Project Manual

FOR

Bid No.: 11-12/11 Berkeley City College Build-Out Phase 3 Project
(Project # 2335)

LOCATED AT

Berkeley City College
2050 Center Dr., Berkeley, Ca 94704

Peralta Community College District
Dr. Sadiq Ikharo, Vice Chancellor
Trent Tornabene, Project Manager
Eva Chiu, Buyer (Measure A, Capital Projects)

Bid Issued: November 10, 2011
The Peralta Community College District, Oakland, California, through the Office of Purchasing Department, is hereby requesting sealed bids for the above mentioned work.

The successful bidder (Contractor) will be required to furnish all labor, material, equipment, and supplies to complete the work. The Contractor must also pay all applicable taxes and provide required insurance, permits and bonding.

**General Bid Information**

<table>
<thead>
<tr>
<th>Bid Description</th>
<th>Berkeley City College Build-Out Phase 3 Project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bid Type</strong></td>
<td>Public Works (Prevailing Wage and Project Labor Agreement)</td>
</tr>
<tr>
<td><strong>Bid Number</strong></td>
<td>11-12/11</td>
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<tr>
<td><strong>Project Number</strong></td>
<td>(Project # 2335)</td>
</tr>
<tr>
<td><strong>Bid Issued</strong></td>
<td>November 10, 2011</td>
</tr>
<tr>
<td><strong>Department</strong></td>
<td>Capital Projects</td>
</tr>
<tr>
<td><strong>Mandatory Site Visit Date</strong></td>
<td>November 21, 2011 at 10:00 a.m.</td>
</tr>
<tr>
<td><strong>Site Visit Location</strong></td>
<td>2050 Center Street, Berkeley, CA 94704 (Lobby of Berkeley City College)</td>
</tr>
<tr>
<td><strong>Project Duration</strong></td>
<td>334 calendar days</td>
</tr>
<tr>
<td></td>
<td>This project is to be completed within the above number of calendar days from the date that the District issues a Notice to Proceed.</td>
</tr>
<tr>
<td><strong>Liquidated Damages</strong></td>
<td>$2,000 per day</td>
</tr>
<tr>
<td></td>
<td>The Contractor agrees to pay the District the above amount per calendar day in the event that the Contractor fails to complete the Contract within the Project Duration indicated above.</td>
</tr>
<tr>
<td><strong>Scheduled Publication Dates</strong></td>
<td>November 08, 2011; November 15, 2011</td>
</tr>
<tr>
<td><strong>Bid Due Date</strong></td>
<td>December 08, 2011 at 2:00 p.m.</td>
</tr>
<tr>
<td></td>
<td>Bids are opened at the bid submittal address 15 minutes after they are due. See “Instructions for Submitting Bids” later in this document.</td>
</tr>
</tbody>
</table>
### Instructions for Submitting Bids

| Submittal Address | Peralta Community College District  
Purchasing Department  
Attn: Eva Chiu  
501 5th Avenue  
Oakland, CA 94606  
(510) 466-7225 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Submittal Copies</td>
<td>One (1) Original</td>
</tr>
</tbody>
</table>
| Submittal Envelope Requirements | Bids must be sealed and have the following information clearly marked and visible on the outside of the envelope:  
  - Bid Number  
  - Name of Your Company  
  - Address  
  - Phone Number |
| Late Submittals   | Proposals received after the time and date stated above shall be returned unopened to the vendor. |

### Questions about the Bid or Requests for Information

Questions and or Requests for Information (RFI) must be submitted in writing and can be submitted by fax or email as follows:

| Primary Contact | Trent Tornabene  
Fax: 510-587-7892  
Email: ttornabene@peralta.edu |
|------------------|---------------------------------------------------------------|
| Question/RFI Due Date | November 29, 2011 at 4:00 p.m.  
Please submit questions as soon as possible. No questions regarding the specifications will be responded to after the above date. All pertinent questions will be responded to and answered in writing no later than the Response Date listed below. |
| Response Date    | December 05, 2011 by 2:00 p.m.  
All pertinent questions will be responded to via addendum faxed or emailed to all prospective bidders, and or posted at the District’s website. Bidders who did not receive a copy of the addendum should download it from the District’s website. See “How to Obtain Bid Documents” section for our web address. All addendums must be acknowledged on the bid form. |
### How to Obtain Bid Documents

Bid documents may be obtained from the location(s) indicated in the table below:

<table>
<thead>
<tr>
<th>Available</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Peralta Community College District&lt;br&gt;Purchasing Department&lt;br&gt;501 5th Avenue&lt;br&gt;Oakland, CA 94606&lt;br&gt;Monday through Friday 9:00 AM to 4:00 PM&lt;br&gt;(510) 466-7225</td>
</tr>
<tr>
<td>Yes, (available for downloading)</td>
<td>Website: <a href="http://www.peralta.edu">www.peralta.edu</a>&lt;br&gt;Click “Service Centers”, then click “Purchasing” and then click “List of Current RFPs/Bids“ to download the bid packet.</td>
</tr>
<tr>
<td>Yes, (available for purchase)</td>
<td>ARC Northern California&lt;br&gt;1700 Jefferson Street&lt;br&gt;Oakland, CA 94612&lt;br&gt;Tel. 510.287.5485 Fax 510.444.1262&lt;br&gt;<a href="http://www.e-arc.com">www.e-arc.com</a>&lt;br&gt;Email: <a href="mailto:oakland@e-arc.com">oakland@e-arc.com</a> Attn: Christina</td>
</tr>
<tr>
<td>Yes, (available for viewing)</td>
<td>Builders Exchange of Alameda&lt;br&gt;3055 Alvarado Street&lt;br&gt;San Leandro, CA 94577&lt;br&gt;Tel. 510-483-8880 Fax 510-352-1509&lt;br&gt;Email: <a href="mailto:beac@beac.com">beac@beac.com</a> Attn: Jan Sanchez</td>
</tr>
<tr>
<td>Yes, (available for viewing)</td>
<td>McGraw Hill Construction&lt;br&gt;11875 Dublin Blvd., Suite A118&lt;br&gt;Dublin, CA 94565&lt;br&gt;Tel. 925-833-9750 Fax 925-833-9754&lt;br&gt;Email: <a href="mailto:Gerry_mccarthy@mcgraw-hill.com">Gerry_mccarthy@mcgraw-hill.com</a> Attn: Gerry McCarthy</td>
</tr>
</tbody>
</table>

### Full Opportunity

The Peralta Community College District hereby affirmatively ensures that Disadvantaged Business Enterprises (DBE), Small Local Business Enterprise (SLBE) and Small Emerging Local Business Enterprise (SELBIE) shall be afforded full opportunity to submit bids in response to this notice and will not be discriminated against on the basis of race, color, national origin, ancestry, disability, gender, transgender status, political affiliation or religion in any consideration leading to the award of contract.

*No qualified disabled person shall, on the basis of disability, be excluded from participating in, be denied the benefits of, or otherwise be subjected to discrimination in any consideration leading to the award.*

Peralta Community College District reserves the right to reject any or all bids, to waive any irregularities or informalities not affected by law, to evaluate the bids submitted and to award the contract according to the proposal which best serves the interests of Peralta Community College District.

Ronald (Ron) Gerhard, Vice Chancellor of Finance & Administration
**Attachments**

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Must Be Returned with Bid</th>
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<tbody>
<tr>
<td>1</td>
<td>Instruction to Bidders</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Prevailing Wage Determination and Project Labor Agreement</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bid Form</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Subcontractor List Form</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Bid Bond</td>
<td>Yes, or a Check</td>
</tr>
<tr>
<td>6</td>
<td>Non-Collusion Affidavit</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Small Local Business Enterprise/Small Emerging Local Business Enterprise Program</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>SLBE/SELBE Self Certification Affidavit</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Vendor’s Questionnaire And Certificate By Compliance</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Environmentally Sustainable Procurement--Construction</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>Certificate Regarding Workers’ Compensation</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>Statement of Equal Employment Opportunity</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>Performance Bond</td>
<td>Required after Award</td>
</tr>
<tr>
<td>14</td>
<td>Payment Bond</td>
<td>Required after Award</td>
</tr>
<tr>
<td>15</td>
<td>Contract</td>
<td>Required after Award</td>
</tr>
<tr>
<td>16</td>
<td>Bid Protest Procedures</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>PCCD Construction Debris Reporting Requirements</td>
<td></td>
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<tr>
<td>18</td>
<td>Construction Protocol Procedures</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Final Cleaning Requirements</td>
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<tr>
<td>20</td>
<td>Post Bid Interview</td>
<td>Require after selection of Bidder</td>
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**Enclosures**

<table>
<thead>
<tr>
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<th>Title</th>
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<tbody>
<tr>
<td>A</td>
<td>Scope of Work</td>
</tr>
<tr>
<td>B</td>
<td>Construction Project Labor Agreement (dated 07-21-2009)</td>
</tr>
<tr>
<td>C</td>
<td>General Conditions (79 pages)</td>
</tr>
<tr>
<td>D</td>
<td>Specifications &amp; Drawings</td>
</tr>
</tbody>
</table>
INSTRUCTIONS TO BIDDERS

Bid Proposals:

No bid proposals shall receive consideration by the Peralta Community College District (hereinafter “District”) unless made in accordance with the following instructions:

1. **Deadline For Receipt of Proposals.** Bid proposals must be sealed and filed at the office of the Director of Purchasing located at 501 5th Avenue, Oakland, California, 94606 no later than the time specified in the invitation. The District suggests that bids be hand delivered in order to ensure their timely receipt. Any bids received after the time stated shall not be opened and shall be returned, sealed, to the bidder.

2. **Bidders Conference.** A mandatory bidders conference will be held on the date specified in the invitation, for the purpose of acquainting all prospective bidders with the bid documents. It is imperative that all prospective bidders attend this conference. Failure to attend the conference may disqualify a non-attending bidder from the bid. Following this meeting, a mandatory site review will be conducted to acquaint bidders with the project.

3. **Requests for Information.** Any questions relative to the bid should be in writing and directed to the Architect or his or her designee at the address specified for receipt of bid proposals.

4. **Bid Proposal Forms.** Bid proposals must be made on a form obtained from the District. All items on the form should be filled out. Numbers should be stated in figures, and the signatures of all individuals must be in long hand. The completed form should be without interlineations, alterations, or erasures.

5. **Execution of Forms.** Each bid must give the full business address of the bidder and must be signed by the bidder with his or her authorized signature. Bids by partnerships must furnish the full names of all partners and must be signed in the partnership name by a general partner with authority to bind the partnership in such matters. Bids by corporations must be signed with the legal name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind the corporation in this matter. The name of each person signing shall also be typed or printed below the signature. When requested by the District, satisfactory evidence of the authority of the officer signing on behalf of the corporation shall be furnished. A bidder's failure to properly sign required forms may result in rejection of the bid. All bids must include the bidder's California contractor's license number and expiration date.

6. **Bid Security.** Bid proposals should be accompanied by a cashier's check or bidder's bond for an amount not less than ten percent (10%) of the bid amount. The cashier's check or bid bond shall be made payable to the order of the District. If the bid bond accompanies the proposal, the bond shall be secured by an admitted surety company, licensed in the State of California, satisfactory to the District. The cashier's check or bond shall be given as a guarantee that the bidder will enter into the contract if awarded the work, and in the case of refusal or failure to enter into the contract within ten (10) calendar days after notification of the award of the contract, the District shall have the right to award to another bidder. If the bidder fails or refuses to timely enter into the contract, the District reserves the right to declare the bid bond forfeited and to pursue all other remedies in law or equity relating to such breach including, but not limited to, seeking recovery of damages for breach of contract. Failure to provide bid security, or bid security in the proper amount, will result in rejection of the bid.

7. **Withdrawal of Bid Proposals.** Bid proposals may be withdrawn by the bidders prior to the time fixed for the opening of bids, but may not be withdrawn for a period of forty-five (45) calendar days after the opening of bids.
8. **Addenda or Bulletins.** Any addenda or bulletins issued during the time of bidding shall form a part of the drawings and specifications issued to bidders for the preparation of their proposals and shall constitute a part of the Contract Documents. No addendum will be issued on such requests received later than five (5) calendar days before the scheduled opening of bids.

9. **Award of Contract.** The District reserves the right to reject any and all bid proposals to contract work with whomever and in whatever manner the District decides, to abandon the work entirely and to waive any informal or non-substantive irregularity as the interest of the District may require.

10. **Bonds.** The successful bidder shall be required to submit payment and performance bonds as specified in the Contract Documents. All required bonds shall be calculated on the maximum total purchase price. A bidder's failure to submit the bonds requested shall result in rejection of the bid proposal.

11. **Rejection of Bids and Award of Contract.** The District reserves the right to waive any irregularities in the bid and the right to accept or reject any and all bids, or to accept or reject any portion or combination thereof, or award on the basis of the total bid, when to do so is in its own best interest. The Contract will be awarded within forty-five (45) calendar days after opening of Bids to the lowest responsible Bidder complying with the requirements of the Contract Documents, subject to Governing Board approval. The time for awarding the Contract may be extended by the District with the consent of the lowest responsible Bidder.

12. **Execution of Contract.** The successful bidder shall, within ten (10) calendar days of notice of award of the contract, sign and deliver to the District, without exception, the executed District contract along with the bonds and certificates of insurance required by the Contract Documents. In the event the bidder to whom an award is made fails or refuses to execute the contract within ten (10) calendar days from the date of receiving notification that the contract has been awarded to the bidder, or fails to provide the required bonds and certificates, the District may declare the bidder's bid deposit or bond forfeited as damages caused by the failure of the bidder to enter into the contract, and may award the work to the next lowest responsible bidder, or may reject all bids and, at its sole discretion, call for new bids.

13. **Drawings and Specifications.** Each bidder shall be required to return to the District all drawings and specifications in an unmutilated condition and without any marks or annotations. All drawings, specifications and other documents used or prepared during the project shall be the exclusive property of District.

14. **Evidence of Responsibility.** Upon the request of the District, a bidder shall submit promptly to the District satisfactory evidence showing the bidder's financial resources, the bidder's experience in the type of work being required by the District, the bidder's organization and workforce available for the performance of the contract and any other required evidence of the bidder's qualifications to perform the proposed contract. The District may consider such evidence before making its decision awarding the proposed contract. Failure to submit evidence of a bidder's responsibility to perform the proposed contract may result in rejection of the bid.

15. **Taxes.** Taxes shall be included in the bid prices.

16. **Bid Exceptions.** The taking of bid exceptions or providing false, incomplete or unresponsive statements may result in the disqualification of the bid.

17. **Discounts.** Any discounts which the bidder desires to provide the District must be stated clearly on the bid form itself so that the District can calculate properly the net cost of the bid proposal. Offers of discounts or additional services not delineated on the bid form will not be considered by the District in the determination of the lowest responsible bidder.

18. **Quantities.** The quantities shown are approximate. The District reserves the right to increase or decrease quantities as desired.
19. **Prices.** Bidders must quote prices F.O.B. unless otherwise noted. Prices should be stated in the units specified and bidders should quote each item separately.

20. **Samples.** On request, samples of the products being bid shall be furnished to the District at no cost to the District.

21. **Special Brand Names.** In describing any item, the use of a manufacturer or special brand, except in those instances where the product is designated to match others in use on a particular public improvement either completed or in the course of completion, does not restrict bidding to that manufacturer or special brand, but is intended only to indicate quality and type of item desired. Bidders may furnish any material, product, thing or service of comparable quality or utility. If a bidder is requesting substitution of “an equal” item, the make and grade of the article on which the bid is submitted must be stated in the bid proposal and illustrations and catalogue information submitted. The District reserves the right to make all decisions on product and vendor selection.

22. **Container Costs and Delivery.** All costs for containers shall be borne by the bidder. All products shall conform to the provisions set forth in the federal, county, state and city laws for their production, handling, processing and labeling. Packages shall be so constructed to ensure safe transportation to point of delivery.

23. **Bid Negotiations.** A bid response to any specific item of this bid with terms such as “negotiable”, “will negotiate” or similar, will be considered as non-compliance with that specific term.

24. **Prevailing Law.** In the event of any conflict or ambiguity between these instructions and state or federal law or regulations, the latter shall prevail. Additionally, all equipment to be supplied or services to be performed under the bid proposal shall conform to all applicable requirements of local, state and federal law, including, but not limited to, California Labor Code Sections 1771, 1778 and 1779.

25. **Governing Law and Venue.** In the event of litigation, the bid documents, specifications and related matters shall be governed by and construed in accordance with the laws of the State of California. Venue shall be with the appropriate state or federal court located in Alameda County, California.

