**
**WALLS = 38.67x 8.00x 8.00/12.00 x 150 = 30933.33 LBS.**
**BOTTOM = 11.33x 9.33x 8.00/12.00 x 150 = 10577.78 LBS.**
**TOTAL STRUCTURE WEIGHT** 53411.11 LBS.

**SOIL WT. DRY = 11.33x 9.33x 1.00x100.00 = 10577.78 LBS.**
**SOIL WT. WET = 11.33x 9.33x 0.00x 57.60 = 0.00 LBS.**
**SOIL WEIGHT ABOVE STRUCTURE** 10577.78 LBS.
SOIL FRICTIONAL RESISTANCE

NORMAL STRESS = Ka \times \text{SUBMERGED WT. x AVG. DEPTH} = 118.37 \text{ LBS/SQ.FT.}

RESIST. = \text{COHESION} + \text{(STRESS x TANGENT INT. ANG)} = 43.08 \text{ LBS/SQ.FT.}

SOIL FRICTION = 43.08 \times 41.33 \times 9.42 = 16768.64 \text{ LBS.}

\[
\begin{align*}
\text{SAFETY FACTOR} &= \frac{53411.11 + 10577.78 + 16768.64}{29152.36} = 2.77
\end{align*}
\]
**JENSEN PRECAST COMPANY**

**FLOTATION CALCULATION PROGRAM VERSION 2.10**

8'-0" x 10'-0" x 8'-0" JENSEN TANK 1 TO 5 FOOT BURY
WATER AT 6.00 FEET BELOW FINISHED GRADE
9.00" TOP SLAB, 8.00" FLOOR, AND 8" WALL THICKNESS
TOP SLAB AT 1.00 TO 5 FEET BELOW FINISHED GRADE ELEVATION

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>EXTERIOR HEIGHT</td>
<td>9.42 FEET</td>
</tr>
<tr>
<td>EXTERIOR PERIMETER</td>
<td>41.33 FEET</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO WATER</td>
<td>6.00 FEET</td>
</tr>
</tbody>
</table>

| SOIL WT. DRY     | 100.00 LBS/CU.FT. |
| SOIL WT. SUBMERGED | 57.60 LBS/CU.FT. |
| SOIL COHESION    | 0.00 LBS/SQ.FT. |
| INTER. FRICTION ANGLE | 20.00 DEGREES |
| SOIL PRESS. COEFFICIENT -K_a- | 0.36 |

**DISPLACED VOLUME = 11.33 x 9.33 x 8.42 = 890.30 CUBIC FT.**

**UPLIFT FORCE = 62.4 LBS/CU.FT. x DISPLACED VOLUME = 55554.49 LBS.**

| TOP SLAB = 11.33 x 9.33 x 9.00/12.00 x 150 = 11900.00 LBS. |
| WALLS = 38.67 x 8.00 x 8.00/12.00 x 150 = 30933.33 LBS. |
| BOTTOM = 11.33 x 9.33 x 8.00/12.00 x 150 = 10577.78 LBS. |

**TOTAL STRUCTURE WEIGHT = 53411.11 LBS.**

| SOIL WT. DRY = 11.33 x 9.33 x 5.00x100.00 = 52888.89 LBS. |
| SOIL WT. WET = 11.33 x 9.33 x 0.00x57.60 = 0.00 LBS. |

**SOIL WEIGHT ABOVE STRUCTURE = 52888.89 LBS.**
SOIL FRICTIONAL RESISTANCE

NORMAL STRESS = Ka x SUBMERGED WT. x AVG. DEPTH = 201.31 LBS/SQ.FT.

RESIST. = COHESION + (STRESS x TANGENT INT. ANG) = 73.27 LBS/SQ.FT.

SOIL FRICTION = 73.27 x 41.33 x 9.42 = 28518.93 LBS.

SAFETY FACTOR = \[
\frac{53411.11 + 52888.89 + 28518.93}{55554.49} = 2.43
\]
### JENSEN PRECAST CONCRETE
### TOP SLAB BEAM PROGRAM VERSION 3.00
### ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P_{11} = \frac{16000.0 \times 1.70 \times 1.3}{\text{BEAM WIDTH}} = 8500.00 \text{ LBS.}
\]

\[
W_{d1} = (0.750 \times 150 \times 1.4) + (1.00 \times 1\text{10.00} \times 1.4) = 311.50 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = \frac{W_{d1} \times \text{LOAD WIDTH/BEAM WIDTH}}{374.40 \text{ LBS/SQ.FT.}}
\]

\[
M_u = \frac{P_{11} x L + W_{d1} x L^2}{4} = 21941.65 \text{ FT.LBS.}
\]

\[
\frac{M_u}{\phi} = \frac{M_u}{0.90} = 292555.27 \text{ IN.LBS.}
\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

F\(\text{c}\) = 4500.0, \(b = 0.825\), \(F_y = 60000\).

\[ \sigma_b = 0.85 \frac{F_c}{F_y} = 0.85 \frac{87000}{87000+60000} = 0.0311 \]

\[ \sigma_{\text{max}} = 0.75 \sigma_b = 0.02335 \]

\[ \sigma_{\text{min}} = \frac{200}{F_y} = 0.00333 \]

\[ d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \]

TRY NO. 5 BARS AT 4 1/2" ON CENTER \(A_s = 0.827\) SQ.IN.

\[ \sigma = \frac{A_s}{bd} = 0.01030 \quad \text{STEEL RATIO OK} \]

\[ \phi = \frac{\sigma_{fy}}{F_c} = 0.13735 \]

\[ M_n = \frac{F_c b d^2}{1 - 0.59\phi} = 304820.47 \text{ IN.LBS.} \]

\[ 304820.47 > 292555.27 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK} \]
COVER SLAB FOR 8X10 VAULT (SLBBeam.dat)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ Vu = \frac{W \times (L-2d)}{2} + P_{11} = 9914.37 \text{ LBS.} \]

\[ Vu / \phi = \frac{V_u}{0.85 \text{ b d}} = 145.345 \text{ LBS./SQ.IN.} \]

SHEAR AT SLAB EDGE NOTCH

\[ Vu = \frac{W \times L}{2} + P_{11} = 10123.02 \text{ LBS.} \]

\[ Vu / \phi = \frac{V_u}{0.85 \text{ b (t-notch)}} = 124.057 \text{ LBS./SQ.IN.} \]

\[ V_c = 1.9\sqrt{f'_c + 2500.0 \sigma} \frac{V_u d}{\mu} = 153.209 \text{ LBS/SQ.IN.} \]

153.209 > 145.345 LBS./SQ.IN. SHEAR CAP. OK ✓

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1944 SQ.IN.

USE NO. 5 BARS AT 18" ON CENTER As = 0.207 SQ.IN.
**JENSEN PRECAST CONCRETE**  
**TOP SLAB BEAM PROGRAM VERSION 3.00**  
**CRACK CONTROL CHECK**

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)  
ASTM C857 A-16 (AASHTO HS-20-44) LOADING  
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"  
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P_{11} = \frac{16000 \times 1.3}{\text{BEAM WIDTH}} = 5000.00 \text{ LBS.}
\]

\[
W_{d1} = (0.750 \times 150) + (1.00 \times 110.00) = 222.50 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = W_{d1} \times \text{LOAD WIDTH/BEAM WIDTH} = 267.43 \text{ LBS/SQ.FT.}
\]

\[
M = \frac{P_{11}xL + W_{d1}xL^2}{4} = \frac{13350.28 \text{ FT.LBS.}}{160203.39 \text{ IN.LBS.}}
\]

\[
F\!c=4500. \quad F_y=60000.
\]
COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C657 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[ d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES} \]

TRY NO. 5 BARS AT 4 1/2" ON CENTER
\[ A_s = 0.827 \text{ SQ.IN.} \]

\[ \sigma = \frac{A_s}{bd} = 0.01030 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2an + (an)^2)^{0.5} - an = 0.325 \]

\[ j = 1 - \frac{k}{3} = 0.892 \]

\[ M = \frac{32497.060}{A_{sdj}} \]

\[ D_c \text{ (FOR CRACK CONTROL)} = 2.3125 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 20.8125 \text{ SQ.IN.} \]

\[ \text{MAX. } f_s = \frac{130000.00}{(D_c \text{AREA})^{0.33}} = 35738.919 \text{ psi} \]

\[ \text{MAX. } f_s = 0.60 \times F_y = 36000.000 \text{ psi} \]

\[ 35738.919 > 32497.060 \text{ LBS/SQ.IN. CRACK CONTROL OK } \]
COVER SLAB FOR 8X10 VAULT (SLB.BEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
P_{11} = \frac{16000 \times 1.3}{\text{BEAM WIDTH}} = 5000.00 \text{ LBS.}
\]

\[
W_{d1} = (0.750 \times 150) \times (1.00 \times 110.00) = 222.50 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = W_{d1} / \text{LOAD WIDTH/BEAM WIDTH} = 267.43 \text{ LBS/SQ.FT.}
\]

\[
F_{lc} = 4500. \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad F_{y} = 60000.
\]

\[
d = 9.00 - 2.00 - 0.3125 = 6.6875 \text{ INCHES}
\]

NO. 5 BARS AT 4 1/2" ON CENTER A\text{s} = 0.827 SQ.IN.

\[
n = \frac{E_s}{E_c} = 7.584
\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[ \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 729.000 \text{ IN.}^4 \]

\[ \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 162.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 x F!c^-0.50 = 503.115 psi
CRACKING MOMENT = STRESS x Sg = 81504.68 IN.LBS.