26. **Subcontractors.** Pursuant to the Subletting and Subcontracting Fair Practices Act, Public Contract Code Sections 4100-4114, inclusive, every bidder shall, on the enclosed form set forth:

   (a) The name, location of the place of business, and all information required on the Subcontractor List for each subcontractor who will perform work or labor or render service to the bidder in or about the work in an amount in excess of one-half (1/2) of one percent (1%) of the bidder's total bid.

   (b) The portion of the work which will be done by each subcontractor. If the bidder fails to specify a subcontractor for any portion of the work to be performed under the contract in excess of one-half (1/2) of one percent (1%) of the bidder's total bid, bidder agrees that bidder is fully qualified to and will perform that portion of the work. The successful bidder shall not, without the consent of the District, and in compliance with Public Contract Code Sections 4100 - 4114, either:

   (1) Substitute any person as subcontractor in place of the subcontractor designated in the original bid;

   (2) Permit any subcontract to be voluntarily assigned or transferred or allow the work to be performed by anyone other than the original subcontractor listed in the bid; or

   (3) Sublet or subcontract any portion of the work in excess of one-half (1/2) of one percent (1%) of the total bid as to which the bidder's original bid did not designate a subcontractor.
27. **Examination of Contract Documents and Work Site.** Before submitting a bid proposal, bidders shall examine the contract, the drawings, the specifications and other Contract Documents. Bidders shall visit the site of the proposed work and shall fully inform themselves of all conditions in and about the work site, the building or buildings, if any, and any work that may have been done thereon. However, no bidder shall visit the site without prior authorization. All bidders are requested to contact the Physical Plant Department or designee for coordination of site visits. Submission of a bid proposal constitutes acceptance of the terms of this provision.

28. **Form of Contract.** The bidder selected by the District will be required to execute, without exception, a contract included in the bidding package. The contract and other documents are subject to the approval of the District and its legal counsel.

29. **Licenses.** Each bidder, and their subcontractors, if any, must possess all appropriate and required licenses or other permits to perform the work as identified in contract documents. Upon request, each bidder shall furnish the District with evidence demonstrating possession of the required licenses or permits. Failure to submit such evidence to the District’s satisfaction may result in rejection of the bid.

30. **Denial of Right to Bid.** Contractors or subcontractors who have violated state law governing public works shall be denied the right to bid on this public work contract as set forth in California Labor Code Section 1777.7.

31. **Bidders Interested in More Than One Bid.** No person, firm, or corporation shall be allowed to make, or file, or be interested in more than one bid unless alternate bids are specifically called for. A person, firm, or corporation that has submitted a sub-proposal to a bidder, or that has quoted prices of materials to a bidder, is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders or make a prime proposal.

32. **Contractors State License Board.** Contractors are required by law to be licensed and regulated by the Contractors State License Board. Any questions concerning a contractor may be referred to the Registrar, Contractors State License Board, P. O. Box 26000, Sacramento, California 95826.

33. **Additive and Deductive Items: Method of Determining Lowest Bid.** Pursuant to Public Contract Code section 20103.8, should this bid solicitation include additive and/or deductive items, the checked [X] method shall be used to determine the lowest bid:

   ______ (a) The lowest bid shall be the lowest bid price on the base contract without consideration of the prices on the additive or deductive items.

   ______ (b) The lowest bid shall be the lowest total of the bid prices on the base contract and those additive or deductive items that were specifically identified in the bid solicitation [see bid proposal form] as being used for the purpose of determining the lowest bid price.

   ______ (c) The lowest bid shall be the lowest total of the bid prices on the base contract and those additive or deductive items taken in order from a specifically identified list of those items, depending upon available funds as identified in the solicitation.

   ______ (d) The lowest bid shall be determined in a manner that prevents any information that would identify any of the bidders from being revealed to the public entity before the ranking of all bidders from lowest to highest has been determined.

If no method is checked, sub-paragraph (a) shall be used to determine the lowest bid.

Notwithstanding the method used by the District to determine the lowest responsible bidder, the District retains the right to add to or deduct from the contract any of the additive or deductive items included in the bid solicitation.
Peralta Community College District

**Prevailing Wage Determination**

The Governing Board has obtained from the Director of the Department of Industrial Relations, the general prevailing rate of per diem wages in the locality in which the work is to be performed for each craft, classifications or type of worker needed to execute the contract, including employer payments for health and welfare, pension, vacation, apprenticeship and similar purposes. Copies of these prevailing rates are Internet accessible at [http://www.dir.ca.gov/DLSR/statistics_research.html](http://www.dir.ca.gov/DLSR/statistics_research.html) or shall be made available at the District's Purchasing office to any interested party upon request during regular business hours. For this bid, wage determination 2010-2 shall be used.

The schedule of per diem wages is based upon a working day of eight hours. The rate for holiday and overtime work shall be at least time and one half.

It shall be mandatory upon the contractor to whom the contract is awarded, and upon any subcontractor under him, to pay not less than the specified rates to all workers employed by them in the execution of the contract. It is the contractor's responsibility to determine any rate change, which may have or will occur during the intervening period between each issuance of published rates by the Director of Industrial Relations.

The District’s Prevailing Wage Manager for this project is:

Mr. Alex Dobrin  
PADILLA ASSOCIATES

**Project Labor Agreement**

The Peralta Community College District has entered into a Project Labor Agreement (PLA) for all its Public Works construction projects, which requires that the successful General Contractor, and its field Subcontractors to sign the applicable Letter of Assent (LOA). The complete text including the terms and conditions, and the LOA, are included in the bid package for review by all Contractors bidding on this project. Contractors contemplating bidding on this project are strongly encouraged to review the complete PLA documents, but should at minimum be aware of the following:

- No work stoppages, strikes, sympathy strikes, slowdowns or lockouts are allowed during the execution of the work.
- There are provisions for alternative dispute resolution, depending on affected crafts.
- Based on a formula and certain basic requirements, a Contractor may use up to five (5) “core” workers, but all workers must be dispatched through the applicable union halls.
- There are goals for the utilization of local workers, utilizing the normal hiring hall procedures for dispatch.

A Contractor is not required to become signatory to a union to work on a project covered by the PLA, but is required to sign a Letter of Assent (LOA) agreeing to work under the terms of the PLA, on a project by project basis. Workers are not required to join a union but must be dispatched through a union hiring hall and must pay union initiation fees and dues when working on a project covered by the PLA.

The District’s PLA Program Manager for this project is:

Mr. Jake Sloan  
Davillier-Sloan—Labor Management Consultants

Please direct all PLA questions to the Primary Contact listed in the “Questions about the Bid or Requests for Information” section of the Invitation For Bid, and the Primary Contact will forward your question to the PLA Program Manager, to be answered as part of the formal Addendum for this bid.
The undersigned having carefully examined the location of the proposed work, the local conditions of the place where the work is to be done, the Invitation for Bid, the General Conditions and Instructions to Bidders, the Peralta Community College District (District) Contract, the Specifications and all of the contract documents for this project, and accurately completed the Vendor’s Questionnaire, proposes to perform the contract, including all of its component parts, and to furnish any and all required labor, materials, equipment, insurance, permit, bonding, transportation and services required for the construction of the project in strict conformity with the plans and specifications prepared, including any Addenda, within the time specified for the lump sum price of (including all taxes):

**Total Bid Price**

<table>
<thead>
<tr>
<th>Total lump sum bid price (including all allowances) of</th>
</tr>
</thead>
<tbody>
<tr>
<td>$______________________  (Numeric amount)</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>______________________________________________________ (Written amount)</td>
</tr>
</tbody>
</table>

Written amount prevails if any discrepancy exists.

**Agreement Terms**

1. If awarded the contract, the undersigned hereby agrees to sign said contract and furnish the necessary Payment Bond, Performance Bond, and Certificates of Insurance within 10 calendar days after the Notice of the Award of this contract and agrees to commence construction within 10 calendar days after the Notice to Proceed is issued by the District.

2. The undersigned has checked carefully all the above figures and understands that the District will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

3. Peralta Community College District reserves the right to reject any or all bids, to waive any irregularities or informalities not affected by law, to evaluate the bids submitted and to award the contract according to the proposal which best serves the interests of the District.

Bidder Name: ________________________________  Date: ___________________
Agreement Terms Continued

4. All pages of this Bid Form must be completed and signed in ink. The bid will be awarded to the lowest responsive, responsible bidder.

Bid Bond
Each bid shall be accompanied by a cashier's check payable to the Peralta Community College District, or a bidder's bond executed by an admitted surety insurer, licensed to do business in the State of California as a surety, made payable to the Peralta Community College District in an amount not less than ten percent (10%) of the maximum amount of the bid. The check or bid bond shall be given as a guarantee that the bidder to whom the contract is awarded shall execute the contract documents and shall provide the required payment and performance bonds as specified therein within ten (10) days after the notification of the award of the contract.

Amount – Bidders **must** enclose an amount of not less than 10 percent of the entire bid as either:

- _____ Cashier's Check: Check Number: __________________________
  Issuing Bank: ____________________________________
  Amount: $_______________________________________

- _____ Bidder’s Bond: Surety Company: __________________________

Addendum Acknowledgement
The following addendum(s) are acknowledged in this bid: _________________________

Bidder Information and Signature

Contractor Name: ____________________ Title: ___________________________
Contact Person (print name): _______________________________________________
Address: ________________________________________________________________
Telephone: __________________________ Fax: _____________________________
Contractor License #: _________________ Expiration Date: ___________________
Authorized Signature:________________________________  Date: _______________
**SUBCONTRACTOR LIST FORM**

*Bid No.: 11-12/11 Berkeley City College Build-Out Phase 3 Project (Project # 2335)*

**No Subcontractors**

_____ Check here and skip to the “Signature” section if you have no subcontractors who will perform contract work in an amount in excess of 1/2 of 1 percent of the total contract price.

**Subcontractors**

In accordance with the provisions of Public Contract Code section 4104, each bidder shall list below the name and location of place of business for each sub-contractor who will perform a portion of the contract work in an amount in excess of 1/2 of 1 percent of the total contract price. In each such instance, the nature of the work to be sublet shall be described. **All columns must be completed.**

<table>
<thead>
<tr>
<th>Subcontractor and Location</th>
<th>Type of Work or Trade Classification</th>
<th>Amount</th>
<th>License No.</th>
<th>Type of Business* (check one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>SLBE ___ SELBE ___ Other _____</td>
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*See the “Small Local Business Enterprise (SLBE)/Small Emerging Local Business Enterprise Program (SELBE)” document in this bid package for definitions and requirements.

**Signature**

Contractor Name: ________________________ Title: ______________________________

Authorized Signature: ________________________ Date: ________________
BID BOND

Know all men by these presents, that we _____________________________________________ as principal, and ________________________________, as surety are firmly bound unto the Peralta Community College District (hereinafter "District"), in the penal sum of TEN PERCENT (10%) of the Total Amount of the Bid of the Principal submitted to the said DISTRICT for the work described below for the payment of which sum in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by the presents.

The condition of this obligation is such that whereas the Principal has submitted the accompanying bid dated ________________________________, for ________________________________________________________, ________________________________________________________,

Now, therefore, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or if no period be specified within sixty (60) calendar days after said opening; and if the Principal is awarded the contract and shall within the period specified thereafter, or, if no period be specified, within five (5) calendar days after the prescribed forms are presented to him or her for signature, enter into a written contract with DISTRICT, in accordance with the bid as accepted or fail to give bond with good and sufficient surety or sureties as may be required, for the faithful performance and proper fulfillment of such contract and for the payment for labor and materials used for the performance of the work of installation under the contract, or in the event of the withdrawal of said bid within the period specified or the failure to enter into such contract and give such bonds within the time specified, if the Principal shall pay DISTRICT the difference between the amount specified in said bid and the amount for which DISTRICT may procure the required work and/or supplies, if the latter amount be in excess of the former, together with all costs incurred by DISTRICT in again calling for bids, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the term of the contract on the call for bids, or to the work to be performed thereunder, or the specifications accompanying the same shall in anywise affect its obligation under this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said contract or the call for bids, or to the work, or to the specifications.

In the event suit is brought upon this bond by DISTRICT and judgment is recovered, the Surety shall pay all costs incurred by DISTRICT in such suit, including a reasonable attorney's fee to be fixed by the court.

In witness whereof the above-bounded Parties have executed this instrument under their several seals this day of ________________________________, the name and corporate seal of each corporate Party being hereunder affixed and these presents duly signed by its undersigned representative, pursuant to the authority of its governing body.

(Corporate Seal)

Principal

By ________________________________

Title ________________________________

(Corporate Seal)

Surety

Attach Attorney-In-Fact Certificate

By ________________________________

Title ________________________________

(To be signed by Principal and Surety and Acknowledgment And Notary Seal to be Attached.)
State of California, County of _______________

(Name) ____________________________________________, being first duly sworn, deposes and says that he or she is (title)______________________ of (company)____________________________ the party 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 the 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; 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 the 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 public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her 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.

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

Date: ____________________ Signature: ____________________________________________
The District is committed to ensure equal opportunity and equitable treatment in awarding and managing its public contracts and has established an annual overall program goal of twenty-five percent participation for small local businesses. To facilitate opportunities for small local business, the District will use a maximum 5% bidding preference for SLBE and SELBE firms. The preference is only used for computation purposes to determine the winning bidder, the contract is awarded at the actual bid amount. Please review the following guidelines to see if your firm qualifies for the preference.

The 5% bidding preference for an SLBE and SELBE firms are for construction, personal and professional services, goods and services, maintenance, repairs, and operations where responsibility and quality are equal. The preference will be 5% of the bid amount of the lowest responsive responsible bidder, and may not exceed $50,000.00 for any bid.

A Non-SLBE/SELBE Prime Contractor who utilizes 25% of total bid amount, with SLBE or SELBE subcontractors (who meet the District’s Definition of an SLBE and SELBE), can also receive a maximum of 4% bidding preference, not to exceed $50,000.00 for any bid. (See below Subcontractors section.)

Definitions:

**SLBE**: A Small Local Business Enterprise is a business that has not exceeded gross annual revenue of 8.5 million dollars for a construction firm, or 6 million dollars for goods and non-professional services firm, or 3 million dollars for architecture, engineering and professional services firm, for the past three consecutive years and meets the below geographic location requirements.

**SELBE**: A Small Local Emerging Business Enterprise is a business that has not exceeded gross annual revenue of 1.5 million dollars for the past three consecutive years and meets the below geographic location requirements.

**Commercially Useful Function**: Shall mean a business is directly responsible for providing the materials, equipment, supplies or services to the District as required by the contract solicitation. The business performs work that is normal for its business services and carries out its obligation by actually performing, managing, or supervising the work involved. The business is not Commercially Useful if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of SLBE or SELBE participation.

**Geographic Location Requirements**:

- The business must be located at a fixed, established commercial address located in the District’s market area of Albany, Alameda, Berkeley, Emeryville, Oakland, or Piedmont, and not a temporary or movable office, a post office box, or a telephone answering service.

- If the business has an office outside of the District’s market area as well as an office within the market area, the office within the District’s market area must be staffed on a full time permanent basis with someone employed by the business.

- If requested, the business that has an office outside of the District’s market area must provide proof of one or more past contracts citing the business address (such as contracts to perform work, to rent space or equipment, or for other business services) was within the District’s market area at least one (1) year prior to the date of contract award. The one-year requirement does not apply to businesses whose sole establishment is located within the District’s market area.
Subcontractors:

Non-SLBE/SELBE Prime Contractors who use subcontractors, who meet the district definitions of SLBE and SELBE, may receive a maximum of 4% bidding preference if the following conditions are met:

1. 25% of total bid amount is with Subcontractors who meet the District's definition of an SLBE and SELBE. The Prime Contractor must list each Subcontractor on the Subcontractor List form, clearly identifying the SLBE and SELBE status and the Dollar Amount of work each subcontractor will perform.

2. The Subcontractors must provide a Commercially Useful Function.

3. The Prime Contractor must maintain the Subcontractor percentages (based on the quoted dollar amounts) indicated in the Subcontractor List form at the time the Contract is awarded and throughout the term of the Contract.

4. The Prime Contractor must fill out sign the SLBE/SELBE Self Certification Affidavit and return it with the bid documents, and 48 hours after the bid opening the Prime Contractor must submit signed SLBE/SELBE Self Certification Affidavit from each of the SLBE and SELBE subcontractors listed in the Subcontractor form. The Subcontractor must agree to provide the requested documentation to verify the SLBE/SEBLE status.

5. No Substitutions can be made to the SLBE and SELBE subcontractor without the prior written approval of the District. The District will approve a subcontractor substitution on the following conditions:
   a. A written statement from the subcontractor agreeing to the substitution.
   b. When the subcontractor has been given a reasonable opportunity to execute the subcontract, yet fails to, or refuses to execute the subcontract, or refuses to satisfy contractual obligations.
   c. When the subcontractor becomes insolvent.
   d. When the District determines the work performed by the subcontractor is not in accordance with the contact agreement, or the subcontractor is substantially and unduly delaying or disrupting the progress of work.