DEAD LOAD IMMEDIATE DEFLECTIONS:

\[ \frac{WdL^2}{8} = 2512.78 \text{ FT.LBS.} \]
\[ \frac{WdL^2}{30153.39 \text{ IN.LBS.}} = \]

\[ C \text{ CRACKED SECTION} = 2.172 \text{ INCHES} \]
\[ Yt = d - C \text{ CRACKED SECTION} = 4.515 \text{ INCHES} \]

\[ \frac{b C^3}{12} + C b (C/2)^2 + N As Yt^2 = 168.824 \text{ IN.}^4 \]

\[ I_{crk} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M)^3)I_{crk} = 729.000 \text{ IN.}^4 \]

IF Ieff > Ig Ieff = Ig

\[ \frac{5 \text{ WdL} L^4}{384 EI} = 0.0122 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SL.BEAM.DAT)
ASTM C657 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

LIVE LOAD IMMEDIATE DEFLECTIONS:

\[
M_{tot} = \frac{P_{11}xL}{4} + \frac{W_{d1}xL^2}{8} = 13350.28 \text{ FT.LBS.}  \\
\text{160203.39 IN.LBS.}
\]

C CRACKED SECTION = 2.172 INCHES

\[
Y_t = d - C \text{ CRACKED SECTION} = 4.515 \text{ INCHES}
\]

\[
b \cdot c^3
\]

\[
I_{crk} = \frac{b \cdot c^3}{12} + C \cdot b \cdot (c/2)^2 + N \cdot A \cdot Y_t^2 = 168.824 \text{ IN."}^4
\]

\[
I_{eff} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M) I_{crk} = 242.590 \text{ IN."}^4
\]

IF I_{eff} > I_g I_{eff} = I_g

\[
\frac{P_{11} \cdot L^3}{48 \cdot EI} = 0.1265 \text{ INCHES}
\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

SLAB SPAN 8.67 FEET
SLAB THICKNESS 9.00 INCHES
LOADED WIDTH 5.00 FEET
BEAM WIDTH 4.16 FEET
DEPTH TO SLAB TOP 5.00 FEET
DEPTH TO GROUND WATER 6.00 FEET
SOIL DENSITY -WET- 120.00 LBS/CU. FT.
SOIL DENSITY -DRY- 110.00 LBS/CU. FT.
WHEEL LOADING 16000.00 LBS.
WHEEL SPACING 6.00 FEET
AXLE SPACING 14.00 FEET
SLAB EDGE NOTCH DEPTH 1.00 INCHES
CRACK LIMIT -\sigma- 130000.00 LBS/IN.

\[ W11 = \frac{32000 \times 1.70}{(1.75 \times 5.00)^2} = 710.53 \text{ LBS/SQ.FT.} \]

\[ W11 = W11 \times \text{LOAD WIDTH/BEAM WIDTH} = 854.00 \text{ LBS/SQ.FT.} \]

\[ Wd1 = (0.750 \times 150 \times 1.4) + (5.00 \times 110.00 \times 1.4) = 927.50 \text{ LBS/SQ.FT.} \]

\[ Wd1 = Wd1 \times \text{LOAD WIDTH/BEAM WIDTH} = 1114.78 \text{ LBS/SQ.FT.} \]

\[ \frac{WxL^2}{8} = 18498.94 \text{ FT.LBS.} \]

\[ 221987.31 \text{ IN.LBS.} \]

\[ \frac{M_u}{\phi} = \frac{M_u}{0.90} = 246652.56 \text{ IN.LBS.} \]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

F!c=4500. B=0.825 Fy=60000.

\[ \sigma_b = 0.85 \beta \frac{F!c}{Fy} \frac{87000}{87000+Fy} = 0.0311 \]

amax = 0.75 \sigma_b = 0.02335

amin = 200/Fy = 0.00333

d = 9.00 - 2.00 - 0.3125 = 6.6875 INCHES

TRY NO. 5 BARS AT 5" ON CENTER As = 0.744 SQ.IN.

\[ \sigma = \frac{As}{bd} = 0.00927 \quad \text{STEEL RATIO OK} \checkmark \]

\[ \omega = \frac{oFy}{F!c} = 0.12361 \]

Mn = F!c b d^2 = (1-0.59\omega) = 276757.58 IN.LBS.

276757.58 > 246652.56 IN.LBS. \quad \text{MOMENT CAP. OK} \checkmark
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50” WIDE BEAM WITH 60” WIDE LOAD - SPANNING 104”
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ Vu = \frac{W \times (L-2d)}{2} + P_{ll} = 7437.50 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \times b \times d} = 109.034 \text{ LBS./SQ.IN.} \]

SHEAR AT SLAB EDGE NOTCH

\[ Vu = \frac{W \times L}{2} + P_{ll} = 8534.69 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \times b \times (t\text{-notch})} = 104.592 \text{ LBS./SQ.IN.} \]

\[ Vc = 1.9\sqrt{F_{\text{fc}}} + 2500.0 \frac{d}{\mu} = 150.633 \text{ LBS./SQ.IN.} \]

150.633 > 109.034 LBS./SQ.IN. SHEAR CAP. OK

MINIMUM REINFORCING

\[ As_{\text{min.}} = 0.0018 \times b \times t = 0.1944 \text{ SQ.IN.} \]

USE NO. 5 BARS AT 18” ON CENTER As = 0.207 SQ.IN.
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
CRACK CONTROL CHECK

COVER SLAB FOR 8X10 VAULT (SLB.BEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Slab Span</th>
<th>8.67 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab Thickness</td>
<td>9.00 Inches</td>
</tr>
<tr>
<td>Loaded Width</td>
<td>5.00 Feet</td>
</tr>
<tr>
<td>Beam Width</td>
<td>4.16 Feet</td>
</tr>
<tr>
<td>Depth to Slab Top</td>
<td>5.00 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 Feet</td>
</tr>
<tr>
<td>Slab Edge Notch Depth</td>
<td>1.00 Inches</td>
</tr>
<tr>
<td>Crack Limit -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
W_{II} = \frac{32000.}{(1.75 \times 5.00)^2} = 417.96 \text{ LBS/SQ.FT.}
\]

\[
W_{II} = W_{II} \times \text{LOAD WIDTH/BEAM WIDTH} = 502.35 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = (0.750 \times 150) + (5.00 \times 110.00) = 662.50 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = W_{d1} \times \text{LOAD WIDTH/BEAM WIDTH} = 796.27 \text{ LBS/SQ.FT.}
\]

\[
M = \frac{W_{d1} \times L^{2}}{8} = 12202.06 \text{ FT.LBS.}
\]

\[
F_{s} = 4500. \quad F_{y} = 60000.
\]

THESE INFORMATION AND THE DATA DERIVED HEREIN OR HEREON IS NOT TO BE REPRODUCED, COPIED, OR DUPLICATED IN ANY WAY COMPLETELY OR IN PART, IN ANY WAY WITHOUT THE WRITTEN PERMISSION OF JENSEN PRECAST.
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
CRACK CONTROL CHECK

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

d = 9.00 - 2.00 - 0.3125 = 6.6875 INCHES

TRY NO. 5 BARS AT 5" ON CENTER As = 0.744 SQ.IN.

\[ \sigma = \frac{As}{bd} = 0.00927 \]

\[ n = \frac{Es}{Ec} = 7.584 \]

\[ k = (2\alpha + (\alpha)\cdot 2)^0.5 - \alpha = 0.311 \]

\[ j = 1 - \frac{k}{3} = 0.896 \]

\[ M \]

\[ fs = \frac{M}{Asjd} = 32835.581 \]

\[ Dc \text{ (FOR CRACK CONTROL)} = 2.3125 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 23.1250 \text{ SQ.IN.} \]

\[ \text{MAX. } fs = \frac{130000.00}{(\text{FOR CRACK CONTROL}) (Dc\text{AREA})^{0.33}} = 34505.547 \text{ psi} \]

\[ \text{MAX. } fs = 0.60 \times Fy = 36000.000 \text{ psi} \]

34505.547 > 32835.581 LBS/SQ.IN. CRACK CONTROL OK ✔
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLBBEAM.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>LOADED WIDTH</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>BEAM WIDTH</td>
<td>4.16 FEET</td>
</tr>
<tr>
<td>DEPTH TO SLAB TOP</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
W_{11} = \frac{32000}{(1.75 \times 5.00)^2}\]

\[
W_{11} = 417.96 \text{ LBS/SQ.FT.}
\]

\[
W_{11} = W_{11} \times \text{LOAD WIDTH/BEAM WIDTH} = 502.35 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = (0.750 \times 150) + (5.00 \times 110.00) = 662.50 \text{ LBS/SQ.FT.}
\]

\[
W_{d1} = W_{d1} \times \text{LOAD WIDTH/BEAM WIDTH} = 796.27 \text{ LBS/SQ.FT.}
\]

\[F_{c} = 4500.\]

\[F_{y} = 60000.\]

\[d = 9.00 - 2.00 - 0.3125 = 6.6775 \text{ INCHES}\]

NO. 5 BARS AT 5" ON CENTER \(A_s = 0.744 \text{ SQ.IN.}\)

\[n = \frac{E_s}{E_c} = 7.584\]
JENSEN PRECAST CONCRETE
TOP SLAB BEAM PROGRAM VERSION 3.00
DEFLECTION CALCULATION

COVER SLAB FOR 8X10 VAULT (SLB10M40.DAT)
ASTM C857 A-16 (AASHTO HS-20-44) LOADING
50" WIDE BEAM WITH 60" WIDE LOAD - SPANNING 104"
TOP SLAB AT 1.00 TO 5.00 FEET BELOW FINISHED GRADE

\[
I_g = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 729.000 \text{ IN.}^4
\]

\[
S_g = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 162.000 \text{ IN.}^3
\]

CRACKING STRESS = 7.5 \times f'c^0.50 = 503.115 psi
CRACKING MOMENT = STRESS \times S_g = 81504.68 \text{ IN.LBS.}

DEAD LOAD IMMEDIATE DEFLECTIONS:

\[
M_{dl} = \frac{W_{dl} \times L^2}{8} = 7481.88 \text{ FT.LBS.}
\]

\[
C_{\text{CRACKED SECTION}} = 2.081 \text{ INCHES}
\]

\[
Y_t = d - C_{\text{CRACKED SECTION}} = 4.606 \text{ INCHES}
\]

\[
I_{crk} = \frac{\text{b} \times \text{C}^3}{12} + \frac{\text{C} \times (\text{C}/2)^2 + \text{N} \times \text{Y}_t^2}{12} = 155.786 \text{ IN.}^4
\]

\[
I_{eff} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M)^3)I_{crk} = 584.619 \text{ IN.}^4
\]

IF \( I_{eff} > I_g \) \( I_{eff} = I_g \)

\[
D_{L_{def}} = \frac{5 W_{dl} L^4}{384 \text{ EI}} = 0.0453 \text{ INCHES}
\]
LIVE LOAD IMMEDIATE DEFLECTIONS:

\[ M_{tot} = \frac{W \times L^2}{8} = \frac{12202.06 \text{ FT.LBS.}}{146424.75 \text{ IN.LBS.}} \]

C CRACKED SECTION = 2.081 INCHES

\[ Y_t = d - C \text{ CRACKED SECTION} = 4.606 \text{ INCHES} \]

\[ I_{crk} = \frac{b \times C^3}{12} + C \times b \times (C/2)^2 + N \times A \times Y_t^2 = 155.786 \text{ IN}^3 \]

\[ I_{eff} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M)^3)I_{crk} = 254.646 \text{ IN}^3 \]

IF \( I_{eff} > I_g \) Then \( I_{eff} = I_g \)

\[ LL \text{ def} = \frac{5 \times W11 \times L^3}{384 \times EI} = 0.0656 \text{ INCHES} \]
### Jensen Precast Concrete
**Center Section Design Program Version 3.00**

**Ultimate Strength Design**

8'-0"x10'-0"x8'-0" Tank Bottom Section (REKCTB.DAT)
ASTM C899 A-16 (AASHTO HS-20-44) Loading
96" Section Height with 70" Beam
Top of Wall at 1.67 to 5.67 Feet Below Finished Grade

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Width</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Length</td>
<td>10.67 Feet</td>
</tr>
<tr>
<td>Section Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Beam Height</td>
<td>5.83 Feet</td>
</tr>
<tr>
<td>Dist Centerline to Opening Far Edge</td>
<td>0.00 Feet</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top</td>
<td>1.67 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Lateral Press. -Wet-</td>
<td>81.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Lateral Press. -Dry-</td>
<td>40.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Live Load Surcharge</td>
<td>80.00 Lbs.</td>
</tr>
<tr>
<td>Crack Control -z-</td>
<td>130000.00 Lbs/In.</td>
</tr>
</tbody>
</table>

\[ \begin{align*} 
P_1 &= \text{Lateral Pressure at Grade Elevation} \\
P_2 &= \text{Lateral Pressure at Water Elevation} \\
P_3 &= \text{Lateral Pressure at Top of Wall} \\
P_4 &= \text{Lateral Pressure at Base of Wall} \\
\end{align*} \]

\[ \begin{align*} 
P_1 &= 80.00 \times 1.70 = 136.00 \text{ Lbs/Sq.Ft.} \\
P_2 &= P_1 + 6.00 \times 40.00 \times 1.70 = 544.00 \text{ Lbs/Sq.Ft.} \\
P_3 &= P_1 + 1.67 \times 40.00 \times 1.70 = 249.56 \text{ Lbs/Sq.Ft.} \\
P_4 &= P_2 + (9.67 - 6.00) \times 81.00 \times 1.70 = 1049.36 \text{ Lbs/Sq.Ft.} \\
P_{avg} &= P_3 + P_4 / 2 = 649.46 \text{ Lbs/Sq.Ft.} \\

\end{align*} \]

\[ P_{bmr} = \frac{P_{avg} \times \text{Section Height}}{\text{Beam Height}} = 891.20 \text{ Lbs/Sq.Ft.} \]

\[ F_{c} = 4500, \quad f_0 = 0.825, \quad F_{y} = 60000. \]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
90" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[
\frac{f_{c}}{\sigma_{b}} = \frac{87000}{87000 + F_{y}} = 0.0311 \\

\sigma_{\max} = 0.75 \sigma_{b} = 0.02335 \quad \sigma_{\min} = \frac{200}{F_{y}} = 0.00333
\]

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
\frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} = 8455.15 \text{ FT.LBS.}
\]

\[
\frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} = 5582.52 \text{ FT.LBS.}
\]

MOMENT DIST. long wall = 1287.78 FT.LBS.
MOMENT DIST. short wall = 1584.84 FT.LBS.

-\mu = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{8}

\[
\frac{-\mu}{\phi} = \frac{-\mu}{0.90} = 95564.89 \text{ IN.LBS.}
\]

\[
\frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{8} = 5515.35 \text{ FT.LBS.}
\]

\[
\frac{+\mu}{\phi} = \frac{+\mu}{0.90} = 73538.03 \text{ IN.LBS.}
\]
NEGATIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 5 1/2" ON CENTER As = 0.676 SQ.IN.

σ = As/bd = 0.01409 STEEL RATIO OK /\n
Fy = 0.18788

Mn = Fy c b d^2 « (1-0.59«) = 144333.54 IN.LBS.

144333.54 > 95564.89 IN.LBS. MOMENT CAP. OK /

SHEAR CAPACITY CHECK

Pavg x(LENGTH-2d) 3248.38 LBS. AT d FROM CORNER-

Vu = ———- 2

Vu/φ = ———- = 79.617 LBS./SQ.IN. AT d FROM CORNER-

0.85 b d

Vu = Pbm x DIST TO OPEN = 0.00 LBS. AT OPENING-

Vu/φ = ———- = 0.00 LBS./SQ.IN. AT OPENING-

0.85 b d

Vc = 2.00 Fy c = 134.164 LBS./SQ.IN.

134.164 > 79.617 LBS./SQ. IN. SHEAR CAP. OK /
POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 7" ON CENTER As = 0.531 SQ.IN.

\( \sigma = \frac{A_s}{b_d} = 0.01107 \) STEEL RATIO OK ✓

\( \frac{\sigma}{f_y} = 0.14762 \)

\( F!c \)

\( M_n = F!c \cdot b \cdot d^2 = (1-0.59\alpha) = 116434.48 \) IN.LBS.

116434.48 > 73538.03 IN.LBS. MOMENT CAP. OK ✓

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ.IN.

USE NO. *4 BARS AT 13 1/2" ON CENTER As = 0.178 SQ.IN.
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C990 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

WALL WIDTH = 8.67 FEET
WALL LENGTH = 10.67 FEET
SECTION HEIGHT = 8.00 FEET
BEAM HEIGHT = 5.83 FEET
DIST CENTERLINE TO OPENING FAR EDGE = 0.00 FEET
WALL THICKNESS = 8.00 INCHES
DEPTH TO TOP = 1.67 FEET
DEPTH TO GROUND WATER = 6.00 FEET
LATERAL PRESS. -WET- = 81.00 LBS/CU.FT.
LATERAL PRESS. -DRY- = 40.00 LBS/CU.FT.
LIVE LOAD SURCHARGE = 80.00 LBS.
CRACK CONTROL -z- = 130000.00 LBS/IN.

P1 = LATERAL PRESSURE AT GRADE ELEVATION
P2 = LATERAL PRESSURE AT WATER ELEVATION
P3 = LATERAL PRESSURE AT TOP OF WALL
P4 = LATERAL PRESSURE AT BASE OF WALL

P1 = 80.00 = 80.00 LBS/SQ.FT.
P2 = P1 + 6.00 x 40.00 = 320.00 LBS/SQ.FT.
P3 = P1 + 1.67 x 40.00 = 146.80 LBS/SQ.FT.
P4 = P2 + (9.67 - 6.00)x 81.00 = 617.27 LBS/SQ.FT.
Pavg = P3 + P4 / 2 = 382.03 LBS/SQ.FT.
Pbm = \frac{Pavg \times SECTION\ HEIGHT}{BEAM\ HEIGHT} = 524.23 LBS/SQ.FT.