Firms that meet the District criteria for an SLBE and SELBE can complete the below self-certification affidavit signed under penalty of perjury. Firms claiming SLBE and SELBE status in the self-certification affidavit will be required to submit proof of residency and revenue 48 hours after bid opening. Such proof shall consist of a copy of a contract to perform work, to rent space or equipment, or for other business services, executed from their local address, and the firm’s tax returns for the past three consecutive years.
Peralta Community College District

SLBE/ SELBE SELF CERTIFICATION AFFIDAVIT

I certify under penalty of perjury that my firm meets the District's definition of a Small Local Business Enterprise or a Small Emerging Local Business Enterprise and resides in the geographic location of the District’s market area and qualifies for the below preference. The maximum preference will be five percent of the bid amount of the lowest responsible bidder, and may not exceed $50,000.00 for any bid. The preference is only used for computation purposes to determine the winning bidder; the contract is awarded at the actual bid amount. The District's Contract Compliance Office will determine whether this requirement has been fulfilled. Bidders may only claim one of the below preferences.

<table>
<thead>
<tr>
<th>Certification Status</th>
<th>Preference</th>
<th>Preference Claimed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLBE</td>
<td>5% of lowest bid</td>
<td></td>
</tr>
<tr>
<td>SELBE</td>
<td>5% of lowest bid</td>
<td></td>
</tr>
<tr>
<td>25% of Subcontractors are</td>
<td>4% of lowest bid</td>
<td></td>
</tr>
<tr>
<td>SLBE/SELBE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Applicable</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

1. I acknowledge and am hereby advised that upon a finding of perjury with the claims made in this self certification affidavit the District is authorized to impose penalties which may include any of the following:

   a) Refusal to certify the award of a contract
   b) Suspension of a contract
   c) Withholding of funds
   d) Revision of a contract for material breach of contract
   e) Disqualification of my firm from eligibility for providing goods and services to the Peralta Community College District for a period not to exceed five (5) years

2. I acknowledge and have been advised and hereby agree that my firm will be required to provide proof (and if applicable, my SLBE and SELBE Subcontractors will provide proof) of the status claimed on this self-certification affidavit 48 hours after bid opening. Proof of status claimed includes tax returns from the previous three years and past contracts to determine the size and geographical location of my firm.

3. I declare that the above provisions are attested to under penalty of perjury under the laws of the State of California.

Bid Number: _________________ Bid Name: ________________________________

Signed ___________________________ Date ___________________________

Printed or typed name ___________________________ Title ___________________________

Name of Company ___________________________ Telephone ___________________________ Fax ___________________________

Attachment 8
The following information is requested for information purposes only. It will not be used in determining bid award.

Date

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Telephone</th>
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<td></td>
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</tbody>
</table>

Business Fax  Email Address  Website

<table>
<thead>
<tr>
<th>Street Address</th>
<th>City/State</th>
<th>Zip Code+ 4®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

Mailing Address  City/State  Zip Code + 4®

<table>
<thead>
<tr>
<th>Type of Organization (Check one)</th>
<th>Individual ☐</th>
<th>Partnership ☐</th>
<th>Corporation ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Owner(s)</td>
<td></td>
<td>State of Incorporation (if applicable)</td>
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</table>

Name of Partners  (I) Indicate (G) General (L) Limited

Local Address

Amount of Annual Business

The District is identifying vendor ownership as follows:

<table>
<thead>
<tr>
<th></th>
<th>Asian-American</th>
<th>Black or African-American</th>
<th>Latino other than Mexican-American</th>
<th>Mexican or Mexican-American</th>
<th>Native American</th>
<th>Pacific Islander, other Asian</th>
<th>White</th>
<th>Disabled</th>
<th>Veteran</th>
<th>Women</th>
<th>Subcontractor</th>
<th>Employee</th>
<th>Apprentice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total #</td>
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<td>% of assets</td>
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</tbody>
</table>

The District is identifying vendor workforce as follows:

<table>
<thead>
<tr>
<th></th>
<th>Asian-American</th>
<th>Black or African-American</th>
<th>Latino other than Mexican-American</th>
<th>Mexican or Mexican-American</th>
<th>Native American</th>
<th>Pacific Islander, other Asian</th>
<th>White</th>
<th>Disabled</th>
<th>Veteran</th>
<th>Women</th>
<th>Subcontractor</th>
<th>Employee</th>
<th>Apprentice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total #</td>
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<td>% of assets</td>
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</table>
Explain whether current workforce is racially and ethnically proportionate to the area from which the workforce is drawn (national, state, or local). Use separate sheet if necessary.

<table>
<thead>
<tr>
<th>Main Headquarters Office(s)</th>
<th>Address/Telephone</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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<tr>
<td>Total # of Employees _____</td>
<td></td>
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</tbody>
</table>

Detail steps taken by vendor since inception to assure non-discriminatory recruiting, hiring, and apprenticeship, placement, promotion, demotion, layoff and termination practices. Use separate sheet if necessary.

What are you interested in providing the District? (e.g., construction, consulting, goods or services).

<table>
<thead>
<tr>
<th>Local Office(s) Address/Telephone</th>
<th>(List all as applicable)</th>
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<tbody>
<tr>
<td></td>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
</tr>
<tr>
<td>Total # of Employees _____</td>
<td></td>
</tr>
</tbody>
</table>

Name and list residential zip code for each employee, subcontractor, or apprentice for awarded contract

(Please use the Zip+4®)
Use separate sheet as necessary

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<td>5.</td>
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<td></td>
<td>6.</td>
</tr>
</tbody>
</table>
It is the policy of the Peralta Community College District (Board Policy 2.40, Environmental Sustainability), to purchase products or services that help to minimize the adverse effects on human health and the environment, when compared to other products and services that serve the same purpose with comparable efficacy. The District recognizes that environmentally responsible purchasing will help create and sustain markets for environmentally sustainable products, and is committed to encouraging the procurement of products with high recycled content, FSC certified lumber, Energy Star rated equipment, low and no VOC paints, low-toxicity cleaning supplies and Green Seal approved chemicals, and will promote contracting with businesses in close proximity, to reduce our carbon footprint and to promote the District's SLBE program.

For Operation and Construction services the District is committed to:

- **Utilizing LEED** (Leadership in Energy and Environmental Design) or equivalent certification criteria as follows:
  - All new building projects shall qualify for *at least* LEED NC Silver certification and shall strive for higher levels of certification, especially where overall long-term building operations, student learning, and worker productivity savings can be realized through doing so.
  - All renovation projects over 10,000 square feet shall meet basic “LEED Existing Building” certification standards.
- **Maximizing energy efficiency** throughout the District, in particular, heating, cooling, lighting, information technology, mechanical, and water systems. It is the goal of the District to reduce dramatically our energy consumption for existing buildings and for all new buildings to exceed the State of California Building Code Title 24 energy efficiency requirements *by no less than 35%*.
- **Reduction of water consumption** for all uses, including for irrigation and domestic purposes.
- **Waste source reduction** and the re-use of materials. The District encourages all contractors to re-use and recycle as much construction and demolition debris as possible, and only when it is not feasible to do so, dispose of it in a landfill. All contractors must adhere to the District’s Construction Debris Reporting Requirements.
- **Sustainable landscaping and grounds design**, construction and maintenance practices which promote integrated pest management and use of drought tolerant, fire safe, and native vegetation types.

All public work projects must adhere to the District Environmental Sustainability Policy 2.40. The formal policy is available for download at [www.peralta.edu](http://www.peralta.edu); click on the District Services Center tab and then Purchasing to view the environmentally sustainable purchasing policy.

**Signature**

I acknowledge and agree to adhere to the District’s Environmental Sustainability policy.

Contractor Name: _______________________  Title: _______________________________

Authorized Signature: _______________________  Date: ________________
CERTIFICATE REGARDING WORKERS’ COMPENSATION

Labor Code Section 3700 in relevant part provides:

"Every employer except the State shall secure the payment of compensation in one or more of the following ways:

(a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this State.

(b) Be securing from the Director of Industrial Relations a certificate of consent to self-insure, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his employees."

I am 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 I will comply with such provisions before commencing the performance of the work of this Contract and will require all subcontractors to do the same.

___________________________________________
Contractor

By: _______________________________________

(In accordance with Article 5 [commencing at Section 1860], Chapter 1, Part 7, Division 2 of the Labor Code, the above certificate must be signed and filed with the awarding body prior to performing any work under this Contract.)
Peralta Community College District

Statement of Equal Employment Opportunity

I hereby certify that __________________________________________
(Legal Name of Vendor/Consultant/Contractor)

Will not discriminate against any employee or applicant for employment because of race, creed, sex, color or national origin and shall insure compliance with all provisions of Executive Order No. 11246 (as amended by Executive order No.11375).

The vendor’s questionnaire requests information for record keeping purposes only. The information requested will not be used as a basis for contract award.

However, after a contract is awarded to your company, the District requires your company to report:

a. Actual racial, gender and residential workforce composition of your company for the contract work.
b. Actual racial, gender and residential workforce composition of subcontractors for the contract work.
c. Number of apprenticeship workforce for the contract work.

This report must be submitted to the District Department of General Services on a quarterly basis.

I declare under penalty of perjury under the laws of the state of California that the information I have provided herein is true and correct and is of my own personal knowledge.

BY: __________________________________________
Date

Print Name
PERFORMANCE BOND

Know all men by these presents, that

WHEREAS, Peralta Community College District (hereinafter DISTRICT), at a regular Business Meeting on _______________________, have awarded to ________________________________, hereinafter designated as the Principal, a contract for _____________________________________

_____________________________________________________________________________________________

_____________________________________________________________________________________________

_____________________________________________________________________________________________

_____________________________________________________________________________________________

and

_____________________________________________________________________________________________

_____________________________________________________________________________________________

_____________________________________________________________________________________________

_____________________________________________________________________________________

WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract;

NOW, THEREFORE, We, the Principal and ___________________________________________________________________________________________, as Surety, are held and firmly bound unto the Peralta Community College District, hereinafter called the DISTRICT, in the penal sum of ___________________________________________________________________________________________, DOLLARS ($ ______________________ ) lawful money of the United States for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

The condition of the obligation is such, that if the above bounden Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the said contract and any alteration thereof made as therein provided, on his or their parts to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless DISTRICT, its officers and agents, as therein stipulated, then this obligation shall become null and void. Otherwise it shall be and remain in full force, virtue, and effect.

And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the specifications accompanying the same shall in any wise affect its obligations on this bond, it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

In the event suit is brought upon this bond by the District and judgment is recovered, Surety shall pay all costs incurred by the District in such suit, including reasonable attorney’s fees to be fixed by the court.

Surety further agrees that death of the Contractor shall not relieve the surety of its obligations hereunder.

In witness whereof, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the Principal and Surety above named on the ________ day of ______________________, 20__.
(To be signed by Principal and Surety and acknowledgment and notary seal to be attached.)

Principal

By ________________________________

Title ________________________________

Surety

By ________________________________

Title ________________________________

The above bond is accepted and approved this ______ day of ______________________, 20__,

By: ________________________________
   Authorized District Signature

Required attachment: County Clerk’s Certificate pursuant to CCP section 995.640 or confirming information from Department of Insurance website within seven days before contract submittal.
PAYMENT BOND

Know all men by these presents: that

WHEREAS, Peralta Community College District (hereinafter “DISTRICT”) and

hereinafter designated as the "Principal", have entered into a contract for the furnishing of all materials, labor services and transportation necessary, convenient, and proper which said Agreement dated and all of the contract documents attached to or forming a part of said Agreement, are hereby referred to and made a part hereof, and

WHEREAS, pursuant to law, the Principal is required before entering upon the performance of the work, to file a good and sufficient bond with the body by whom the contract is awarded, Sections 3247 to 3252, inclusive, of the Civil Code of California.

NOW, therefore, these presents witnesseth:
That the said Principal and the undersigned ____________________________________________

____________________________, as corporate surety, are held and firmly bound unto all laborers, materialmen, and other persons referred to in said statutes in the sum of ______________________

_________________________________________________ DOLLARS ($ _________________), lawful money of the United States, by the terms of said contract, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, or assigns, jointly and severally by these presents.

The condition of this obligation is that if the said Principal or any of his or its subcontractors, or the heirs, executors, administrators, successors, or assigns of any, all or either of them shall fail to pay for any materials, provision, provendor or other supplies or teams used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor hereon of any kind, or for amounts due under the Unemployment Insurance Act with respect to such work or labor, or for any of the persons named in Section 3181 of the California Civil Code, or for any amounts required to be deducted, withheld, and paid over to the Franchise Tax Board from the wages of employees of the Principal or any of his or its subcontractors pursuant to Section 18806 of the Revenue and Taxation Code with respect to such work or labor, that said Surety will pay the same in amount not exceeding the amount hereinabove set forth, and also, in case suit is brought upon this bond, will pay reasonable attorneys’ fees to be awarded and fixed by the court and to be taxed as costs and to be included in the judgment therein rendered.

It is hereby expressly stipulated and agreed that this bond shall inure to the benefit of any and all persons, companies and corporations entitled to file claims under Section 3181 of the California Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this bond.

Should the condition of this bond be fully performed, then this obligation shall become null and void, otherwise it shall be and remain in full force and effect.

And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of said contract or the specifications accompanying the same shall in any manner affect its obligations on this bond, and it does hereby waive notice of any such change, extension, alteration, or addition.

In witness whereof, this instrument has been duly executed by the Principal and Surety this ________________ day of ____________________.

(To be signed by Principal and Surety and acknowledgment and notary seal to be attached.)

PRINCIPAL
By _____________________________________________
TITLE __________________________________________

SURETY
By _____________________________________________
TITLE __________________________________________

The above bond is accepted and approved this

__________________________________________ day of _______________, 20__.

By ______________________________________________
Authorized District Signature

Required attachment: County Clerk’s Certificate pursuant to CCP section 995.640 or confirming information from Department of Insurance website within seven days before contract submittal
CONTRACT

THIS CONTRACT is made by and between the Peralta Community College District, hereinafter called the District, and ______________________________, hereinafter called the Contractor.

The District and the Contractor hereby agree as follows:

1. Description of Work

The Contractor agrees to furnish all labor, materials, equipment, plant, tools, supervision, appurtenances, and services, including transportation and utilities, required to perform and complete

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

The Contract Documents consist of the Contract, any Amendment to Contract, Technical Specifications and Drawings, Supplementary General Conditions, General Conditions, Instructions to Bidders, Notice Inviting Bids, Bid Form, all addenda, completed bond and insurance forms, completed Bidder's Questionnaire, and

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

All Contract Documents are intended to coordinate so that any work called for in one document and not mentioned in another document is to be executed as if mentioned in all documents.

2. Compensation

As full compensation for the Contractor's complete performance of the work in this Contract, the District agrees to pay the Contractor, and the Contractor agrees to accept the sum of ________________ which shall be paid to him according to the General Conditions Article on "Payments".

3. Prevailing Wages

As required by Labor Code Section 1773.2, the District has in its office the general prevailing rate of per diem wages for workers employed on public works as determined by the Director of Industrial Relations. This document shall be available to any interested party on request during regular business hours and shall be posted at the job site by the Contractor.

4. Time for Completion

The starting date of the Contract shall be the day listed by the District in the Notice to Proceed and the Contractor shall fully complete all the work before the expiration of ___________ calendar days from said starting date.

Time is of the essence in the performance of this Contract.

Liquidated damages for Contractor's failure to complete the Contract within the time fixed for completion are established in the amount of ___________ per calendar day.
5. **Contractors' State License Board**

Contractors are required by law to be licensed and regulated by the Contractors' State License Board. Any questions concerning a contractor may be referred to the Registrar, Contractors' State License Board, P. O. Box 26000, Sacramento, California 95826.

IN WITNESS WHEREOF, the parties to these present have set their hands hereto on the day and year written below.

___________________________________  _____________________________________
District                                      Contractor

Resolution No. ____________  (Contractor License No. and Expiration Date)

___________________________________
Date

By  ________________
Individual Signature

___________________________________
Title

___________________________________
Date

Approved As to Form

By: _____________________________  For: _______________________________
   Legal Counsel                   Corporation or Partnership

___________________________________
Date

If Corporation, Seal Below.
Peralta Community College District

Bid Protest Procedures

Any Bidder submitting a Bid Proposal to the District may file a protest provided that each and all of the following are complied with:

(i) The bid protest is relevant and in writing;

(ii) The bid protest is filed and received by the District's Purchasing Manager not more than five (5) calendar days following the date of the bid opening;

(iii) The written bid protest sets forth, in detail, all grounds for the bid protest, including without limitation all facts, supporting documentation, legal authorities and argument in support of the grounds for the bid protest; any matters not set forth in the written bid protest shall be deemed waived. All factual contentions must be supported by competent, admissible and creditable evidence.

Any bid protest not conforming to the foregoing shall be rejected by the District without recourse.

Provided that a bid protest is filed in strict conformity with the foregoing, the District's Vice Chancellor of General Services or such individual(s) as may be designated by him/her, shall review and evaluate the basis of the bid protest and make a determination.

If the determination is unacceptable to the bid protestor, the Chancellor shall review and evaluate the basis of the bid protest and make a secondary determination.

If the bid protestor chooses to appeal the Chancellor's determination, the District's Board of Trustees will render a final determination and disposition of a bid protest by taking action to adopt, modify or reject the disposition of a bid protest. Action by the District's Board of Trustees relative to a bid protest shall be final and not subject to appeal or reconsideration by the District, any employee or officer of the District or the District's Board of Trustees.

In the event that any legal or equitable proceedings are instituted and the District is named as a party thereto, the prevailing party(ies) shall recover from the other party(ies), as cost, all attorneys' fees and cost incurred in connection with any such proceeding, including any appeal arising therefrom.
The District is committed to Environmental Sustainability as a matter of public policy and to the
greatest extent possible reducing its ecological foot print. The District encourages all contractors to
re-use and recycle as much construction and demolition debris as possible, and only when it is not
feasible to do so, dispose of it in a landfill. Per State Law AB75, on an annual basis the District is
required to report all re-use, recycle, and garbage disposal tonnage to the State of California.

As a condition for the completion of the construction project, the contractor must report all re-use,
recycling, and disposal of construction materials at the completion of the project (or annually by
January 31st of the following year if the project’s completion is more than one calendar year). The
contractor may use the below form to report to the District all construction debris off-hauled from the
District’s construction site, or may submit the below required information on the contractor’s
letterhead. This form must be submitted by January 31st to the District at: Peralta Community
College District, Department of General Services, 333 East 8th Street, Oakland, CA, 94606, Attention
Facilities Project Coordinator

**Construction Debris Reporting for:** January 1, 20____ to December 31, 20____.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Re-use (Tons)</th>
<th>Recycle (Tons)</th>
<th>Garbage Disposal (Tons)</th>
<th>Proposed Destination</th>
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</thead>
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<td>Example: Concrete</td>
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<td>45</td>
<td></td>
<td>ABC Concrete Recycling Company</td>
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</table>

**Totals**

I declare under penalty of perjury under the laws of the State of California that the above information
is true and correct.

Signed  
Date

Printed or Typed Name  
Title

Name of Contractor  
Telephone  
Fax

Attachment 17
Construction Protocol Procedures

**Director of Physical Plant:**
1. Notify College Business Officer (in writing) at least 2 weeks in advance of any work to be done on campus, including dates, times, locations of work; provide name and cell phone # of project manager.

2. Receive from College Business Officer (in writing) a list of concerns, issues, problems that need to be addressed/taken into account as well as a list of faculty members and departments that will be affected by affected by each project.

3. Collect/withhold an indemnity amount from the contractor for unanticipated cleaning costs, repairs, and replacement of any furniture, equipment, tools, etc. lost, damaged, or destroyed as a result of construction.

4. Direct the Project Manager to personally meet with the College Business Officer and faculty involved/affected with each project and sign-off on plan of operations.

5. Notify the faculty (in writing) that it is not their responsibility to clean, store, remove, replace, any equipment, furniture, tools, etc.

**College Business Officer:**
1. Notify the faculty (in Writing) of any construction projects (including dates, times, locations) that will take place in their area.

2. Meet with the faculty to gather their concerns, issues, problems, and convey those (in writing) to the Vice Chancellor of General Services and the Project Manager; also convene a meeting with the Project Manager to convey these concerns in person.

3. Notify (in writing) the appropriate Dean(s) and the VP of Instruction of any needs to find alternate space for storage, equipment, furniture, tools, classrooms.

4. Notify (in writing) Locals 790 and 39 of the impending project and the need to remove, store, replace, protect, and clean as well as whatever is needed in the way of establishing alternate workspaces.

5. Convey all of the above information to the Director of Physical Plant and the Project Manager.

**Project Manager:**
1. Needs to meet on campus, on site, with the affected faculty to be sure all of the college’s concerns have been addressed, understood, and agreed to in a written plan of operations; the written plan should be given to the contractor and the Vice Chancellor of General Services.

2. No project should begin without a written plan that has not been signed by the VP of Instruction, Academic Dean, College Business Officer, Faculty/Department Chair(s), Project Manager, Contractor, and Director of Capital Projects.
PART 1 - GENERAL

1.01 SUMMARY

A. The contractor is responsible for daily cleanup and a final cleaning prior to occupancy. This section only addresses the final cleaning required prior to punchlisting and occupancy.

B. Cleaning Program:
   1. The cleaning program shall include all construction areas and surrounding areas affected by the construction including site, exteriors of buildings / structures, roofs and interior of buildings.
   2. The areas to be cleaned shall be turned over to the owner in a "move-in" condition.
   3. All areas shall be free of all construction materials, dust, debris, markings and dirt.
   4. All surfaces shall be washed, cleaned and cleared of markings.
   5. All existing and new fixtures shall be cleaned, sanitized and ready for use.
   6. All new and existing hard surface floors will be stripped and waxed.

1.02 PROJECT CONDITIONS

A. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with PCCD Construction Debris Reporting Requirements.

B. Comply fully with Federal and local environmental and antipollution regulations.
   1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
   2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.01 MATERIALS AND METHODS

A. Use cleaning materials and methods which will not create hazards to health or property or cause damage to products and which are recommended by manufacturers of products to be cleaned.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Provide final cleaning operations. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
   1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
   2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   3. Remove petrochemical spills, stains, and other foreign deposits.
   4. Remove tools, construction equipment, machinery, and surplus material from the site.
5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

6. All walls not newly painted shall be washed to clean readily removable dirt, markings, dust, and grime.

7. Remove debris and surface dust from limited access spaces, including roofs, attics and similar spaces.

8. All existing floors shall be thoroughly stripped of old wax and have at least four (4) coats of a combination wax/sealer, or two (2) coats of sealer and four (4) coats of wax. Contractor shall submit for prior approval manufactures information on floor finish to be applied. All new floors shall have their factory seal stripped off and shall have a floor finish applied according to the recommendations of the manufacturer.

9. New carpeted areas shall be thoroughly vacuumed, including edges. Any spotting during construction shall be removed. Existing carpeted areas shall be thoroughly shampooed.

10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Clean interior and exterior of all windows.

11. Clean all Toilet Rooms thoroughly and sanitized. All wall surfaces shall be free of grime, dirt, dust, markings and graffiti. All mirrors, fixtures, and partitions will be cleaned free of dirt and markings.

12. Scrub and seal all ceramic and terrazzo floors and walls.

13. Remove labels that are not permanent labels.

14. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

15. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

16. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

17. Replace disposable air filters and clean permanent air filters. Clean all exposed surfaces of diffusers, registers, and grilles.

18. Clean ducts, blowers, and coils if units were operated without filters during construction.

19. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned out bulbs; defective and noisy starters in fluorescent fixtures, and defective dimming switches.

20. Leave the Project clean and ready for occupancy.

C. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period. Repair any damage from removal.

D. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

End of Section
DISTRICT PROJECT/CONSTRUCTION MANAGER

Name:
Acting District Representative
333 E. 8th Street
Oakland, CA 94606
510-______________

BIDDER:

I. INTRODUCTIONS:
   A. Present _____________________ _______________________
   _____________________ _______________________
   _____________________ _______________________
   _____________________ _______________________

II. PROPOSED CONTRACT:
    ADDENDUM NO.

III. PURPOSE OF INTERVIEW IS TO ASSURE:
    A. Contractor acknowledgment of a complete and accurate bid.
    B. Contractor submission of a fair and equitable bid.
    C. Fair comparisons of bid.

IV. CONTRACTUAL REQUIREMENTS:
    A. Do you understand you are a prime contractor?   Yes☐ No☐
    B. Can you meet the specified insurance requirement
       listed in the General Conditions Section for GL, WC, Auto
       and Builders Risk (contract amount)?     Yes☐ No☐
    C. Are you a union company?                   Yes☐ No☐
    D. Are you a SLBE or SELBE?                   Yes☐ No☐
       If so in what county, city, state__________________________________________________
    E. Are any of your sub-tier contractors SLBE or SELBE?    Yes☐ No☐
       If so in what county, city, state__________________________________________________
    F. You are required to obtain a Performance, and a Labor
       and Material Bond for 100% of the Contract price
       1. Will you provide bonds as stipulated?    Yes☐ No☐
       2. Cost for bond: ________%     Yes☐ No☐
       3. Is your insurance company California licensed?   Yes☐ No☐
    J. Acknowledged Receipt of Addenda Number____________________
    K. Acknowledged Receipt of Pre-Bid Clarification Questions    Yes☐ No☐
    L. Additive and deductive costs for alternate items
       included in your proposal?        Yes☐ No☐
    M. Unit pricing and Allowances included in your proposal?   Yes☐ No☐

Who in your office is in charge of submitting the required Insurance and Bonds

Name ___________________________ Date __________________

Attachment 20, Page 1 of 4
V. SCOPE OF WORK:

A. You have a complete understanding of your Scope of Work under the proposed Agreement and the Scope of Work (attached)  

   Yes ☐ No ☐

B. You are required to have the following personnel:
   1. Safety Coordinator w/sole responsibility to coordinate, report and Enforce safety  
      Yes ☐ No ☐
   2. Scheduling personnel or independent scheduler  
      Yes ☐ No ☐
   3. Custodial cleanup services besides base- bid final cleaning  
      Yes ☐ No ☐
   4. Commissioning Coordinator (to be brought in at the start of Construction to the final completion  
      Yes ☐ No ☐
   5. Independent Testing and Balancing Contractor for HVAC  
      Yes ☐ No ☐
   6. Independent Contractor for Indoor Air Quality Testing  
      Yes ☐ No ☐
   7. Certified Arborist  
      Yes ☐ No ☐

C. You have re-reviewed the documents and understand the Scope of the Work. Are there any items that need to be identified or require clarification?  

   Yes ☐ No ☐

If yes, please identify item.

1. ______________________________________________________________
2. ______________________________________________________________
3. ______________________________________________________________
4. ______________________________________________________________

Is (are) the cost(s) for items listed above included in your proposal items?  

   Yes ☐ No ☐

C. Review bid alternatives (if applicable)  

   Yes ☐ No ☐

D. Review unit pricing  

   Yes ☐ No ☐

E. Review allowances  

   Yes ☐ No ☐

F. Are you offering any unsolicited alternates?  

   Yes ☐ No ☐

1. ______________________________________________________________
2. ______________________________________________________________
3. ______________________________________________________________

G. Are the plans and specifications clear and understandable to your satisfaction?  

   Yes ☐ No ☐
VI. VALUE ENGINEERING: (describe)  BASE BID:  $ ________________

1.  
2.  

Add / Deduct

______________________________________________________________________

REVISED TOTAL $_____________

VII. SCHEDULE:

A. Do you acknowledge and agree to the stipulated completion dates and milestones in the Contract?  

Yes☐ No☐

1.  Will you provide a detailed construction schedule at the Preconstruction Conference per Section 01320 per the Contract?  

Yes☐ No☐

2.  It is understood the Project schedule is critical. Can you accelerate any and all schedule activities if the requirement occurs?  

Yes☐ No☐

If not, what must change and why? _____________________________  

__________________________________________________________  

__________________________________________________________

B. Identify critical materials, deliveries and dependencies, including Owner Furnished items that could affect the completion of your work.

1.  
2.  
3.  

C. You have reviewed the Contract and you understand your work must be completed in accordance with the Project Schedule. You further understand Construction Manager MAY assess liquidated damages if you fail to meet the Master Schedule requirements. You further understand delays by you may cause other contractors to be delayed, and that you WILL accelerate your work upon written direction by the Construction Manager.

VIII. CONTRACTOR COMMENTS / SUGGESTIONS:

1.  
2.  
3.  

Attachment 20, Page 3 of 4
IX. CONTRACTOR

NOTE: You agree the information contained herein is part of your contractual obligations. Your signature acknowledges your agreement to perform all work discussed herein, and that costs for all work are included in your proposal.

The foregoing information is true and accurate, and I am authorized to sign as an officer of the company I am representing.

Company Name ________________________________________________________________

Signature: ___________________________ Title: _____________

Date: ________________________________

X. DISTRICT PROJECT/CONSTRUCTION MANAGER

Signature: ___________________________ Title: _____________

Date: ________________________________

END OF SECTION
SCOPE OF WORK

Bid No.: 11-12/11 Berkeley City College Build-Out Phase 3 Project

This project involves the following scopes of work per Construction Documents prepared by Murakami/Nelson Architects:

1) Build-out of existing unimproved spaces into Art Studios on the 4th floor  
2) Improvements and alterations to lab spaces, classrooms and offices on the 1st, 2nd, 3rd and 5th floors  
3) Modifications to mechanical, plumbing, electrical and fire sprinkler systems.

This is a Public Works and Project Labor Agreement (PLA) project, and will require payment of prevailing wages. The successful Bidder will be required to sign a Letter of Assent agreeing to the terms and conditions of the District’s PLA. 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 B General Building Contractors License.

Construction Hours:
Construction hours are to be scheduled as necessary to meet the required 10-months duration.
PERALTA COMMUNITY COLLEGE DISTRICT

CONSTRUCTION PROJECT LABOR AGREEMENT

JULY 21, 2009
## PROJECT LABOR AGREEMENT
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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 on 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.

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Project Labor Agreement
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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 Favorited 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.
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

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.

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
eourage 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 Jurisdictic 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 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.

ARTICLE 16
LOCAL HIRING PROGRAM

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 be 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.

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**Peralta Community College District**

BY: [Signature]

Elihu Harris
Chancellor

DATE: 4/6/10

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**Alameda County Building & Construction Trades Council AFL-CIO (Council)**

BY: [Signature]

Barry Luboviski
Secretary-Treasurer

DATE: _________________

---

**Asbestos Workers, Local 16**

BY: [Signature]

Steve Steele

---

**Boilermakers, Local 549**

BY: [Signature]

Frank Secreet
Bricklayers & Allied Craftsmen, Local 3

By: Tom Spear

District Council of Plasterers and Cement Masons of Northern California

By: Steve Scott

Plasterers, Local 66

By: Chester Murphy, Jr.

Elevator Constructors, Local 8

By: Pat McGarvey

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

Cement Masons, Local 300

By: Steve Scott

Electrical Workers, Local 595

By: Victor Uno

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

Ironworkers, Local 378
By: Emilio Rivera

By: Joe Standley

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
By: Doug Christopher

Roofers and Waterproofers, Local 81
By: Doug Ziegler
Sheet Metal Workers, Local 104

By: [Signature]

Bruce Word

Sign Display & Allied Crafts, Local 510

By: [Signature]

Mike Hardeman

Sprinkler Fitters, Local 483

By: [Signature]

Stan Smith, Jr.

Teamsters, Local 853

By: [Signature]

Rome Aloise

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: [Signature]

Jay Williams

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

By: [Signature]

Dennis Soares
Sheet Metal Workers, Local 104
By: 
Bruce Word

Sprinkler Fitters, Local 483
By: 
Stan Smith, Jr.

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342
By: 
Jay Williams

Sign Display & Allied Crafts, Local 510
By: 
Mike Hardeman

Teamsters, Local 853
By: 
Rome Aloice

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355
By: 
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 __________________________

_________________________________________________________________
LETTER OF UNDERSTANDING ADDRESSING LOCAL BUSINESS UTILIZATION

During negotiations, the District and the Building Trades Council discussed local business participation on District projects that will be covered by the Project Labor Agreement. The District, the Building Trades Council and the Affiliates of the Council agreed that such participation will benefit the local community and insure additional opportunities for work that is not covered by the Project Labor Agreement.

It is therefore agreed that every effort will be taken to encourage all participating Contractors to use good faith efforts to obtain supplies, materials and goods from local suppliers and manufacturers. Such ancillary off site support services include fabrication of: millwork, cabinets and modular furniture, electrical components, miscellaneous ornamental iron, prefinishing of materials and also the furnishing of building materials and office supplies used during construction.

Therefore, the District, the Building Trades Council and the Unions will make every effort to encourage use of local businesses on non-covered work needed to construct the College facilities.

Sincerely,

[Signature]

Elihu Harris, Chancellor
on behalf of the Peralta Community College District

AGREED AND ACCEPTED on behalf of the Building and Construction Trades Council of Alameda County, AFL-CIO and the Local Unions signatory to the Peralta Community College District Construction Project Labor Agreement this 21 day of July 2009.