F!c=4500.
Fy=60000.
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
P_{\text{FEM}} \times \text{LENGTH} \times \text{LENGTH} = \frac{4973.62 \text{ FT.LBS.}}{12} \\
\]

\[
P_{\text{FEM}} \times \text{WIDTH} \times \text{WIDTH} = \frac{3283.84 \text{ FT.LBS.}}{12} \\
\]

MOMENT DIST. long wall = 757.52 FT.LBS.
MOMENT DIST. short wall = 932.26 FT.LBS.

\[
-M = P_{\text{FEM}} \text{ long wall} - \text{DIST long wall} = 4216.10 \text{ FT.LBS.} \\
\]

\[
+M = -M + \frac{P_{\text{FEM}} \times \text{LENGTH} \times \text{LENGTH}}{8} = 3244.32 \text{ FT.LBS.} \]

\[
\text{38931.90 IN.LBS.} \\
\]
NEGATIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5 BARS AT 5 1/2" ON CENTER \( A_s = 0.676 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01409 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2n + (an)^2)^{0.5} - an = 0.368 \]

\[ j = 1 - \frac{k}{3} = 0.877 \]

\[ M \]

\[ f_s = \frac{130000.00}{130000.00} = 23197.394 \text{ psi} \]

\[ (\text{FOR CRACK CONTROL}) \quad (Dc)\text{AREA}^{0.33} \]

\[ \text{MAX. } f_s = 0.60 \times F_y = 36000.000 \text{ psi} \]

23197.394 > 21312.183 LBS/SQ.IN. CRACK CONTROL OK ✓
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 7" ON CENTER As = 0.531 SQ.IN.

σ = As/bd = 0.01107

n = Es / Ec = 7.584

k = (2an + (an)^2)^0.5 - an = 0.334

j = 1 - (k/3) = 0.889

M
fs = ---- = 20611.922
Asjd

Dc (FOR CRACK CONTROL) = 4.0000 INCHES

AREA (FOR CRACK CONTROL) = 56.0000 SQ.IN.

MAX. fs = 1300.00
(FOR CRACK CONTROL) (DcAREA)^0.33 = 21405.601 psi

MAX. fs = 0.60 x Fy = 36000.000 psi

21405.601 > 20611.922 LBS/SQ.IN. CRACK CONTROL OK

CALCULATIONS BY 12:02 PM 31-07-88

THIS DOCUMENT AND THE DATA DERIVED HEREFROM ARE THE PROPERTY OF JENSEN PRECAST AND MAY NOT BE REPRODUCED, USED OR DISCLOSED, IN WHOLE OR IN PART, WITHOUT THE WRITTEN CONSENT OF JENSEN PRECAST.
### JENSEN PRECAST CONCRETE

#### CENTER SECTION DESIGN PROGRAM VERSION 3.00

**8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)**

**ASTM C890 A-16 (AASHTO HS-20-44) LOADING**

**96" SECTION HEIGHT WITH 70" BEAM**

**TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL WIDTH</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>1.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS.</td>
</tr>
<tr>
<td>CRACK CONTROL -Z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

### Deflection Calculation

- **P1** = LATERAL PRESSURE AT GRADE ELEVATION
- **P2** = LATERAL PRESSURE AT WATER ELEVATION
- **P3** = LATERAL PRESSURE AT TOP OF WALL
- **P4** = LATERAL PRESSURE AT BASE OF WALL

\[
P1 = 80.00 \quad \text{LBS/SQ.FT.}
\]

\[
P2 = P1 + 6.00 \times 40.00 = 320.00 \quad \text{LBS/SQ.FT.}
\]

\[
P3 = P1 + 1.67 \times 40.00 = 146.80 \quad \text{LBS/SQ.FT.}
\]

\[
P4 = P2 + (9.67 - 6.00) \times 81.00 = 617.27 \quad \text{LBS/SQ.FT.}
\]

\[
P_{avg} = P3 + P4 / 2 = 382.03 \quad \text{LBS/SQ.FT.}
\]

\[
F_{pam} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = 524.23 \quad \text{LBS/SQ.FT.}
\]

\[
F_{y} = 45000.
\]

\[
F_{y} = 60000.
\]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[
\text{FEM long wall} = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} = 4973.62 \text{ FT.LBS.}
\]

\[
\text{FEM short wall} = \frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} = 3283.84 \text{ FT.LBS.}
\]

MOMENT DIST. long wall = 757.52 FT.LBS.
MOMENT DIST. short wall = 932.26 FT.LBS.

\[
-M = \text{FEM long wall} - \text{DIST long wall} = 4216.10 \text{ FT.LBS.}
\]

\[
+M = -M + \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{8} = 3244.32 \text{ FT.LBS.}
\]

38931.90 IN.LBS.
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFORMATION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCBT.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
95° SECTION HEIGHT WITH 70° BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000\text{ INCHES} \]

NO. 5 BARS AT 7" ON CENTER \( A_s = 0.531\text{ SQ.IN.} \)

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000\text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000\text{ IN.}^3 \]

CRACKING STRESS = 7.5 \times f_c^{0.50} \approx 503.115\text{ psi} \]

CRACKING MOMENT = STRESS \times S_g = 64398.76\text{ IN.LBS.} \]

C CRACKED SECTION = 1.337\text{ INCHES} \]

\[ Y_t = d - C \text{ CRACKED SECTION} = 2.663\text{ INCHES} \]

\[ I_{crk} = \frac{b \ C^3}{12} + b \ C \left( \frac{C}{2} \right)^2 + N \times A_s \times Y_t^2 = 38.143\text{ IN.}^4 \]

\[ I_{eff} = (M_{crk}/M)^3 I_g + (1-(M_{crk}/M)^3)I_{crk} = 512.000\text{ IN.}^4 \]

IF \( I_{eff} > I_g \) \( I_{eff} = I_g \)

\[ \text{Deflect} = \frac{P_{BEAM} L^4}{384 \ E I} = 0.0156\text{ INCHES} \]
### JENSEN PRECAST CONCRETE

**CENTER SECTION DESIGN PROGRAM VERSION 3.00**
**ULTIMATE STRENGTH DESIGN**

- **8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)**
- **ASTM C890 A-16 (AASHTO HS-20-44) LOADING**
- **96" SECTION HEIGHT WITH 70" BEAM**
- **TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL WIDTH</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL LENGTH</td>
<td>10.67 FEET</td>
</tr>
<tr>
<td>SECTION HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BEAM HEIGHT</td>
<td>5.83 FEET</td>
</tr>
<tr>
<td>DIST CENTERLINE TO OPENING FAR EDGE</td>
<td>0.00 FEET</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP</td>
<td>5.67 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>LATERAL PRESS. -WET-</td>
<td>81.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LATERAL PRESS. -DRY-</td>
<td>40.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>LIVE LOAD SURCHARGE</td>
<td>80.00 LBS.</td>
</tr>
<tr>
<td>CRACK CONTROL -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

**Pressure Calculations**

- **P1** = LATERAL PRESSURE AT GRADE ELEVATION
- **P2** = LATERAL PRESSURE AT WATER ELEVATION
- **P3** = LATERAL PRESSURE AT TOP OF WALL
- **P4** = LATERAL PRESSURE AT BASE OF WALL

\[
P1 = \frac{80.00 \times 1.70}{1.70} = 136.00 \text{ LBS/SQ.FT.}
\]

\[
P2 = P1 + \frac{6.00 \times 40.00 \times 1.70}{1.70} = 544.00 \text{ LBS/SQ.FT.}
\]

\[
P3 = P1 + \frac{5.67 \times 40.00 \times 1.70}{1.70} = 521.56 \text{ LBS/SQ.FT.}
\]

\[
P4 = P2 + (13.67 - 6.00) \times \frac{81.00 \times 1.70}{1.70} = 1600.16 \text{ LBS/SQ.FT.}
\]

\[
P_{avg} = \frac{P3 + P4}{2} = 1060.86 \text{ LBS/SQ.FT.}
\]

\[
P_{bm} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} = 1455.72 \text{ LBS/SQ.FT.}
\]

- **F!c=4500.**
- **B=0.825**
- **Fy=60000.**
JENSEN PRECAST CONCRETE  
CENTER SECTION DESIGN PROGRAM VERSION 3.00  
ULTIMATE STRENGTH DESIGN  

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)  
ASTM C890 A-16 (AASHTO HS-20-44) LOADING  
96" SECTION HEIGHT WITH 70" BEAM  
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE  

\[ \frac{F_{1c}}{87000} \frac{c_b}{87000+F_y} = 0.0311 \]

\[ \sigma_{max} = 0.75 \frac{c_b}{0.02335} \sigma_{min} = \frac{200}{F_y} = 0.00333 \]

K long wall = 1.00/LENGTH = 1.00000  
K short wall = 1.00/WIDTH = 1.23068  
DEF. FACTOR long wall = 0.44829  
DEF. FACTOR short wall = 0.55171  

\[ \frac{P_{bm}}{x \text{LENGTH} \times \text{LENGTH}} = \frac{13811.06}{12} \text{ FT.LBS.} \]

\[ \frac{P_{bm}}{x \text{WIDTH} \times \text{WIDTH}} = \frac{9118.77}{12} \text{ FT.LBS.} \]

MOMENT DIST. long wall = 2103.52 FT.LBS.  
MOMENT DIST. short wall = 2588.76 FT.LBS.  

\[ -\mu = \frac{F_{1c}}{x \text{DIST} \text{long wall}} = \frac{11707.53}{140490.41} \text{ IN.LBS.} \]

\[ -\mu/\phi = -\mu/0.90 = \frac{156100.45}{156100.45} \text{ IN.LBS.} \]

\[ \frac{P_{bm}}{x \text{LENGTH} \times \text{LENGTH}} = \frac{9009.05}{8} \text{ FT.LBS.} \]

\[ +\mu = -\mu + \frac{P_{bm}}{8} = \frac{108108.61}{120120.67} \text{ IN.LBS.} \]
NEGATIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 4" ON CENTER As = 0.930 SQ.IN.