[Signature]

Barry Luboviski, Secretary-Treasurer
Building and Construction Trades Council of Alameda County, AFL-CIO
Attachment C

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: [Signature]
Elihu Harris
Chancellor

DATE: ______________________

Asbestos Workers, Local 16

By: [Signature]
Steve Steele

Bricklayers & Allied Craftsmen, Local 3

By: [Signature]
Tom Spear

District Council of Plasterers and Cement Masons of Northern California

By: ______________________
Steve Scott

Alameda County Building & Trades Council AFL-CIO (Council)

BY: [Signature]
Barry Luboviski
Secretary-Treasurer

DATE: 7-21-2009

Boilermakers, Local 549

By: ______________________
Dale Bilyeu

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: [Signature]
Robert Alvarado

Cement Masons, Local 300

By: ______________________
Steve Scott
Plasterers, Local 66

By: ____________________________
Chester Murphy, Jr.

Elevator Constructors, Local 8

By: ____________________________
Pat McGarvey

Hod Carriers, Local 166

By: ____________________________
Sam Robinson

Laborers, Local 304

By: ____________________________
Jose Zapieren

District Council Ironworkers of the State of California and Vicinity

By: ____________________________
Joe Standley

Electrical Workers, Local 595

By: ____________________________
Victor Uno

Laborers District Council on behalf of, Hod Carriers, Local 166, Laborers, Local 67, Laborers, Local 304

By: ____________________________
Oscar De La Torre

Laborers, Local 67

By: ____________________________
Victor Parra

Operating Engineers, Local 3

By: ____________________________
Russ Burns

Ironworkers, Local 378

By: ____________________________
Emilio Rivera
Attachment C

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

By: ____________________________
    Doug Christopher

Sheet Metal Workers, Local 104

By: ____________________________
    Bruce Word

Sprinkler Fitters, Local 483

By: ____________________________
    Stan Smith, Jr.

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: ____________________________
    Jay Williams

Roofers and Waterproofers, Local 81

By: ____________________________
    Doug Ziegler

Sign Display & Allied Crafts, Local 510

By: ____________________________
    Mike Hardeman

Teamsters, Local 853

By: ____________________________
    Rome Aloise

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

By: ____________________________
    Dennis Soares
Attachment C

District Council 16, Painters & Allied Trades  Roofers and Waterproofers, Local 81
on behalf of Auto & Marine Painters, Local
1176, Carpet & Linoleum Layers, Local 12,
Glaziers, Architectural Metal & Glassworkers,
Local 169, Painters & Tapers, Local 3

By: ____________________________   By: ____________________________

Doug Christopher                     Doug Ziegler

Sheet Metal Workers, Local 104

By: ____________________________

Bruce Word

Sprinkler Fitters, Local 483

By: ____________________________

Stan Smith, Jr.

United Association of Steamfitters,
Pipefitters, Plumbers & Gasfitters,
Local 342

By: ____________________________

Jay Williams

United Association of Journeyman &
Apprentices of the Pipe Fitting Industry,
Underground Utility / Landscape, Local 355

By: ____________________________

Dennis Soares
Attachment D

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

Chancellor Elihu Harris
Peralta Community College District

Acknowledged and agreed to this 21st day of July 2009
Attachment E

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.
PERALTA COMMUNITY COLLEGE DISTRICT

CONSTRUCTION PROJECT LABOR AGREEMENT

JULY 21, 2009
PROJECT LABOR AGREEMENT
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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 on 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(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.
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.

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.

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

The Unions, District and Contractor(s) agree that for the duration of this Agreement:

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 been 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.

ARTICLE 16
LOCAL HIRING PROGRAM

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:** 4/6/10

**Alameda County Building & Construction Trades Council AFL-CIO (Council)**

**By:**

Barry Luboviski
Secretary-Treasurer

**DATE:** ________________

**Asbestos Workers, Local 16**

**By:**

Steve Steele

**Boilermakers, Local 549**

**By:**

Frank Secreet
Bricklayers & Allied Craftsmen, Local 3

By: Tom Spear

District Council of Plasterers and Cement Masons of Northern California

By: Steve Scott

Plasterers, Local 66

By: Chester Murphy, Jr.

Elevator Constructors, Local 8

By: Pat McGarvey

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

Cement Masons, Local 300

By: Steve Scott

Electrical Workers, Local 595

By: Victor Uno

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

By: __________________________
   Doug Christopher

Roofers and Waterproofers, Local 81

By: __________________________
   Doug Ziegler
Sheet Metal Workers, Local 104

By: [Signature]

Bruce Word

Sign Display & Allied Crafts, Local 510

By: [Signature]

Mike Hardeman

Sprinkler Fitters, Local 483

By: [Signature]

Stan Smith, Jr.

Teamsters, Local 853

By: [Signature]

Rome Aloi

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: [Signature]

Jay Williams

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

By: [Signature]

Dennis Soares
Sheet Metal Workers, Local 104

By: ______________________

Bruce Word

Sprinkler Fitters, Local 483

By: ______________________

Stan Smith, Jr.

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: ______________________

Jay Williams

Sign Display & Allied Crafts, Local 510

By: ______________________

Mike Hardeman

Teamsters, Local 853

By: ______________________

Rome Aloice

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

By: ______________________

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 ____________________________

________________________________________

Peralta Community College District
Project Labor Agreement
Page 33 of 36
LETTER OF UNDERSTANDING ADDRESSING LOCAL BUSINESS UTILIZATION

During negotiations, the District and the Building Trades Council discussed local business participation on District projects that will be covered by the Project Labor Agreement. The District, the Building Trades Council and the Affiliates of the Council agreed that such participation will benefit the local community and insure additional opportunities for work that is not covered by the Project Labor Agreement.

It is therefore agreed that every effort will be taken to encourage all participating Contractors to use good faith efforts to obtain supplies, materials and goods from local suppliers and manufacturers. Such ancillary off site support services include fabrication of: millwork, cabinets and modular furniture, electrical components, miscellaneous ornamental iron, prefinishing of materials and also the furnishing of building materials and office supplies used during construction.

Therefore, the District, the Building Trades Council and the Unions will make every effort to encourage use of local businesses on non-covered work needed to construct the College facilities.

Sincerely,

[Signature]

Elihu Harris, Chancellor
on behalf of the Peralta Community College District

AGREED AND ACCEPTED on behalf of the Building and Construction Trades Council of Alameda County, AFL-CIO and the Local Unions signatory to the Peralta Community College District Construction Project Labor Agreement this 21st day of July 2009.

[Signature]

Barry Luboviski, Secretary-Treasurer
Building and Construction Trades Council of Alameda County, AFL-CIO
Attachment C

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: [Signature]
Elihu Harris
Chancellor

DATE: ______________________

**Asbestos Workers, Local 16**

By: [Signature]
Steve Steele

**Bricklayers & Allied Craftsmen, Local 3**

By: [Signature]
Tom Spear

**District Council of Plasterers and Cement Masons of Northern California**

By: ______________________
Steve Scott

**Alameda County Building & Trades Council AFL-CIO (Council)**

BY: [Signature]
Barry Luboviski
Secretary-Treasurer

DATE: 7-21-2009

**Boilermakers, Local 549**

By: ______________________
Dale Bilyeu

**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: [Signature]
Robert Alvarado

**Cement Masons, Local 300**

By: ______________________
Steve Scott
Attachment C

Plasterers, Local 66

By: __________________________

Chester Murphy, Jr.

Elevator Constructors, Local 8

By: __________________________

Pat McGarvey

Hod Carriers, Local 166

By: __________________________

Sam Robinson

Laborers, Local 304

By: __________________________

Jose Zapien

District Council Ironworkers of the State of California and Vicinity

By: __________________________

Joe Standley

Electrical Workers, Local 595

By: __________________________

Victor Uno

Laborers District Council on behalf of, Hod Carriers, Local 166, Laborers, Local 67, Laborers, Local 304

By: __________________________

Oscar De La Torre

Laborers, Local 67

By: __________________________

Victor Parra

Operating Engineers, Local 3

By: __________________________

Russ Burns

Ironworkers, Local 378

By: __________________________

Emilio Rivera
Attachment C

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

By: ____________________________

Doug Christopher

Sheet Metal Workers, Local 104

By: ____________________________

Bruce Word

Sprinkler Fitters, Local 483

By: ____________________________

Stan Smith, Jr.

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: ____________________________

Jay Williams

Roofers and Waterproofers, Local 81

By: ____________________________

Doug Ziegler

Sign Display & Allied Crafts, Local 510

By: ____________________________

Mike Hardeman

Teamsters, Local 853

By: ____________________________

Rome Aloise

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

By: ____________________________

Dennis Soares
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

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 Aloise

United Association of Steamfitters, Pipefitters, Plumbers & Gasfitters, Local 342

By: ____________________________  By: ____________________________

Jay Williams  Dennis Soares

United Association of Journeyman & Apprentices of the Pipe Fitting Industry, Underground Utility / Landscape, Local 355

Peralta Community College District Project Labor Agreement
Attachment D

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,

[Signature]

Barry Luboviski, Secretary-Treasurer,  
Alameda County Building and Construction Trades Council  
on behalf of the signatory Unions and Councils to the Project Labor Agreement

[Signature]

Chancellor Elihu Harris  
Peralta Community College District

Acknowledged and agreed to this 21 day of July, 2009
Attachment E

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 21 day of July 2009.
Specifications & Project Manual

BERKELEY CITY COLLEGE
PHASE 3: BUILD-OUT
2050 Center Street
Berkeley, California 94704

Peralta Community College District
333 East 8th Street
Oakland, California 94606

DSA Backcheck
September 27, 2011

DSA File No. 1-C1
DSA Application No. 01-111745

murakami/Nelson
100 Filbert Street, Oakland CA 94607
510.444.7959

Murakami/Nelson job #0802C
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<th>Design Team</th>
<th>Professional Stamp Page</th>
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| **Architect:**  
  *murakami / Nelson,* Architectural Corporation  
  100 Filbert Street  
  Oakland, CA 94607  
  Tel: (510) 444-7959  
  Fax: (510) 893-5244  
  Contact: Lorna Dare, Project Architect | Stamp on Proceeding Page 1 |
| **Structural Engineer:**  
  *Forell / Elsesser Engineers, Inc.*  
  160 Pine Street, Suite 600  
  San Francisco, CA 94111  
  Tel: (415) 837-0700  
  Fax: (415) 837-0800  
  Contact: Simin Naasheh | Stamp on Proceeding Page 2 |
| **Mechanical Engineer:**  
  *H&M Mechanical Group*  
  8517 Earhart Road, Suite 230  
  Oakland, CA 94621  
  Tel: (510) 569-2000  
  Fax: (510) 569-2002  
  Contact: Gary Hennings | Stamp on Proceeding Page 3 |
| **Fire Sprinkler Engineer:**  
  *Aon Fire Protection Engineering*  
  1850 Gateway Boulevard, Suite 1030  
  Concord, CA 94520  
  Tel: (925) 827-5858  
  Fax: (925) 827-8997  
  Contact: Patrick Ward, Brian Haggland | Stamp on Proceeding Page 4 |
| **Electrical Engineer:**  
  *BWF Consulting Engineers, Inc.*  
  510 Myrtle Avenue, Suite 100  
  South San Francisco, CA 94080  
  Tel: (650) 871-0220  
  Fax: (650) 871-0224  
  Contact: Michael Voiglander | Stamp on Proceeding Page 5 |
| **Telecommunications Engineer:**  
  *TEECOM Design Group*  
  1333 Broadway, Suite 610  
  Oakland, CA 94612  
  Tel: (510) 337-2800  
  Fax: (510) 337-2804  
  Contact: Kevin Mendenhall | Stamp on Proceeding Page 6 |
BERKELEY CITY COLLEGE
Phase 3 Build-Out
2050 Center Street
Berkeley, CA 94704

STRUCTURAL ENGINEER
(Division 3, 5)

Simin Naaseh

Forell / Elsesser Engineers, Inc.
160 Pine Street, Suite 600
San Francisco, CA 94111
BERKELEY CITY COLLEGE
Phase 3 Build-Out
2050 Center Street
Berkeley, CA 94704

H&M Mechanical Group
8517 Earhart Road, Suite 230
Oakland, CA 94621

MECHANICAL ENGINEER
(Division 11)

Gary L. Hennings
BERKELEY CITY COLLEGE
Phase 3 Build-Out
2050 Center Street
Berkeley, CA 94704

TELECOMMUNICATIONS
(Division 16)

TEECOM Design Group
1333 Broadway, Suite 610
Oakland, CA 94612
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ARTICLE 1 - GENERAL PROVISIONS

1.01 THE CONTRACT DOCUMENTS

A. The Contract Documents consist of the Bid Documents (as defined in the Instructions to Bidders), Agreement, and Conditions of the Contract, Drawings, Specifications, Addenda, other documents listed in the Agreement, and Modifications issued after execution of the Contract. The Conditions of the Contract include these General Conditions and related documents.

B. Where provisions of the General Conditions relate to Project administration of work-related requirements of the Contract, some of those paragraphs are expanded in Division 1 - General Requirements of the Specifications.

C. Bidding Documents, Conditions of the Contract, and Division 1 - General Requirements contain information necessary for completion of every part of the Project and are applicable to each Section of the Specifications.

1. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.02 THE CONTRACT

A. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a written Modification executed by the parties hereto.

B. The Contractor’s signing of the Contract signifies its acceptance of the time limits as being sufficient for completion of the Work, as well as acceptance of the other terms and conditions of the Contract Documents.

1.03 BASIC DEFINITIONS OF TERMS USED IN THE CONTRACT DOCUMENTS

A. Basic Definitions of Terms Used in the Contract Documents:

1. Addenda: Written or graphic instruments issued prior to the opening of Bids which make changes, additions or deletions to the Bid Documents or the Contract Documents.

2. Accepted, Approved: Accepted or approved, or satisfactory for the Work, as determined in writing by the District, unless otherwise specified. Where used in conjunction with the District's response to submittals, requests, applications, inquiries, and reports by the Contractor, the term "approved" shall be held to limitations of the District's responsibilities and duties as specified in the Conditions of the Contract. In no case shall the District's approval be interpreted as a release of the Contractor from its responsibilities to fulfill the requirements of the Contract Documents.

3. Approved Equal, Accepted Equal: Approved in writing by the District as being of equivalent quality, utility and appearance. Equivalent means equality in the opinion of the authorized District representative. The burden of proof of equality is the responsibility of the Contractor

4. Agreement: The Agreement or Contract between the District and the Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made part thereof as provided herein.
5. Architect: The person holding a valid state Architect's license, Whose firm has been designated within the Contract Documents as the Architect of Record to provide architectural services on this Project.

6. As Required: In accordance with the requirements of the Contract Documents.

7. By Others: Work on this Project that is outside the scope of Work to be performed by the Contractor under this Contract, but that will be performed by the District or other contractors, or other means or at other expense.

8. PCCD: Peralta Community College District, Owner, District.

9. Change Order: A written instrument prepared by the District and signed by the District and the Contractor, stating their agreement upon all of the following (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any; and (3) the extent of the adjustment in the Contract Time, if any, issued after the effective date of the Agreement.

10. Clarification: A document consisting of supplementary details, instructions or information issued by the District which clarifies or supplements the Contract Documents and becomes a part of the Contract Documents. Clarifications do not constitute a change in Contract Sum or an extension of Time except as otherwise approved by the District. Clarifications will be issued through the Request for Information (RFI) administrative system.

11. Concealed: Work not exposed to view in the finished Work, including within or behind various construction elements.

12. Construction Manager: An independent consultant hired by the District to monitor, manage the construction work on behalf of the District.

13. Contract: The legally binding agreement between the Owner and the Contractor, wherein the Contractor agrees to furnish the labor, materials, equipment, plant and appurtenances required to perform the work described in the Contract Documents, and the Owner agrees to pay the Contractor for such work.


15. Contract Sum: The sum stated in the Agreement and, including authorized adjustments, the total amount payable by the District to the Contractor for the performance of the Work under the Contract Documents.

16. Contractor: The person or entity holding a valid Contractor's License in the state of California with whom the District has executed the Agreement and is identified as such therein and referred to throughout the Contract Documents as if singular in number and neuter in gender. The term "Contractor" means the Contractor or its authorized representative.

17. Day: Calendar day, of 24 hours, measured from midnight to the next midnight, unless otherwise specifically stipulated.

18. Defective Work: Work that is unsatisfactory, faulty, or deficient, that does not conform to the Contract Documents or the general standards of workmanship of the particular industry or trade; that fails to perform to the reasonable expectation of the ultimate user, or that does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; or work that has been damaged prior to the filing of the Notice of Completion by the District.
19. Delivery: In reference to any item specified or indicated shall mean to unload and store with proper protection at the Project site.

20. Designated, Determined, Directed: Required by the District, unless otherwise specified.

21. District: The Peralta Community College District, its Board of Trustees, and its Chancellor.

22. District-Furnished, Contractor-Installed: Items furnished and paid for by the District for installation by the Contractor pursuant to the Contract Documents.

23. Drawings: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

24. Effective Date of the Agreement: The date indicated in the agreement on which it was executed, but if no such date is indicated it shall mean the date on which the agreement is signed and delivered by the last of the two parties to sign and deliver.

25. Exposed: Work exposed to view in the finished Work, including behind louvers, grilles, registers and various other construction elements.

26. Furnish or Supply: Purchase and deliver to the Project site, including proper storage only; no installation is included. The term "furnish" also means to supply and deliver to the Project site.

27. Indicated or As Shown: Shown or noted on the Drawings or written in the Specifications, whichever is more restrictive.

28. Inspector of Record: The person responsible for inspection of the work during fabrication and construction. Acts under the direction of the Architect but is responsible to the District and the Division of the State Architect, Structural Safety Section.

29. Install: Apply, connect or erect items that have been furnished; furnishing or supplying is not included. The term "install" also describes operations at the Project site, including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

30. Installer: The "installer" is the person engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular element of construction at the Project site, including installation, erection, application and similar required operations. It is a requirement that installers are experienced and licensed in the operations they are engaged to perform.

31. Modification: (a) A written amendment to the Contract signed by both parties, or (b) a written Change Order, or (c) a written order for a change in the Work (Unilateral Change Order and Force Account Change Order) issued by the District after the effective date of the Contract.

32. Notice to Proceed: The written notice issued by the District to the Contractor authorizing the Contractor to proceed with the Work and establishing the date of commencement of the Contract Time.

33. Notice of Completion: The legal document filed by the District, with the Division of the State Architect, after the Project has been fully completed as required by the contract documents.
34. Division of the State Architect (DSA):  The enforcement arm of the Division of the State Architect, having jurisdiction over school building construction projects in lieu of the local building department.

35. Owner: The Peralta Community College District ("PCCD" also referred to herein as "District") identified as such in the Agreement and referred to throughout the Contract Documents as if singular in number. The term "Owner" means the District, its governing board, employees, and its authorized agents or representatives. Also referred to as "District."

36. Partial Occupancy: The stage in the progress of the Work when the District finds the Work or designated portion thereof sufficiently complete in accordance with the Contract Documents to occupy and utilize the Work for its intended use.

37. Progress Report: A periodic (monthly, weekly, etc.) report submitted by Contractor to Owner with progress payment invoices comparing actual work accomplished to the Project Schedule. See Section 9.03 F of the GENERAL CONDITIONS titled PROGRESS PAYMENT. All reports to be verified as per Sections 4-335, 4-336, 4-337 and 4-343 of PART 1 of Title 24 of the California Code of Regulations.

38. Project: The Peralta Community College District Project and adjacent areas as indicated elsewhere in the Contract Documents.

39. Project Completion: Project Completion shall be the date of such acceptance of the Work by the District, as provided under California Civil Code Section 3086, when the Contract has been performed, including all remedial (punch-list) items, and when all contractual requirements are fulfilled.

40. Provide: Furnish and install or supply and install complete in place at the site.

41. Punch List: A list of corrections, replacements, installations, or touch-ups prepared by the Architect with the assistance of the Inspector of Record and issued to the Contractor with the Notice of Substantial Completion.

42. Regular Working Hours: 7:00 a.m. to 5:30 p.m., Monday through Friday, except District legal holidays and as allowed in Division 1.

43. Request for Change (RFC): See paragraph 2.06A and 2.07.

44. Request for Information (RFI): A document prepared by the Contractor or District requesting information from one of the parties regarding the Project or Contract Documents. The RFI system is also a means for the District to submit Contract Document clarifications or supplements to the Contractor.

45. School Building: Any building used for community college purposes and built according to the California State Building Code containing the regulations of the Division of the State Architect, Division of the State Architect/Structural Safety Section covering the construction of public schools.

46. Site or Project Site: Geographical location of the Project as shown elsewhere in the Contract Documents.

47. Specifications: The written portion of the Contract Documents, which includes requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

49. Subcontractor: A person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and neuter in gender and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

50. Substantial Completion: The Work has progressed to the point where, as evidenced by the Certificate of Substantial Completion issued by the District, it is sufficiently complete in accordance with the Contract Documents as deemed by the District so that the entire Project could be occupied for the intended purpose and the Work utilized for its intended purpose.

51. Work, The Work: The excavation, construction and services required by the Contract Documents and provided to the Project site.

1.04 EXECUTION, CORRELATION AND INTENT

A. The intent of the Contract Documents is to include all labor and materials necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

B. Arrangement and titles of Drawings, and organization of the Specifications into divisions, sections and articles in the Contract Documents shall not be construed as segregation of the various units of material and labor, and shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. The Contractor may arrange and delegate its Work in conformance with trade practices and shall be responsible therefore. The District assumes no liability arising out of jurisdictional issues raised or claims advanced by trade organizations or other interested parties based on the arrangement or manner of subdivision of the content of the Drawings and Specifications. The District assumes no responsibility to act as arbiter to establish subcontract limits between any portions of the Work, but the District shall be promptly advised of obstacles encountered which might in any way affect the timely prosecution of the Work.

C. In interpreting the Contract Documents, words describing materials or Work with a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with such well-known meaning.

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

E. If a conflict exists in the Contract Documents regarding the quality of a product, the highest quality product shall be provided as determined by the District.

F. The layout of mechanical and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items, and accessories on the Drawings is shown in diagrams and symbols to illustrate the relationships existing between the parts of the Work, and all variations in alignment, elevation, and detail required to avoid interference and satisfy architectural and
structural limitations are not necessarily shown. If rerouting, i.e. relocating a duct, pipe, conduit or similar utilities from the indicated room or space to another room or space to avoid structural interference, causes an increase in linear footage which exceeds 25% of the indicated rout if the structural interference did not exist, then the Contractor will be compensated for the amount in excess of 25% under the provisions for Change Orders of Article 7. Actual layout of the Work shall be carried out without affecting the architectural and structural integrity and limitations of the Work and shall be performed in such sequence and manner as to avoid conflicts; provide clear access to all control points, including valves, strainers, control devices, and specialty items of every nature related to such systems and equipment, said clear access defined as arms reach without required use of special equipment or the dismantling of building systems or equipment; obtain maximum headroom; and provide adequate clearances as required for operation and maintenance unless specifically detailed otherwise.

G. The Drawings shall not be scaled for dimensions when figured dimensions are given, dimensions could be calculated, or field measured. When a true dimension cannot be determined from the Drawings or field measurement, the Contractor shall request same from the District, giving reasonable advance notice, but not less than 30 calendar days, so as not to delay or disrupt the Work.

H. In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

I. When there is a conflict between existing on-site conditions and the Drawings, the existing condition shall govern. The Contractor shall provide the Work and adjust to the existing condition at no additional cost to the District.

1.05 CONDITIONS AS TO SPECIFICATIONS AND DRAWINGS

A. Interpretation of Drawings and Specifications: The Contractor shall check Drawings furnished by District and shall promptly notify the District in writing of any discrepancies. Should any discrepancy appear or any misunderstanding arise as to the import of anything contained in the Drawings or Specifications, the matter shall be referred to the District, who shall decide the true meaning and intent of the Drawings or Specifications, and the District's decision shall be binding on the Contractor at no additional cost to the District. Suitable instructions will be given when any such discrepancy or misunderstanding is discovered.

B. Interpretation of Phrases: Wherever the words "as directed," "as permitted," or words to the like effect are used, it shall be understood that the direction, requirement, or permission of the District, or governmental regulatory agency having jurisdiction is intended. The words "sufficient," "necessary," "proper," and the like shall mean sufficient, necessary, or proper in the judgment of the authorized District representative. Wherever the words "inspect," "approved," "acceptable," "satisfactory," or words of like import are used to describe a requirement, direction, review, or judgment of the District as to the Work, it is intended that such requirement, direction, review, or judgment will be solely to observe and evaluate, in general, the completed work for compliance with the requirements of the Contract Documents, unless otherwise specifically stated and does not waive or alter the Contractor's responsibility for completion of the Work in compliance with the Project Documents.

C. Reasonably Implied Parts of Work Shall Be Done Though Absent From the Drawings or Specifications: Any part of the Work which is not mentioned in the Specifications but is shown on the Drawings, or any part not shown on the Drawings but described in the Specifications, but is necessary or normally required as a part of such Work, or is necessary or required to make each installation satisfactorily or legally operable, shall be performed by the
Contractor as incidental Work without extra cost to the District, as if fully described in the Contract Documents, and the expense thereof shall be included in the price bid.

1.06 AMENDING CONTRACT DOCUMENTS

A. The Contract Documents may be amended after execution of the Agreement to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

1. A Change Order, or
2. A Unilateral Change Order, or
3. Force Account Change Order.

B. In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

1. District's written interpretation or clarification.
2. Architect's supplemental instructions or notes added to shop drawings or samples.

1.07 PRECEDENCE OF DOCUMENTS

A. The Contract Documents are complementary and shall have no order or precedence. Anything mentioned in Specifications and not shown on Drawings, or shown on Drawings and not mentioned in Specifications, shall be of like effect as if shown or mentioned in both. In case of difference between Drawings and Specifications, if true intent is not obvious, the Contractor shall submit a Request for Information and a determination will be made by the District, as provided in Paragraph 1.05A hereinabove. Omissions from Drawings or Specifications or mis-description of details of work which are manifestly necessary to carry out the intent of Drawings and Specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or mis-described details of work; they shall be fully performed as if fully and correctly set forth and described in the Drawings and Specifications.

1.08 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

A.. The Contract Documents were prepared for use for the Work of this Contract only and are owned by the District. No part of the Contract Documents shall be used for any other construction or for any other purpose except with the written consent of the District. Any unauthorized use of the Contract Documents is at the sole liability of the user.

1.09 CONFERENCES AND MEETINGS:

A. See INVITATION FOR BIDS on whether a Pre-bid Conference will be held or not. The site may be inspected at the times noted in the INVITATION FOR BIDS. Where an appointment is shown as required, Bidders shall follow the procedure stated. Questions regarding the extent, nature, and details of the work shall be directed to Facilities Planning & Construction, PCCD.

B. Upon notification to the Contractor that he/she is the lowest responsible bidder, an itemized summary, known as the Schedule of Values, must be submitted during the Pre-construction Conference. The Schedule of Values must reflect the Original Bid.

C. The Contractor and/or his representative shall attend a conference at the Project Site at the beginning of construction for the purpose of determining Contractor's access to, and use of
the site, verifying utilities, and such other items as may be pertinent to the start of
construction.

D. Progress meetings will be held at the frequency, (typically weekly) day and time as
determined by the Owner’s representative for this project. The Contractor and each
Subcontractor will attend these meetings to discuss current issues and coordination. Architect,
consultants, and Inspectors may also be required to attend as needed. The purpose of these
meetings is to provide a formal and regular forum for the project team to coordinate and
present questions, problems and issues that need to be addressed. It will also provide an
opportunity to review the progress on previous issues and action items along with submittal
and schedule review.

E. Special meetings may be requested by the Owner and may include any members of the
project team.

F. Contractor shall give a minimum of 48 hours prior notice to Owner, through Architect on
Construction Project before expected work completion. Meeting and walk-through to be
scheduled at site, wherein an inspection of work shall be made by all parties concerned on
construction, to determine completeness and conformity of the work to the Contract.
Deficiencies observed and noted shall be given to the Contractor in writing and as per
SECTION 9.07 A of the GENERAL CONDITIONS titled PROJECT COMPLETION AND FINAL
PAYMENT, all deficiencies shall be corrected to the satisfaction of the Owner.

ARTICLE 2 - DISTRICT’S RESPONSIBILITIES

2.01 INFORMATION AND SERVICES REQUIRED OF THE DISTRICT

A. The District shall furnish surveys and reports describing physical characteristics, legal
limitations for the site of the Project, and a legal description of the site.

B. The District shall provide for approval by the California Division of the State Architect and shall
pay all permanent utility service connection fees. All other permits, easements, approvals, and
other charges required for construction shall be secured and paid for by the Contractor.

1. The District will furnish to the Contractor an approved set of plans and specifications.

2. The District’s responsibility in respect of certain inspections, tests, and approvals is set forth in Paragraph 13.05.

C. The foregoing are in addition to other duties and responsibilities of the District enumerated
herein in these General Conditions.

D. The Contractor will be furnished up to four (4) sets of Drawings and Specifications and one (1)
reproducible set of Drawings and Specifications at no cost. The Contractor shall pay the
reproduction costs of any additional sets required. Subsequent modifications, Change Orders,
and Proposed Change Orders will be issued in the same manner.

2.02 DISTRICT’S RIGHT TO STOP THE WORK

A. The District may order the Contractor to stop the Work, or any portion thereof, until the cause
for such order has been eliminated. Any District Stop Work Order shall be in writing, signed
by an authorized District representative specifically so empowered by the District in writing.

B. However, the right of the District to stop the Work shall not give rise to a duty on the part of
the District to exercise this right for the benefit of the Contractor or any other person or entity.

C. Reasons for Stop Work Order include, but are not limited to, the following:
1. If the Contractor fails to correct Work, which is not in accordance with the requirements of the Contract Documents.

2. If the Contractor fails to carry out Work in accordance with the Contract Documents.

3. If the Contractor disregards the authority of the authorized District representative.

4. If the Contractor disregards the Laws and Regulations of any public body having jurisdiction.

5. If the Contractor violates in any substantial way any provisions of the Contract Documents.

6. Failure to maintain current certificates of insurance on file with the District.

7. When original contract work is proceeding but will be modified by pending Contract Modification.

2.03 DISTRICT’S RIGHT TO CARRY OUT THE WORK

A. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the District to commence and continue correction of such default or neglect with diligence and promptness, the District may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the District may, without prejudice to other remedies the District may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the District representative's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the District.

2.04 NO WAIVER OF RIGHT

A. Neither the inspection by the District or its authorized agents or representatives, nor any order or certificate for the payment of money, nor any payment for, nor Acceptance of the whole or any part of the Work by the District, nor any extension of time, nor any position taken by the District or its authorized agents or representatives shall operate as a waiver of any provision of this Contract, or of any power herein reserved by the District or any right to damage herein provided, nor shall any waiver of any breach of this Contract be held to be a waiver of any other or subsequent breach.

B. All remedies provided in this Contract shall be taken and construed as cumulative; that is, in addition to each and every other remedy herein provided; and the District shall have any and all equitable and legal remedies, which it would in any case have.

2.05 DISTRICT’S ADMINISTRATION OF THE CONTRACT

A. The District has designated the District Representative as its representative during construction. The designated authorized representatives of the General Services Office will have limited authority to act on behalf of the District. The District may at any time during the performance of this Contract, make changes in the authority of any representative or may designate additional representatives. These changes will be communicated to the Contractor in writing. The Contractor assumes all risks and consequences of performing the Contract in
accordance with any order, including but not limited to instruction, direction, interpretation or determination, of anyone not authorized to issue such order.

B. The District will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The District will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The District will not have control over or charge of and will not be responsible for the acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

C. The District will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data, Samples and other submittals, but only for the limited purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. The District's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Contractor or separate contractors, while allowing sufficient time in the District Consultant's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The District's review of the Contractor's submittals shall not relieve the Contractor of its obligations under the Contract Documents. The District's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences or procedures. The District's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

D. Administration of construction per Title 24 shall include the following delineation of responsibilities: Duties of architect, structural engineer, or professional engineer per Section 4-341; Duties of contractor per Section 4-343; and Verified reports per Sections 4-336 and 4-343.

2.06 CLARIFICATION AND REQUEST FOR CHANGE (RFC) NOTIFICATION

A. If in the opinion of the Contractor, the Contract Documents are not sufficiently detailed or explained therein, or should any questions arise as to the meaning or intent of the Contract Documents, or should District's comments on submittals returned to the Contractor appear to change the requirements of the Contract, the Contractor shall request written clarification by submitting a Request for Information (i.e. RFI) within seven (7) calendar days of discovery. Should any clarification (e.g., response to the Contractor's RFI), in the opinion of the Contractor, exceed the requirements of the Contract Documents, a written notice in a form approved by the District (i.e. Request for Change) shall be given to the District, within seven (7) calendar days of receipt of the District's clarification, and before proceeding with the Work thereof. Non-receipt of such notice, or proceeding with Work pertaining to said notice shall be construed as relieving the District of any Request for Change or Claim for added cost or an extension of time arising therefrom.