$\sigma = \frac{As}{bd} = \frac{0.01937}{0.25833}$

Steel Ratio OK

$M_n = \frac{Fc}{b}d^2\left(1 - 0.59\phi\right) = \frac{189180.60}{166100.45}$

IN.LBS. > IN.LBS. 

MOMENT CAP. OK

SHEAR CAPACITY CHECK

$Vu = \frac{Pa}{2(\text{LENGTH}-2d)} = 5306.07$ LBS. -AT d FROM CORNER-

$Vu/\phi = \frac{0.85b}{0.85b} = 130.051$ LBS./SQ.IN. -AT d FROM CORNER-

$Vu = P_{bm} \times \text{DIST TO OPEN} = 0.00$ LBS. -AT OPENING-

$Vu/\phi = \frac{0.85b}{0.85b} = 0.00$ LBS./SQ.IN. -AT OPENING-

$V_c = 2.00 \sqrt{F_c} = 134.164$ LBS./SQ.IN.

134.164 > 130.051 LBS./SQ.IN. SHEAR CAP. OK

This document and the data derived herein or herefrom, if not be reproduced, used or disclosed, in whole or in part, in anyone without the written permission of Jensen Precast.
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5  BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

\[ \sigma = \frac{A_s}{b d} = 0.01722 \quad \text{STEEL RATIO OK} \checkmark \]

\[ \omega = \frac{F_y}{F' c} = 0.22963 \]

Mn = F'c b d^2 \omega (1-0.59\omega) = 171520.47 IN.LBS.

171520.47 > 120120.67 IN.LBS.  \quad \text{MOMENT CAP. OK} \checkmark

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ.IN.

USE NO.  4 BARS AT 13 1/2" ON CENTER As = 0.178 SQ.IN.
### Jensen Precast Concrete
**Center Section Design Program Version 3.00**

**Crack Control Check**

8'-0"x10'-0"x8'-0" Tank Bottom Section (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) Loading
96" Section Height with 70" Beam
Top of Wall at 1.67 to 5.67 Feet Below Finished Grade

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Width</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Length</td>
<td>10.67 Feet</td>
</tr>
<tr>
<td>Section Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Beam Height</td>
<td>5.83 Feet</td>
</tr>
<tr>
<td>Dist Centerline to Opening Far Edge</td>
<td>0.00 Feet</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top</td>
<td>5.67 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Lateral Pressure - Wet</td>
<td>81.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Lateral Pressure - Dry</td>
<td>40.00 Lbs/Cu.Ft.</td>
</tr>
<tr>
<td>Live Load Surcharge</td>
<td>80.00 Lbs</td>
</tr>
<tr>
<td>Crack Control - z</td>
<td>130000.00 Lbs/In.</td>
</tr>
</tbody>
</table>

**Equations:**

- **P1** = Lateral Pressure at Grade Elevation
- **P2** = Lateral Pressure at Water Elevation
- **P3** = Lateral Pressure at Top of Wall
- **P4** = Lateral Pressure at Base of Wall

1. \[ P1 = 80.00 = 80.00 \text{ Lbs/Sq Ft.} \]
2. \[ P2 = P1 + 6.00 \times 40.00 = 320.00 \text{ Lbs/Sq Ft.} \]
3. \[ P3 = P1 + 5.67 \times 40.00 = 306.80 \text{ Lbs/Sq Ft.} \]
4. \[ P4 = P2 + (13.67 - 6.00) \times 81.00 = 941.27 \text{ Lbs/Sq Ft.} \]
5. \[ P_{avg} = P3 + P4 / 2 = 624.03 \text{ Lbs/Sq Ft.} \]
6. \[ P_{bm} = \frac{P_{avg} \times \text{Section Height}}{\text{Beam Height}} = 856.31 \text{ Lbs/Sq Ft.} \]

**F1c=4500**

**Fy=60000**
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[ K_{\text{long wall}} = 1.00/\text{LENGTH} = 1.00000 \]
\[ K_{\text{short wall}} = 1.00/\text{WIDTH} = 1.23068 \]
\[ \text{DEF. FACTOR}_{\text{long wall}} = 0.44829 \]
\[ \text{DEF. FACTOR}_{\text{short wall}} = 0.55171 \]

\[ FEM_{\text{long wall}} = \frac{P_{\text{bfm}} \times \text{LENGTH} \times \text{LENGTH}}{12} = 8124.15 \text{ FT.LBS.} \]
\[ FEM_{\text{short wall}} = \frac{P_{\text{bfm}} \times \text{WIDTH} \times \text{WIDTH}}{12} = 5363.98 \text{ FT.LBS.} \]
\[ \text{MOMENT DIST.}_{\text{long wall}} = 1237.37 \text{ FT.LBS.} \]
\[ \text{MOMENT DIST.}_{\text{short wall}} = 1522.80 \text{ FT.LBS.} \]
\[ -M = FEM_{\text{long wall}} - \text{DIST}_{\text{long wall}} = 6886.78 \text{ FT.LBS.} \]
\[ 82641.42 \text{ IN.LBS.} \]
\[ +\mu; -\mu; + \frac{P_{\text{bfm}} \times \text{LENGTH} \times \text{LENGTH}}{8} = 5299.44 \text{ FT.LBS.} \]
\[ 63593.30 \text{ IN.LBS.} \]
NEGATIVE MOMENT STEEL SELECTION

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

TRY NO. 5 BARS AT 4" ON CENTER \( A_s = 0.930 \text{ SQ.IN.} \)

\[ \sigma = \frac{A_s}{bd} = 0.01937 \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ k = (2\sigma + (\sigma)^2)^0.5 - \sigma = 0.415 \]

\[ j = 1 - (k/3) = 0.862 \]

\[ M = \text{_____} = 25779.292 \]

\[ A_s \cdot j d \]

\[ D_c \text{ (FOR CRACK CONTROL)} = 4.0000 \text{ INCHES} \]

\[ \text{AREA (FOR CRACK CONTROL)} = 32.0000 \text{ SQ.IN.} \]

\[ \text{MAX. } f_s = \frac{130000.00}{(D_c \times \text{AREA})^0.33} = 25795.271 \text{ psi} \]

\[ \text{MAX. } f_s = 0.60 \times F_y = 36000.000 \text{ psi} \]

25795.271 > 25779.292 LBS/SQ.IN. CRACK CONTROL OK
POSITIVE MOMENT STEEL SELECTION

d = 8.00 - 3.69 - 0.3125 = 4.0000 INCHES

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

σ = As/bd = 0.01722

n = Es / Ec = 7.584

k = (2n + (an)^2)^0.5 - an = 0.397

j = 1 - (k/3) = 0.868

M

fs = ---- = 22164.348
Asjd

Dc (FOR CRACK CONTROL) = 4.0000 INCHES

AREA (FOR CRACK CONTROL) = 36.0000 SQ.IN.

MAX. fs = \frac{130000.00}{(Dc \times \text{AREA})^{0.33}} = 24802.146 psi

MAX. fs = 0.60 \times Fy = 36000.000 psi

24802.146 > 22164.348 LBS/SQ.IN. CRACK CONTROL OK
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C930 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

| WALL WIDTH   | 8.67 FEET |
| WALL LENGTH  | 10.67 FEET |
| SECTION HEIGHT | 8.00 FEET |
| BEAM HEIGHT  | 5.83 FEET |
| DIST CENTERLINE TO OPENING FAR EDGE | 0.00 FEET |
| WALL THICKNESS | 8.00 INCHES |
| DEPTH TO TOP | 5.67 FEET |
| DEPTH TO GROUND WATER | 6.00 FEET |
| LATERAL PRESS. -WET- | 81.00 LBS/CU.FT. |
| LATERAL PRESS. -DRY- | 40.00 LBS/CU.FT. |
| LIVE LOAD SURCHARGE | 80.00 LBS. |
| CRACK CONTROL -2- | 130000.00 LBS/IN. |

P1 = LATERAL PRESSURE AT GRADE ELEVATION
P2 = LATERAL PRESSURE AT WATER ELEVATION
P3 = LATERAL PRESSURE AT TOP OF WALL
P4 = LATERAL PRESSURE AT BASE OF WALL

\[
P1 = 80.00 \quad = \quad 80.00 \text{ LBS/SQ.FT.}
\]

\[
P2 = P1 + 6.00 \times 40.00 \quad = \quad 320.00 \text{ LBS/SQ.FT.}
\]

\[
P3 = P1 + 5.67 \times 40.00 \quad = \quad 306.80 \text{ LBS/SQ.FT.}
\]

\[
P4 = P2 + (13.67 - 6.00) \times 81.00 \quad = \quad 941.27 \text{ LBS/SQ.FT.}
\]

\[
P_{avg} = P3 + P4 / 2 \quad = \quad 624.03 \text{ LBS/SQ.FT.}
\]

\[
P_{bm} = \frac{P_{avg} \times \text{SECTION HEIGHT}}{\text{BEAM HEIGHT}} \quad = \quad 856.31 \text{ LBS/SQ.FT.}
\]

\[\text{F'c}=4500. \quad \text{Fy}=60000.\]
8'-0" x 10'-0" x 8'-0" TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