2.07 RESOLUTION OF RFCs & CLAIMS

A. Request for Change

1. A Request for Change (RFC) is a document prepared by the Contractor to seek additional compensation and time from the District.

2. The Contractor and the District shall make good-faith attempts to resolve any and all RFCs that may arise during the performance of the Work of this Contract. Within seven (7) calendars of the written RFC to the District, the Contractor shall provide a written RFC
narrative explaining its reasons for requesting additional compensation or time. The written RFC narrative shall reference all related schedule activities and contract specification sections and drawings directly pertaining to the RFC.

3. The District will review the Contractor's timely written RFC narrative, and provide a decision within thirty (30) calendar days after receipt of the Contractor's RFC written narrative. Unless otherwise directed by the District in writing, the Contractor shall diligently proceed with the Work in accordance with the District's decision.

B. Claim:

1. "Claim" means a written demand or written ascertain by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of Contract terms, or other relief arising under or relating to this Contract. A voucher, invoice, other routine request for payment, or an RFC submitted by the Contractor shall not be considered a claim under the Contract until it complies with the notification and documentation requirements of this Article. The Contractor hereby waives any evidentiary privilege, if any is applicable, that may attach to said claim and otherwise render it inadmissible as evidence in a court of law.

2. If, after receiving the District's decision in response to the Contractor's written RFC narrative, the Contractor still considers the Work required of it to be outside the requirements of the Contract Documents, it shall notify the District by submitting a written notice of potential claim within seven (7) calendar days after receiving the District's decision.

3. Within thirty days of receiving the District's decision in response to the Contractor's written RFC narrative, the Contractor shall submit a claim with all the documentation required by Article 2.07C and 2.07D. The Contractor hereby agrees that failure to provide written notice of potential claim to the District within seven (7) calendar days, and all required documentation within thirty (30) calendar days, will result in the Contractor waiving its right to additional compensation and time pertaining to said claim.

4. Upon receipt of the Contractor's claim and all documentation required by Article 2.07C and 2.07D, the District will review said claim and render a final decision in writing.

C. Certification:

1. The Contractor, under penalty of perjury, shall submit with the claim its and Subcontractors' certification that:
   a. The claim is made in good faith.
   b. Supporting data are accurate and complete to the best of the Contractor's and/or Subcontractor's knowledge and belief.
   c. The amount requested accurately reflects the Contract adjustment for which the Contractor believes the District is liable.
   d. That any privilege, if any is applicable, that would prevent the claim or its contents from being admitted as evidence in any judicial or quasi-judicial forum, is waived by the contractor and any party involved in the presentation of the claim.

2. If the Contractor is an individual, the certification shall be executed by that individual.
3. If the Contractor is not an individual, the certification shall be executed by an officer or general partner of the Contractor having overall responsibility for the conduct of the Contractor's affairs.

4. If a false claim is submitted, it will be considered fraud and the Contractor will be subject to damages and criminal prosecution.

5. In regard to any claim or portion of a claim for Subcontractor work, the Contractor shall fully review said claim and certify said claim, under penalty of perjury, to have been made in good faith.

6. The Contractor hereby agrees that failure to furnish certification as required hereinbefore will result in the Contractor waiving its right to the subject claim.

D. Claim Format:

1. The Contractor shall submit the claim documentation in the following format:
   a. Summary of claim merit and quantum plus clause under which the claim is made.
   b. List of documents relating to claim:
      1) Specifications.
      2) Drawings.
      3) Clarifications/Requests for Information/Requests for Change.
      4) Schedules.
      5) Other.
   c. Chronology of events and correspondence.
   d. Analysis of claim merit.
   e. Analysis of claim cost.
   f. Cover letter and certification.
   g. Attachments:
      1) Specifications.
      2) Drawings.
      3) Clarifications/Requests for Information/Requests for Change.
      4) Correspondence.
      5) Schedules.
      6) Other.

ARTICLE 3 - CONTRACTOR'S RESPONSIBILITIES

3.01 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS
A. The Contract Documents are diagrammatic and do not show every detail but show the purpose and intent only, and the Contractor shall comply with their true intent and meaning, taken as a whole, and shall not avail itself of any manifest error, omission, discrepancy or ambiguity which appear in the Contract Documents, instructions or work performed by others.

B. The Contractor shall verify all dimensions and determine all existing conditions that may affect its Work adequately in advance of the Work to allow for resolution of questions without delaying said Work, and shall be responsible for the accuracy of such dimensions and determinations.

C. Using a uniformly standard RFI form, the Contractor shall notify the District in writing immediately upon discovery of errors, omissions, discrepancies or ambiguities, and a clarification will be issued as to the procedure to be followed.

D. If the Contractor proceeds with any such Work without receiving such clarification, it shall be responsible for any and all resulting damage, including but not limited to that occasioned by delay, and defects.

E. The Contractor during the progress of the Work, shall review the appropriate portions of the Contract Documents a minimum of thirty (30) days, or as required to maintain progress of the Work, prior to commencement of the related Work for the expressed purposes of checking for any manifest errors, omissions, discrepancies or ambiguities. The Contractor shall not be entitled to any compensation for delays, disruptions, inefficiencies or additional administrative effort caused by the Contractor’s untimely review of the Contract Documents.

F. The Contractor shall be responsible for its costs and the costs of its subcontractors to implement and administer a Request for Information (RFI) system throughout the Contract duration. Such costs shall include the distribution of RFIs to its subcontractors, subcontractor reviewing and posting of RFIs, and coordinating the clarification responses by its subcontractors. The Contractor shall be responsible for both the District and District’s administrative costs for answering its RFIs where the answer could reasonably be found by reviewing the Contract Documents.

3.02 SUPERVISION AND CONSTRUCTION PROCEDURES

A. The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible for and have control over all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.

B. The Contractor shall supervise and coordinate the Work of its subcontractors so that information required by one will be furnished by others involved in time for incorporation into the Work in the proper sequence and without delay of materials, devices, or provisions for future Work.

C. Whenever the Work of a subcontractor is dependent upon the Work of other subcontractors or contractors, then the Contractor shall require the subcontractor to:

1. Coordinate its Work with the dependent work.

2. Provide necessary dependent data and requirements.

3. Supply and/or install items to be built into dependent work of others.

4. Make provisions for dependent work of others.
5. Examine dependent drawings and specifications and submittals.

6. Examine previously placed dependent work.

7. Check and verify dependent dimensions of previously placed Work.

8. Notify Contractor of previously placed dependent work or dependent dimensions which are unsatisfactory or will prevent a satisfactory installation of its Work.

9. Not proceed with its Work until the unsatisfactory dependent conditions have been corrected.

D. The Contractor shall immediately comply with any and all orders and instructions given in accordance with the terms of this Contract by the District, but nothing herein contained shall be taken to relieve the Contractor of any of its obligations or liabilities under this Contract, or of performing its required detailed direction and supervision.

E. The Contractor shall at all times from the issuance of the Notice to Proceed until Project Completion of the herein specified Work and during the various guarantee periods, permit the District, its agents and authorized representatives to visit and inspect the Work, the materials and the manufacture and preparation of such materials and subject them to inspection and rejection if the Work does not conform to the requirements of the Contract Documents. This obligation shall include maintaining proper facilities and safe access for such inspection. Where the Contract requires Work to be tested and/or inspected, it shall not be covered up until inspection and approval by the District, and the Contractor shall be solely responsible for notifying the District at least two (2) working days prior to performing such Work, so that necessary arrangements for inspection and testing can be made. Should any such Work be covered without such test and approval, it shall be uncovered and recovered at the Contractor's expense, regardless of whether or not the Work is in conformance.

F. With the exception of emergency or safety measures, no work shall be performed on Saturday, Sunday or legal holiday. Should any work become necessary during that time period, the Contractor shall give notice to the District of such desire and request and obtain its written permission at least two (2) working days prior to performing such Work, or such other period as may be specified, so that the District may make the necessary arrangement for testing and inspection.

G. If either concealed conditions or unknown physical conditions of unusual nature (different materially from those ordinarily encountered and generally recognized as inherent in the Work) are encountered below the surface of the ground or concealed in existing construction and which affect the performance of the Work of this Contract, the Contractor shall immediately notify the District of such conditions. The Contractor shall also inform the District as to how such conditions affect its Work and shall also recommend methods to overcome such conditions. The Contractor shall then wait for instructions in writing from the District prior to proceeding with the affected Work.

H. If the Contractor is notified that a clarification is forthcoming from the District, any Work performed before the receipt of same shall be coordinated with the District to minimize the effect of the clarification on Work in progress. Any Work performed after notification but before receipt of clarification and not so coordinated shall be at the Contractor's risk.

I. Material, Work or workmanship which, in the opinion of the District, or its authorized representatives does not conform to the Contract Documents, or is not equal to the samples submitted to and approved by the District, or is in any way unsatisfactory or unsuited to the purpose for which it is intended, will be rejected. The Contractor shall bear the cost of correcting non-conforming Work. The Contractor shall make a close inspection of all materials.
as delivered, and shall promptly return all defective materials without waiting for their rejection by the District.

J. The Contractor shall remove all rejected material and Work, and all defective and non-conforming Work, from the site without delay. If the Contractor fails to remove such Work within forty-eight (48) hours after having been so directed by the District, the District may perform the removal and the cost of such removal shall be deducted from progress payments.

K. All defective and non-conforming Work discovered shall be corrected immediately by the Contractor, and any unsatisfactory materials shall be rejected, notwithstanding that they may have been overlooked by authorized inspection. Inspection of the Work shall not relieve the Contractor of any of its obligations to perform satisfactory Work as herein prescribed.

L. Failure or neglect on the part of the District or any of its authorized agents and/or representatives to condemn or reject defective and non-conforming Work or materials shall not be construed to imply acceptance of such Work or materials or waiver of any claim or right if it becomes evident at any time prior to Project Completion; neither shall it be construed as barring the District at any subsequent time from the recovery of damages or of such a sum of money as may be needed to build anew all portions of the Work in which fraud was practiced or improper materials or workmanship used whenever found.

M. The Contractor shall carry on the Work and adhere to the construction schedule required to be submitted under the requirements of the Contract Documents during all disputes or disagreements with the District. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the District and the Contractor may otherwise agree in writing.

N. The Contractor shall make and submit to the Division of the State Architect such verified reports as required by California Code of Regulations, Title 21, Section 36, and Title 24 Sections 4-336 and 4-343

3.03 LABOR AND MATERIALS

A. The Contractor shall employ only competent and skillful persons to perform the Work, and whenever the District shall notify the Contractor that any employee on the Work is, in the District's judgment, incompetent, unfaithful, disorderly or refuses to carry out the provisions of the Contract, such employee shall be removed from the Work.

B. In order that the District can determine whether the Contractor has complied or is complying with the requirements of the Contract, which are not readily enforceable by inspection, and test of the Work and materials, the Contractor shall upon request submit properly authenticated documents or other satisfactory proof of its compliance with such requirements.

C. Except in the event of emergency, no substantial field operations shall be performed outside regular working hours without prior notification to, and permission by, the District. Should the Contractor perform Work outside regular working hours, the District shall be compensated for all expenses in excess of those that would have been incurred had the work been performed during regular working hours. The Contractor will not be entitled to additional compensation for Work performed outside regular working hours except as otherwise expressly authorized in writing by the District prior to the performance of such overtime Work. Any additional compensation for such authorized overtime shall be limited to the direct cost of the premium portion of such authorized overtime.

D. Before ordering materials, equipment, or performing Work, the Contractor shall verify indicated dimensions. If a discrepancy exists, the Contractor shall notify the District of same immediately. The District will then clarify the intended design. The Contractor shall take field measurements required for the proper fabrication and installation of the Work in a timely
fashion in accordance with Article 3 herein. Upon commencement of any item of Work, the Contractor shall be responsible for dimensions related to such item of Work.

E. All materials and equipment shall be delivered, handled, stored, installed, and protected to prevent damage in accordance with best current practice in the industry, in accordance with manufacturers' specifications and recommendations, and in accordance with Contract Document requirements. The Contractor shall store packaged materials and equipment in their original and sealed containers, marked with the brand and manufacturer's name, until ready for use. The Contractor shall deliver materials and equipment in ample time to facilitate inspection and tests prior to installation. Damaged materials or equipment will be rejected.

F. Unless otherwise specified in the Contract Documents, the Contractor shall provide and assume full responsibility for all materials, equipment, labor, transportation, construction equipment, and machinery, tools, appliances, fuel, power, light, heat, telephone, water sanitary facilities and incidentals necessary for the provision, performance, testing, start-up, and completion of the Work.

3.04 WARRANTY

A. The Contractor warrants to the District that materials and equipment provided under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects and of the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents.

B. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by District's abuse, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

C. If required by the District, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.05 TAXES

A. The Contractor shall pay sales, consumer, use and other taxes, which are applicable during the performance of the Work or portions thereof provided by the Contractor. Payment shall apply to all such taxes, whether or not in effect when Bids were received.

B. Federal excise tax is not applicable to the Work, products and services supplied under the Contract.

1. The Contractor will be issued an exemption certificate on request.

3.06 PERMITS, FEES AND NOTICES

A. The Contractor shall pay all utility charges for temporary connections to the Work.

B. Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for all permits (other than approval by the Division of the State Architect), governmental fees (other than permanent utility service connection fees), licenses, and inspections (other than required and special inspections which are to be performed at the expense of the District to comply with prevailing laws and regulations) necessary for proper execution and completion of the Work.

1. The Contractor shall coordinate and obtain the permits.
2. The Contractor shall pay all temporary sewer connection fees under the provisions for Allowances in the General Requirements.

C. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the Work.

D. If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, and rules and regulations, it shall promptly notify the District in writing, and necessary changes shall be accomplished by appropriate Modification.

E. If the Contractor performs Work knowing, or should have know, it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the District and District, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs of correction.

F. The Contractor shall keep the Building Permit, with an approved set of plans and specifications at the job site readily available for inspection during regular hours for the duration of the Contract.

G. The Contractor shall arrange for all required inspections and special inspections with the appropriate District agency and notify the District, so that a District representative will be present at these inspections.

H. The Contractor shall be responsible for submitting all shop drawings, product data, and manufacturer's certificates to the appropriate District agency for approval as may be required under the conditions of applicable permits (e.g., Division of the State Architect).

3.07 SUPERINTENDENTS

A. The Contractor shall at all times be represented at the site by a full time and English speaking project manager or the superintendent whom it has authorized in writing to make decisions, receive and carry out any instructions that may be given to it or them by the District, and the Contractor will be held liable for the faithful observance of such instructions. Prior to the issuance of Notice to Proceed, the Contractor shall inform the District, in writing, of the names, addresses and telephone numbers of its key personnel whom it has authorized to act as its representatives at the site and who are to be contacted in case of emergencies on the job during non-working hours, including Saturdays, Sundays and Holidays.

B. The District reserves the right to approve the Contractor's project manager, assistant project manager, general construction superintendents, project coordinator, project engineers, project schedulers, and foremen, and the right to reject them at any time at the District's sole discretion. The District also reserves the right to refuse replacement of the Contractor's superintendents and foremen if it believes such replacement will negatively affect the Contract.

3.08 CONSTRUCTION AND SUBMITTAL SCHEDULES

A. Basic Progress Schedule:

1. Unless a Computerized CPM Progress Schedule as described in Paragraph B below is required by the Instructions to Bidders, Contractor shall submit a Basic Progress Schedule within seven (7) days after Notice to Proceed and before starting any work.

2. The Basic Progress Schedule shall be in the form of a time scaled bar chart (Gantt Chart) consistent in all respects with the time and order of Work required by the Contract, in sufficient detail to show the chronological relationship of all activities of the Project.
including but not limited to planned starting and completion dates of various activities, submittal of shop drawings, procurement of materials and equipment, and scheduling of deliveries and equipment.

3. The basic progress schedule shall be updated once a month or more frequently if requested by the District.

4. Owner will review the Basic Progress Schedule or revision for conformance with Contract requirements. Within seven (7) days after receipt, Owner will accept the Basic Progress Schedule as feasible or will return it with comments, in which case Contractor shall use Owner's comments and revise the Basic Progress Schedule accordingly.

B. Computerized CPM Progress Schedule

1. The Contractor shall provide a computerized CPM Schedule if required by the Division 1 of the specifications. The Contractor shall use Primavera Project Planning Software or Microsoft Project and shall provide the Owner with file on 3 1/2" IBM compatible computer disk. If the contractor wishes to use any other scheduling software, approval must be first obtained from the owner. At its sole discretion the owner reserves the right to reject the use of any software other than the two stated here. The time of completion of the Project and each milestone shall adhere to the start and finish times in the Notice to Proceed, unless the Contractor requests and Owner approves in writing an earlier time of completion. Approval of such request shall be entirely at the Owner’s discretion. If an earlier time of completion is approved, liquidated damages will be accessed after the new date of completion.