K long wall = 1.00/LENGTH = 1.00000
K short wall = 1.00/WIDTH = 1.23068
DEF. FACTOR long wall = 0.44829
DEF. FACTOR short wall = 0.55171

\[ \text{FEM long wall} = \frac{P_{bm} \times \text{LENGTH} \times \text{LENGTH}}{12} = 8124.15 \text{ FT.LBS.} \]

\[ \text{FEM short wall} = \frac{P_{bm} \times \text{WIDTH} \times \text{WIDTH}}{12} = 5363.98 \text{ FT.LBS.} \]

MOMENT DIST. long wall = 1237.37 FT.LBS.
MOMENT DIST. short wall = 1522.80 FT.LBS.

\[ -M_{pm} = \text{FEM long wall} - \text{DIST long wall} = 6886.78 \text{ FT.LBS.} \]
\[ +M_{pm} = \frac{-M + \text{FEM long wall} \times \text{LENGTH} \times \text{LENGTH}}{8} = 5299.44 \text{ FT.LBS.} \]
\[ 63593.30 \text{ IN.LBS.} \]
JENSEN PRECAST CONCRETE
CENTER SECTION DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8' x 10' x 8' TANK BOTTOM SECTION (REKCTB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING.
96" SECTION HEIGHT WITH 70" BEAM
TOP OF WALL AT 1.67 TO 5.67 FEET BELOW FINISHED GRADE

\[ d = 8.00 - 3.69 - 0.3125 = 4.0000 \text{ INCHES} \]

No. 5 bars at 4 1/2" on center
\[ A_s = 0.827 \text{ SQ.IN.} \]

\[ n = \frac{E_s}{E_c} = 7.584 \]

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

Cracking stress = 7.5 \times f_c^{0.50} = 503.115 \text{ psi} \]

Cracking moment = stress \times Sg = 64398.76 \text{ IN.LBS.} \]

C cracked section = 1.588 INCHES

\[ Y_t = d - C \text{ CRACKED SECTION} = 2.412 \text{ INCHES} \]

\[ I_{crk} = \frac{b \cdot C^3}{12} + b \cdot C \left( \frac{C}{2} \right)^2 + N \cdot A_s \cdot Y_t^2 = 52.494 \text{ IN.}^4 \]

\[ I_{eff} = \left( \frac{M_{crk}}{M} \right)^3 I_g + \left( 1 - \left( \frac{M_{crk}}{M} \right)^3 \right) I_{crk} = 512.000 \text{ IN.}^4 \]

IF \[ I_{eff} > I_g \text{ } Ieff = Ig \]

\[ \text{Deflect} = \frac{P \text{BEAM} \cdot L^4}{384 \cdot EI} = 0.0255 \text{ INCHES} \]
# Jensen Precast Concrete

Bottom Slab Design Program Version 3.00

**Ultimate Strength Design**

- **8'-0" x 10'-0" x 8'-0" Panel Vault (BTMSLB.DAT)**
- **ASTM C890 A-16 (AASHTO HS-20-44) Loading**
- **8" Floor Thickness**
- **Inside Floor at 9.67 to 13.67 Feet Below Finished Grade**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Length</td>
<td>10.00 Feet</td>
</tr>
<tr>
<td>Structure Width</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Bottom Slab Span</td>
<td>8.67 Feet</td>
</tr>
<tr>
<td>Wall Height</td>
<td>8.00 Feet</td>
</tr>
<tr>
<td>Top Slab Thickness</td>
<td>9.00 Inches</td>
</tr>
<tr>
<td>Bottom Slab Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>8.00 Inches</td>
</tr>
<tr>
<td>Depth to Top Slab</td>
<td>1.00 Feet</td>
</tr>
<tr>
<td>Depth to Ground Water</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Soil Density -Wet-</td>
<td>120.00 Lbs/cu.ft.</td>
</tr>
<tr>
<td>Soil Density -Dry-</td>
<td>110.00 Lbs/cu.ft.</td>
</tr>
<tr>
<td>Wheel Loading</td>
<td>16000.00 Lbs.</td>
</tr>
<tr>
<td>Wheel Spacing</td>
<td>6.00 Feet</td>
</tr>
<tr>
<td>Axle Spacing</td>
<td>14.00 Feet</td>
</tr>
<tr>
<td>Crack Limit -z-</td>
<td>130000.00 Lbs/in.</td>
</tr>
</tbody>
</table>

**Live Load** = 32000 x 1.70 = 54400.00 Lbs.

**Dry Earth** = 1.00x11.33x9.33x110.00x1.4 = 16289.78 Lbs.

**Top Slab** = 11.33x9.33x9.00/12.00 x 150 x1.4 = 16660.00 Lbs.

**Walls** = 38.67x8.00x8.00/12.00 x 150 x1.4 = 43306.67 Lbs.

**Total Weight** = 130656.44 Lbs.

**Weight/Sq.Ft.** = 

\[
\frac{130656.44}{11.33 \times 9.33} = 1235.20 \text{ Lbs/Sq.Ft.}
\]
JENSEN PRECAST CONCRETE
BOTTON SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[ W \times L^2 = \frac{11606.05 \text{ FT.LBS.}}{8} = 139272.65 \text{ IN.LBS.} \]

\[ \frac{\mu}{\phi} = \frac{\mu}{0.90} = \frac{154747.39 \text{ IN.LBS.}}{87000} \]

\[ F/c = 4500, \quad B = 0.825, \quad F_y = 60000 \]

\[ \sigma_b = 0.85B \frac{F/c}{F_y} \quad \text{with} \quad \frac{87000}{87000 + F_y} = 0.0311 \]

\[ \sigma_{max} = 0.75 \sigma_b = 0.02335 \]

\[ \sigma_{min} = \frac{200}{F_y} = 0.00333 \]

\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

TRY NO. 5 BARS AT 7 1/2" ON CENTER AS = 0.496 SQ.IN.

\[ \sigma = \frac{A_s}{b d} = 0.00668 \quad \text{STEEL RATIO OK} \checkmark \]

\[ \alpha = \frac{\sigma F_y}{F/c} = 0.08907 \]

\[ M_n = F/c b d^2 \left(1 - 0.59\alpha\right) = 174463.37 \text{ IN.LBS.} \]

\[ 174463.37 > 154747.39 \text{ IN.LBS.} \quad \text{MOMENT CAP. OK} \checkmark \]
8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

SHEAR AT -D- FROM SUPPORT

\[ Vu = \frac{W \times (L-2d)}{2} = 4717.68 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \text{ b d}} = 74.750 \text{ LBS./SQ.IN.} \]

SHEAR AT SLAB EDGE NOTCH

\[ Vu = \frac{W \times L}{2} = 5354.58 \text{ LBS.} \]

\[ Vu/\phi = \frac{Vu}{0.85 \text{ b (t-notch)}} = 74.994 \text{ LBS./SQ.IN.} \]

\[ V_c = 1.9\sqrt{f_{c}} + 2500.\sigma \left( \frac{V_u d}{\mu} \right) = 141.536 \text{ LBS/SQ.IN.} \]

141.536 > 74.994 LBS./SQ.IN. SHEAR CAP. OK

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ.IN.

USE NO. 4 RARS AT 13 1/2" ON CENTER As = 0.178 SQ.IN.
8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BOTTOM SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM SLAB THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP SLAB</td>
<td>1.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

LIVE LOAD = 32000. = 32000.00 LBS.

DRY EARTH = 1.00x11.33x9.33x110.00= 11635.56 LBS.
TOP SLAB = 11.33x9.33x9.00/12.00 x 150 = 11900.00 LBS.
WALLS =8.67x8.00x8.00/12.00 x 150 = 30933.33 LBS.

TOTAL WEIGHT = 86468.89 LBS.

WEIGHT/SQ.FT. = 86468.89 / 11.33 x 9.33 = 817.46 LBS/SQ.FT.
8'-0" x 10'-0" x 8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
M = \frac{W \times L^2}{8} = 7680.93 \text{ FT.LBS.} \\
\frac{92171.13 \text{ IN.LBS.}}{}
\]

\[
F!c=4500. \quad F_Y=60000.
\]

\[
d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES}
\]

TRY NO. 5 BARS AT 7 1/2" ON CENTER As = 0.496 SQ.IN.

\[
\sigma = \frac{As}{bd} = 0.00668
\]

\[
n = \frac{Es}{Ec} = 7.584
\]

\[
k = \left(2an + (an)^2ight) \times 0.5 - an = 0.272
\]

\[
j = 1 - \frac{k}{3} = 0.909
\]

\[
M = \frac{fs}{Asjd} = 33023.370
\]

\[
Dc \quad \text{(FOR CRACK CONTROL)} = 1.8125 \text{ INCHES}
\]

\[
\text{AREA \quad \text{(FOR CRACK CONTROL)} = 27.1875 \text{ SQ.IN.}}
\]

\[
\text{MAX. } fs = \frac{130000.00}{\left(Dc \times \text{AREA} \right)^{0.33}} = 35459.095 \text{ psi}
\]

\[
\text{MAX. } fs = 0.60 \times F_Y = 36000.000 \text{ psi}
\]

\[
35459.095 > 33023.370 \text{ LBS/SQ.IN. \quad CRACK CONTROL OK} \\
\]
# Jensen Precast Concrete

**Bottom Slab Design Program Version 3.00**

**Deflection Calculation**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8'-0&quot;x10'-0&quot;x8'-0&quot; Panel Vault (BTMSLB.DAT)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ASTM C890 A-16 (AASHTO HS-20-44) Loading</strong></td>
<td></td>
</tr>
<tr>
<td><strong>8&quot; Floor Thickness</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Inside Floor at 9.67 to 13.67 Feet Below Finished Grade</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Structure Length</strong></td>
<td>10.00 Feet</td>
</tr>
<tr>
<td><strong>Structure Width</strong></td>
<td>8.00 Feet</td>
</tr>
<tr>
<td><strong>Bottom Slab Span</strong></td>
<td>8.67 Feet</td>
</tr>
<tr>
<td><strong>Wall Height</strong></td>
<td>8.00 Inches</td>
</tr>
<tr>
<td><strong>Top Slab Thickness</strong></td>
<td>9.00 Inches</td>
</tr>
<tr>
<td><strong>Bottom Slab Thickness</strong></td>
<td>8.00 Inches</td>
</tr>
<tr>
<td><strong>Wall Thickness</strong></td>
<td>8.00 Inches</td>
</tr>
<tr>
<td><strong>Depth to Top Slab</strong></td>
<td>1.00 Feet</td>
</tr>
<tr>
<td><strong>Depth to Ground Water</strong></td>
<td>6.00 Feet</td>
</tr>
<tr>
<td><strong>Soil Density -Wet-</strong></td>
<td>120.00 lbs/ft³</td>
</tr>
<tr>
<td><strong>Soil Density -Dry-</strong></td>
<td>110.00 lbs/ft³</td>
</tr>
<tr>
<td><strong>Wheel Loading</strong></td>
<td>16000.00 lbs</td>
</tr>
<tr>
<td><strong>Wheel Spacing</strong></td>
<td>6.00 Feet</td>
</tr>
<tr>
<td><strong>Axle Spacing</strong></td>
<td>14.00 Feet</td>
</tr>
<tr>
<td><strong>Slab Edge Notch Depth</strong></td>
<td>1.00 Inches</td>
</tr>
<tr>
<td><strong>Crack Limit -z-</strong></td>
<td>130000.00 lbs/in</td>
</tr>
</tbody>
</table>

**Live Load = 32000.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dry Earth</strong></td>
<td>1.00x11.33x 9.33x110.00 =</td>
</tr>
<tr>
<td><strong>Top Slab</strong></td>
<td>=11.33x 9.33x 9.00/12.00 x 150 =</td>
</tr>
<tr>
<td><strong>Walls</strong></td>
<td>=38.67x 8.00x 8.00/12.00 x 150 =</td>
</tr>
<tr>
<td><strong>Total Load</strong></td>
<td>=</td>
</tr>
</tbody>
</table>
8'-0"x10'-0"x8'-0" PANEL VAULT (BTM5L8.DAT)  
ASTM C890 A-16 (AASHTO HS-20-44) LOADING  
8" FLOOR THICKNESS  
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

TOTAL LOAD/SQ.FT. = \frac{86468.89}{11.33 \times 9.33} = 817.46\text{ LBS/SQ.FT.}

TOTAL DEAD LOAD = 54468.89\text{ LBS.}

DEAD LOAD/SQ.FT. = \frac{54468.89}{11.33 \times 9.33} = 514.94\text{ LBS/SQ.FT.}

F\text{c}=4500. \quad \quad \quad F\text{y}=60000.

\begin{align*}
W \times L^2 &= 4838.41\text{ FT.LBS.} \\
8 &\quad 58060.87\text{ IN.LBS.}
\end{align*}

\begin{align*}
W \times L^2 &= 7680.93\text{ FT.LBS.} \\
8 &\quad 92171.13\text{ IN.LBS.}
\end{align*}
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

DEAD LOAD IMMEDIATE DEFLECTIONS:

d = 8.00 - 1.50 - 0.3125 = 6.1875 INCHES

NO. 5 BARS AT 7 1/2" ON CENTER As = 0.496 SQ.IN.
n = Es / Ec = 7.584

\[
Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN}^4
\]

\[
Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN}^3
\]

CRACKING STRESS = 7.5 \times F_c^{0.50} = 503.115 psi

CRACKING MOMENT = STRESS \times Sg = 64398.76 IN.LBS.

C CRACKED SECTION = 1.681 INCHES

\[
Yt = d - C \text{ CRACKED SECTION} = 4.507 \text{ INCHES}
\]

\[
I_{crk} = \frac{b \times C^3}{12} + C \times b \times (C/2)^2 + N \times As \times Yt^2 = 95.398 \text{ IN}^4
\]

\[
I_{eff} = (Mc_{rk}/M)^3 \times Ig + (1-(Mc_{rk}/M)^3)I_{crk} = 512.000 \text{ IN}^4
\]

IF Ieff > Ig  Ieff = Ig

\[
\text{DL def} = \frac{5 \times Wd1 \times L^4}{384 \times EI} = 0.0334 \text{ INCHES}
\]
LIVE LOAD IMMEDIATE DEFLECTIONS:

\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

No. 5 bars at 7 1/2" on center
\[ \frac{\text{As}}{\text{Ec}} = 7.584 \]

\[ \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ INCHES}^4 \]

\[ \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ INCHES}^3 \]

Cracking stress = \(7.5 \times f_{c}^{0.50}\)
\[ = 503.115 \text{ psi} \]

Cracking moment = Stress \(\times S_g = 64398.76 \text{ INCHES} \times \text{LBS.} \]

C cracked section = 1.681 INCHES

\[ Y_t = d - C \text{ cracked section} = 4.507 \text{ INCHES} \]

\[ I_{crk} = \frac{b \times C^3}{12} + C b \left(\frac{C}{2}\right)^2 + N As Y_t^2 = 95.398 \text{ INCHES}^4 \]

\[ I_{eff} = (M_{crk}/M)^3 \times I_g + (1-(M_{crk}/M)^3)I_{crk} = 237.490 \text{ INCHES}^4 \]

IF \( I_{eff} > I_g \), \( I_{eff} = I_g \)

\[ \frac{5 \times W I \times L^4}{384 \times E I} = 0.0424 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BOTTOM SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM SLAB THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP SLAB</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
\text{LIVE LOAD} = \frac{32000.0 \times 1.70 \times 11.33 \times 9.33}{(5.00 \times 1.75)^2} = 75158.35 \text{ LBS.}
\]

\[
\text{DRY EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 \times 1.4 = 81448.89 \text{ LBS.}
\]

\[
\text{TOP SLAB} = 11.33 \times 9.33 \times 9.00/12.00 \times 150 \times 1.4 = 16660.00 \text{ LBS.}
\]

\[
\text{WALLS} = 38.67 \times 8.00 \times 8.00/12.00 \times 150 \times 1.4 = 43306.67 \text{ LBS.}
\]

\[
\text{TOTAL WEIGHT} = 216573.90 \text{ LBS.}
\]

\[
\text{WEIGHT/SQ.FT.} = \frac{216573.90}{11.33 \times 9.33} = 2047.44 \text{ LBS/SQ.FT.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
ULTIMATE STRENGTH DESIGN

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C390 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[ W \times L^2 \]
\[ \mu = \frac{W \times L^2}{B} = 19238.00 \text{ FT.LBS.} \]
\[ = 230855.99 \text{ IN.LBS.} \]
\[ \mu / \phi = \mu / 0.90 = 256506.65 \text{ IN.LBS.} \]
\[ F!c=4500. \]
\[ b=0.825 \]
\[ F_y=60000. \]
\[ \sigma_{max} = 0.75 \frac{F!c}{87000} = 0.0311 \]
\[ \sigma_{min} = 200/F_y = 0.00333 \]
\[ d = 8.00 \times 1.50 \times 0.3125 = 6.1875 \text{ INCHES} \]

TRY NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

\[ \sigma = \frac{As}{bd} = 0.01113 \]
STEEL RATIO OK ✓

\[ \sigma = \frac{\sigma_{max}}{F!c} = 0.14845 \]

\[ Mn = \frac{F!c b d^2}{(1-0.59 \sigma_{max})} = 280020.47 \text{ IN.LBS.} \]

\[ 280020.47 > 256506.65 \text{ IN.LBS.} \]
MOMENT CAP. OK ✓
SHEAR AT -D- FROM SUPPORT

\[ V_u = \frac{W \times (L-2d)}{2} = 7819.95 \text{ LBS.} \]

\[ \frac{V_u}{\phi} = \frac{123.905 \text{ LBS./SQ. IN.}}{0.85 \times b \times d} \]

SHEAR AT SLAB EDGE NOTCH

\[ V_u = \frac{W \times L}{2} = 8875.65 \text{ LBS.} \]

\[ \frac{V_u}{\phi} = \frac{124.309 \text{ LBS./SQ. IN.}}{0.85 \times b \times (t\text{-notch})} \]

\[ V_c = \frac{1.9V!c + 2500.\sigma}{M_u} = 150.922 \text{ LBS./SQ. IN.} \]

150.922 > 124.309 LBS./SQ. IN.  SHEAR CAP. OK

MINIMUM REINFORCING

As min. = 0.0018 bt = 0.1728 SQ. IN.

USE NO. 4 BARS AT 13 1/2" ON CENTER As = 0.178 SQ. IN.
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
CRACK CONTROL CHECK

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C690 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

STRUCTURE LENGTH 10.00 FEET
STRUCTURE WIDTH 8.00 FEET
BOTTOM SLAB SPAN 8.67 FEET
WALL HEIGHT 8.00 FEET
TOP SLAB THICKNESS 9.00 INCHES
BOTTOM SLAB THICKNESS 8.00 INCHES
WALL THICKNESS 8.00 INCHES
DEPTH TO TOP SLAB 5.00 FEET
DEPTH TO GROUND WATER 6.00 FEET
SOIL DENSITY -WET- 120.00 LBS/CU.FT.
SOIL DENSITY -DRY- 110.00 LBS/CU.FT.
WHEEL LOADING 16000.00 LBS.
WHEEL SPACING 6.00 FEET
AXLE SPACING 14.00 FEET
SLAB EDGE NOTCH DEPTH 1.00 INCHES
CRACK LIMIT -2- 130000.00 LBS/IN.

\[
32000.00 \times 11.33 \times 9.33 = 44210.79 \text{ LBS.}
\]

\[
\left( 5.00 \times 1.75 \right)^2
\]

\[
\text{DRIE EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 = 58177.78 \text{ LBS.}
\]

\[
\text{TOP SLAB} = 11.33 \times 9.33 \times 9.00/12.00 \times 150 = 11900.00 \text{ LBS.}
\]

\[
\text{WALLS} = 38.67 \times 8.00 \times 8.00/12.00 \times 150 = 30933.33 \text{ LBS.}
\]

\[
\text{TOTAL WEIGHT} = 145221.90 \text{ LBS.}
\]

\[
\text{WEIGHT/SQ.FT.} = \frac{145221.90}{11.33 \times 9.33} = 1372.90 \text{ LBS/SQ.FT.}
\]
**JENSEN PRECAST CONCRETE**  
**BOTTOM SLAB DESIGN PROGRAM VERSION 3.00**  
**CRACK CONTROL CHECK**

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)  
ASTM C890 A-16 (AASHTO HS-20-44) LOADING  
8" FLOOR THICKNESS  
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>( W \times L^2 )</th>
<th>M = \frac{W \times L^2}{8}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12899.89 FT.LBS.</td>
</tr>
<tr>
<td></td>
<td>154798.64 IN.LBS.</td>
</tr>
</tbody>
</table>

\( F/c = 4500 \)  
\( F_y = 60000 \)

\( d = 8.00 - 1.50 - 0.3125 = 6.1875 \) INCHES

**TRY NO. 5**  
BARS AT 4 1/2" ON CENTER  
\( \sigma = \frac{As}{bd} = 0.01113 \)

\( n = \frac{E_s}{E_c} = 7.584 \)

\( k = (2an + (an)^2)^{0.5} - an = 0.335 \)

\( j = 1 - \frac{k}{3} = 0.888 \)

\( M = \frac{fs}{Asjd} = 34069.147 \)

\( D_c \) (FOR CRACK CONTROL) = 1.8125 INCHES

AREA (FOR CRACK CONTROL) = 16.3125 SQ.IN.

\[
\text{MAX. } fs = \frac{130000.00}{(D_c \times A)^{0.33}} = 42041.405 \text{ psi}
\]

\[
\text{MAX. } fs = 0.60 \times F_y = 36000.000 \text{ psi}
\]

36000.000 > 34069.147 LBS/SQ.IN. CRACK CONTROL OK /
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8' - 0"x10' - 0"x8' - 0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

<table>
<thead>
<tr>
<th>STRUCTURE LENGTH</th>
<th>10.00 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE WIDTH</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>BOTTOM SLAB SPAN</td>
<td>8.67 FEET</td>
</tr>
<tr>
<td>WALL HEIGHT</td>
<td>8.00 FEET</td>
</tr>
<tr>
<td>TOP SLAB THICKNESS</td>
<td>9.00 INCHES</td>
</tr>
<tr>
<td>BOTTOM SLAB THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>WALL THICKNESS</td>
<td>8.00 INCHES</td>
</tr>
<tr>
<td>DEPTH TO TOP SLAB</td>
<td>5.00 FEET</td>
</tr>
<tr>
<td>DEPTH TO GROUND WATER</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>SOIL DENSITY -WET-</td>
<td>120.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>SOIL DENSITY -DRY-</td>
<td>110.00 LBS/CU.FT.</td>
</tr>
<tr>
<td>WHEEL LOADING</td>
<td>16000.00 LBS.</td>
</tr>
<tr>
<td>WHEEL SPACING</td>
<td>6.00 FEET</td>
</tr>
<tr>
<td>AXLE SPACING</td>
<td>14.00 FEET</td>
</tr>
<tr>
<td>SLAB EDGE NOTCH DEPTH</td>
<td>1.00 INCHES</td>
</tr>
<tr>
<td>CRACK LIMIT -z-</td>
<td>130000.00 LBS/IN.</td>
</tr>
</tbody>
</table>

\[
\text{LIVE LOAD} = \frac{32000 \times 11.33 \times 9.33}{(5.00 \times 1.75)^2} = 44210.79 \text{ LBS.}
\]

\[
\text{DRY EARTH} = 5.00 \times 11.33 \times 9.33 \times 110.00 = 58177.78 \text{ LBS.}
\]

\[
\text{TOP SLAB} = 11.33 \times 9.33 \times 9.00/12.00 \times 150 = 11900.00 \text{ LBS.}
\]

\[
\text{WALLS} = 38.67 \times 8.00 \times 8.00/12.00 \times 150 = 30933.33 \text{ LBS.}
\]

\[
\text{TOTAL LOAD} = 145221.90 \text{ LBS.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

\[
\text{TOTAL LOAD/SQ.FT.} = \frac{145221.90}{11.33 \times 9.33} = 1372.90 \text{ LBS/SQ.FT.}
\]

\[
\text{TOTAL DEAD LOAD} = 101011.11 \text{ LBS.}
\]

\[
\text{DEAD LOAD/SQ.FT.} = \frac{101011.11}{11.33 \times 9.33} = 954.94 \text{ LBS/SQ.FT.}
\]

\[
F_c=4500. \quad \quad \quad F_y=60000.
\]

\[
\text{Md1} = \frac{W \times L^2}{8} = 8972.70 \text{ FT.LBS.}
\]

\[
\text{Mtot} = \frac{W \times L^2}{8} = 12899.89 \text{ FT.LBS.}
\]

\[
\text{107672.34 IN.LBS.}
\]

\[
\text{154798.64 IN.LBS.}
\]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C990 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

DEAD LOAD IMMEDIATE DEFLECTIONS:

d = 8.00 - 1.50 - 0.3125 = 6.1875 INCHES

NO. 5 BARS AT 4 1/2" ON CENTER As = 0.827 SQ.IN.

n = Es / Ec = 7.584

\[ Ig = \frac{\text{WIDTH} \times \text{THICK}^3}{12} = 512.000 \text{ IN.}^4 \]

\[ Sg = \frac{\text{WIDTH} \times \text{THICK}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 \times f'c^{0.5} = 503.115 psi

CRACKING MOMENT = STRESS x Sg = 64398.76 IN.LBS.

C CRACKED SECTION = 2.073 INCHES

\[ Yt = d - C \text{ CRACKED SECTION} = 4.114 \text{ INCHES} \]

\[ b \frac{C^3}{12} + \frac{C b (C/2)^2 + N As Yt^2}{12} = 141.774 \text{ IN.}^4 \]

\[ \text{Ieff} = \left(\frac{Mcrk}{M}\right)^3 I_g + \left(1 - \left(\frac{Mcrk}{M}\right)^3\right) I_crk = 220.985 \text{ IN.}^4 \]

IF Ieff > Ig Ieff = Ig

\[ DL \text{ def} = \frac{5 \text{ Wd} L^4}{384 \text{ E} L} = 0.1437 \text{ INCHES} \]
JENSEN PRECAST CONCRETE
BOTTOM SLAB DESIGN PROGRAM VERSION 3.00
DEFLECTION CALCULATION

8'-0"x10'-0"x8'-0" PANEL VAULT (BTMSLB.DAT)
ASTM C890 A-16 (AASHTO HS-20-44) LOADING
8" FLOOR THICKNESS
INSIDE FLOOR AT 9.67 TO 13.67 FEET BELOW FINISHED GRADE

LIVE LOAD IMMEDIATE DEFLECTIONS:
\[ d = 8.00 - 1.50 - 0.3125 = 6.1875 \text{ INCHES} \]

\[ \text{No. 5 Bars at 4 1/2" on center} \quad A_s = 0.827 \text{ SQ.IN.} \]
\[ n = E_s / E_c = 7.584 \]

\[ \text{Width x Thick}^3 \]
\[ I_g = \frac{\text{Width x Thick}^2}{12} = 512.000 \text{ IN.}^4 \]

\[ \text{Width x Thick}^2 \]
\[ S_g = \frac{\text{Width x Thick}^2}{6} = 128.000 \text{ IN.}^3 \]

CRACKING STRESS = 7.5 \times f_{lc}^{0.50} = 503.115 \text{ psi} 

CRACKING MOMENT = STRESS \times S_g = 64398.76 \text{ IN.LBS.} 

C CRACKED SECTION = 2.073 \text{ INCHES} 

\[ Y_t = d - C \text{ CRACKED SECTION} = 4.114 \text{ INCHES} \]

\[ \frac{b \cdot C^3}{12} + C \cdot b \cdot (C/2)^2 + N \cdot A_s \cdot Y_t^2 = 141.774 \text{ IN.}^4 \]

\[ I_{eff} = (M_{crk/M})^3 I_g + (1-(M_{crk/M})^3) I_{crk} = 168.430 \text{ IN.}^4 \]

IF \( I_{eff} \geq I_g \quad I_{eff} = I_g \)

\[ 5 \times W_{1/4} \times L^4 \]
\[ U_{def} = \frac{384 \times E I}{L^4} = 0.0825 \text{ INCHES} \]