2. A schedule orientation meeting shall be held 14 days after the Notice to Proceed where the Contractor will be prepared to discuss the schedule, sequence of operations, cost, manpower, and equipment loading methodology. This meeting shall be attended by the Contractor’s Project Manager and Scheduler, Owner’s Representative, Architect (if desired), other Contractor’s key personnel, major Subcontractors and Suppliers. This meeting will also discuss the monthly update requirements, reports, schedule revisions, cost breakdowns, data exchange, etc.

3. Within thirty (30) days after Notice to Proceed, the Contractor shall submit one (1) reproducible, three (3) prints, and 3-1/2" computer disks for Primavera Project Planning or Microsoft Project format of the detailed schedule. The Contract Schedule shall:

a. Provide a time scaled CPM diagram in a format acceptable to the owner. A schedule may be rejected if in Owner's opinion any item is unbalanced.

b. Provide a list identifying all imposed constraints.

c. Indicate activity calendars used.

d. Identify as a separate activity procurement of major equipment, date of ordering through receipt and inspection at the project site.

e. Identify as separate activities Owner furnished materials and equipment.

f. Identify as separate activities all submittals.

g. Detail activities for each milestone to show the plan for completion of the work for each milestone within the time specified.

h. Show dependencies (or relationships) and logic ties between activities. Open-ended activities will not be permitted.

i. Show the major equipment required for perform each activity, if applicable.

j. Show a responsibility code for each activity corresponding to the subcontractor responsible for performing the work.
k. Show the number of days needed for completion inspections, completion of punch list items, and final clean-up for the work associated with each milestone within the Contract time limit.

l. Show interface flag points of coordination with the work of other Contractors engaged by Owner at the site.

5. No activity on the schedule shall have a duration longer than fifteen (15) days, with the exception of submittals, fabrication, procurement and punch list activities, unless otherwise approved by Owner. Activity duration shall be the total number of actual days required to perform the activity including consideration of weather impact on completion of that activity. If an item of work is divided into two or more activities to meet maximum duration requirement, this division of work shall be done in a manner that is logical to the progress of the work (and not by dividing the work into percentages). Do not schedule activities that are dependent on submittal approval and/or material delivery to start earlier than the expected approval or delivery dates.

6. No more than twenty five percent (25%) of construction activities are to be considered as critical or near critical (having 10 days or less of float). Activities related to the procurement of materials and equipment (submit shop drawings, review shop drawings, manufacture of equipment, and shipping) shall not be included in the calculation of the allowable percentage of critical activities as defined above. The work shall be planned so that the schedule will reflect a true critical path, which will run through the start and finish of actual work activities. Critical path shall not run through activity lags and leads.

7. The contract schedule shall represent a practical plan to complete the work within the contract time, be suitable for monitoring progress of the work, and be in sufficient detail to demonstrate adequate planning of the work.

8. The schedule shall allow for Special District events where the District will not allow noisy, dusty or disruptive construction work. These specific dates, if any, are identified in Division 1 of the specifications.

9. Schedules shall include and allow adequate duration for work performed by District (inspections, District-furnished equipment, work by other contractors that interface with this contract).

10. District’s acceptance of or review comments about schedule or scheduling data shall not relieve the contractor from its sole responsibility to plan for, perform, and complete the work within the contract time. Failure of District to discover errors or omissions in schedules it has reviewed, or to inform contractor or subs that they are behind schedule, or to direct or enforce procedures for complying with contract schedule shall not relieve the contractor from its sole responsibility to plan for, perform, and complete the work within the contract time.

11. The Owner will review this schedule when submitted and return to the Contractor within fifteen (15) days. The Contractor shall revise the schedule and resubmit within seven (7) days.

12. Once this schedule is modified to be acceptable to the Owner, the schedule becomes the Accepted Contract Schedule. If the Contractor desires to change the methods or scheduling of work, the Contractor must submit the request in writing. This request will be accepted or rejected by the Owner. This change may be tracked by a change order depending upon the severity of the change. If any critical activity falls more than seven (7) days behind schedule, Contractor must submit a recovery plan within seven (7) days.
13. The Contractor shall submit a monthly update to the schedule with the payment application. The payment application will not be processed for payment without a satisfactory monthly updated schedule. The monthly update will include the Contractor’s estimated percentage completion for each activity and actual start/finish dates. The update shall also include a narrative report describing any changes made to schedule logic, the effects of change orders identified and reflected in the updated schedule, and any other problem areas including a recovery plan.

14. A Short Interval Schedule (SIS) will be submitted weekly and will be discussed in progress meetings. The interval shall be three weeks: this week and two weeks ahead. The SIS must include the status of milestones and completion dates.

15. The Owner may request any report formats of the schedule at any time.

C. The Contractor shall prepare, submit and keep current, for the District’s information, a schedule of submittals which is coordinated with the Contractor’s construction schedule in accordance with the General Requirements and allows the District reasonable time to review submittals.

3.09 DOCUMENTS AND SAMPLES AT THE SITE

A. The Contractor shall maintain at the site for the District one (1) record copy of the Drawings, Specifications, Addenda, Change Orders, RFIs, and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals, all in accordance with the General Requirements. These shall be available to the District representative and shall be delivered to the District prior to Project Completion.

3.10 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, OPTIONS, AND SUBSTITUTIONS

A. Product Options and Substitutions:

1. Summary
   a. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.
   b. Procedures are described for requesting substitutions of unlisted materials lieu of materials named in Specifications or approved for use in addenda.
   c. Within thirty five (35) days after the date of Notice to Proceed, submit to the District a complete list of major products, which are proposed for substitution, with name of manufacturer, trade name, and model.
   d. List products by Specification Section number and title.

2. Product Options
   a. For products indicated or specified only be reference standard, select any product meeting such standard.
   b. For products indicated or specified by naming one or more projects or manufacturers, select products of any named manufacturer, which meet the specified requirements.
   c. For a product or manufacturer, which is not specifically named, submit request for substitution.
d. Where terms "or equal," "or approved equal," or similar references are made, submit request for substitution for product or manufacturer not specifically indicated or named in Specifications.

e. For products indicated or specified by naming only one product and manufacturer, followed by the words "no substitution allowed," there is no option.

3. Substitutions, General

a. Within a period of thirty five (35) days after date of Notice to Proceed, the District will consider formal requests for substitutions from the Contractor only under the following conditions:

1) The burden of proof as to the type, function, and quality of any substitute material or equipment shall be upon the Contractor.

2) The District will be the sole judge as to the type, function, and quality of any substitute material or equipment, and the District’s decision shall be final.

3) The District may require the Contractor to furnish at the Contractor’s expense additional data about the proposed substitute.

4) The District may require the Contractor to furnish at the Contractor’s expense a special performance guarantee or other surety with respect to any substitute.

5) Acceptance by the District of a substitute item proposed by the Contractor shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.

6) The Contractor shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the Contractor’s Work, the Work of its subcontractors of all tiers, and of other contractors, and shall effect such changes without cost to the District.

a) In the event of monetary benefit, seventy-five percent (75%) of the amount of the benefit shall go to the District and twenty-five percent (25%) shall go to the Contractor.

7) After the thirty five (35) day period, requests will be considered only when a product becomes unavailable due to no fault of Contractor. In such cases, all of the provisions of this Section shall still apply.

8) Costs for reviewing substitution requests submitted after thirty five (35) days shall be deducted from progress payments due the Contractor. Costs shall include District’s cost, and Architect’s and Architect’s Sub consultants’ fees.

a) There will be no cost to the Contractor for reviewing substitution requests after thirty five (35) days in cases where the product has become unavailable due to no fault of Contractor.

b. Substitutions will not be considered for acceptance when:
1) They are indicated or implied on submittals without a formal request from Contractor.

2) They are requested directly by a subcontractor or supplier.

3) Acceptance will require substantial revision of Contract Documents.

c. Substitute products shall not be ordered without written acceptance of the District.

d. The District will determine the acceptability of proposed substitutions and reserves the right to reject proposals due to insufficient information.

e. Substitutions required by inability to obtain materials specified will not be acceptable grounds for increase in Contract Sum or time of completion of Contract.

f. Notify District during the thirty five (35) day period after Notice to Proceed where use of products indicated or specified would delay completion of Contract.

4. Contractor’s Representation

a. Requests constitute a representation that Contractor:

1) Has investigated the proposed substitution and determined that it is equal to or superior in all respects to the product indicated or specified.

2) Will furnish the same guarantee/warranty or bond for the proposed substitution as for the product indicated or specified.

3) Will coordinate the installation of an accepted substitution into the Work, and make such other changes as required to complete the Work in accordance with the Contract Documents and applicable regulatory requirements.

4) Waives claims for additional costs associated with the substitution, which may subsequently become apparent.

5) Will pay costs of changes to Contract Documents required by accepted substitutions.

5. Procedures for Proposing Substitutions

a. Requests for acceptance of a substitution shall be submitted to the District in written form and accompanied by sufficient information to enable proper evaluation.

b. Submit separate request for each product and support each request with:

1) Product identification with manufacturer’s literature and samples where applicable.

2) Name and address of similar projects on which product has been used, and date of installation.

3) Complete technical data, including drawings, manufacturer’s specifications, material safety data sheets (MSDS), costs, samples and test reports of the product proposed for substitution.

   a) Submit additional information, if required by the District
4) Data similar to that specified for the product for which substitution is proposed.

5) Submit data relating to changes in construction schedule.

6) Complete breakdown of costs, indicating the amount to be deducted from the Contract Sum, if the proposed substitution is accepted.

7) Signed statement that the proposed substitution is in full compliance with the Contract Documents and applicable regulatory requirements.

8) List of other Work, if any, which may be affected by the substitution.
    a) Contractor shall be responsible for the effect of a substitution upon related Work, and pay the additional costs generated thereby, including the cost of the Architect's and consultants' additional services associated therewith.

9) Information on availability on maintenance service, and source of replacement materials.

10) Sample of manufacturer's standard form of guarantee or warranty for the proposed substitution.

11) Where required, itemize comparison of proposed substitution with product specified and list significant variations.

12) Indicated accurate cost data comparing proposed substitution with product indicated or specified and amount of net change in Contract Sum.
    a) Include costs to other contractors and costs for revisions to Drawings, Details, or Specifications.

b. Environmental Concerns:

1) Project has been designed with special considerations for indoor air quality and environmental conditions including attempts to limit amounts of toxic chemicals, materials, and gases in building.

2) Submittal of substitutions for items listed below shall provide specific information regarding environmental impact of substitutions related to toxic chemicals, materials, and gases.

3) Particleboard and Medium Density Fiberboard: Particleboard and medium density fiberboard are not acceptable as a substitution for any specified products.

4) Adhesives: Low-emitting adhesives have been specified; proposed substitutions shall be required to provide substantiating test reports indicating compliance with indoor air quality concerns.
    a) Submissions shall include all chemical components and their proportions in complete product.
b) Include listing of all substances used in manufacture of product and identified in sample of air emitted from products that appear on any of the following lists.

1) United States Environmental Protection Agency (EPA) Carcinogen Assessment Group (CAG) list of carcinogens.
2) Clean Air Act Sections 109, 111, and 112.
3) The National Toxicology Program’s latest published “Annual Report on Carcinogens.”
4) IARC Human Carcinogens (Groups 1, 2A, and 2B).
5) California Proposition 65 Carcinogens.
6) California Proposition 65 Reproductive Toxins.

c) Provide detection limits of analytical system for each relevant substance along with general information on sensitivity of analytical system.

d) Include complete laboratory reports of any emissions tests conducted by the manufacturer or any contractor, agent, or other laboratory for the manufacturer, and any other evaluations of the impacts of the product’s emissions on indoor air.

6. District’s Review of Proposed Substitutions

a. The District will review requests for substitutions and notify the Contractor in writing of its decision to accept or reject proposed substitutions. It shall be understood that:

1) The District will use its own judgment in determining whether or not a product or item of equipment proposed is equal for the purpose intended quality to that specified.

2) The decision of the District on all such questions of equality shall be final.

3) No claim of any sort shall be made or allowed against the District, the Architect, Architect’s sub consultants, or any of their agents, employees, or sub consultants as a result of any final decision accepting or rejecting any proposed product or equipment.

b. The District at its sole discretion will determine the acceptability of proposed substitutions, and its determination shall be final.

c. Acceptance of a proposed substitution shall not relieve the Contractor from responsibility for the proper execution of the Work and the other requirements of the Contract Documents.

d. If a proposed substitution is not accepted, use the product originally specified or indicated.

B. Shop Drawings, Product Data and Samples:

1. The Contractor shall review, approve, stamp, and submit to the District Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the accepted Submittal Schedule specified in the General Requirements. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.
2. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples and other submittals until the respective submittal has been received, reviewed by the Architect and returned by the Architect. Such Work shall be in accordance with approved submittals. The Contractor is solely responsible for delays or disruptions to the Work caused by inadequate, uncoordinated, incorrect or late submittals. All submittals shall be submitted within thirty-five (35) days after Notice to Proceed and shall be phased to support the Project Schedule as well as to allow Architect maximum review time. Contractor schedule should allow at least two (2) weeks for Architect's review of submittals. More time shall be allowed for particularly complex submittals or if a "substitution" will be submitted which may result in a re-submittal.

3. By approving and submitting Shop Drawings, Product Data, Samples and other submittals, the Contractor represents that it has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals for compliance with the Contract Documents and for coordination of the Work indicated in the submittal and with adjacent Work.

4. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples and other submittals unless the Contractor has specifically informed the Architect in writing attached to the submittal of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the District's approval thereof. Any deviation shall also be indicated on such Shop Drawing, Product Data, Sample or related submittal.

5. The Contractor shall direct specific attention, in writing, for resubmitted Shop Drawings, Product Data, Samples and other submittals, to revisions other than those requested by the Architect on previous submittals.

6. Where a shop drawing or sample is required by the Specifications, any related Work performed prior to the Architect's review and approval of the pertinent submittal shall be at the sole expense and responsibility of the Contractor.

7. Number of copies submitted by the Contractor shall be:

   1) Shop Drawings
      1 sepia reproducible
      3 blue line prints

   2) Catalogue cuts, brochures, calculations, etc.: 7 minimum

   3) Samples: 7 each as directed

8. After review of submittals by the Architect (or the Architect's Consultants), submittals will be returned to the Contractor, indicating one of the following actions:

   a) "Reviewed - No Exceptions Taken": No corrections or re-submissions required.

   b) "Reviewed - Make Corrections Noted": No re-submission required. Fabrication may proceed on the basis that corrections noted are incorporated in the work. If the Contractor cannot comply or
disagrees with the corrections noted, he shall revise the submittal and resubmit before fabrication.

c) "Revise and Resubmit": Re-submission required. Fabrication shall not proceed. Revise submittal as indicated.

d) "Rejected": Re-submission required. Fabrication shall not proceed. Revise in accordance with the Contract Documents.

9. The Architect will return the reproducible copy of each shop drawing, two each of copies of catalogue cuts, brochures, calculations, etc. (or as many additional copies submitted by the Contractor over the required eight (8) minimum) and two (2) each of samples. The Contractor is responsible to obtain and pay for additional copies required for distribution to subcontractors, suppliers and the like. The Contractor shall transmit one copy of all submittals marked "Reviewed - No Exceptions Taken" and "Reviewed - Make Corrections Noted" to the Contractor’s Field Office.

3.11 USE OF SITE

A. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

B. Notwithstanding the designation of Contract limits or the indication of temporary fences or barricades, the provisions of the Contract Documents governing certain portions or phases of the Work may require that certain operations be carried out beyond such designated limits.

C. Pumping, draining and control of surface and ground water shall be carried out so as to avoid endangering the Work or any adjacent facility or property, or interrupting, restricting or otherwise infringing or interfering with the use thereof.

D. The Contractor shall assume full responsibility and shall promptly settle all claims for any damage to any such areas within the Contract limits, or to any adjoining areas of the owners or occupants thereof, resulting from the performance of the Work.

3.12 CUTTING AND PATCHING

A. The Contractor shall be responsible for all cutting, fitting, and patching of its Work as specified in the General Requirements that may be required to make its several parts fit together or to receive the work of other contractors shown upon, or reasonably implied by, the Contract Documents for the completed Work.

B. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the District or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the District or a separate contractor except with written consent of the District. The Contractor shall not withhold from the District the Contractor’s consent to cutting or otherwise altering the Work.

3.13 CLEANING UP

A. The Contractor shall keep the premises and surrounding area, including public areas immediately adjacent to the site such as temporary pedestrian walkways and sidewalks, free from accumulation of waste materials, rubbish, and excess materials.

1. The Contractor shall perform such clean up and removal regularly and as often as necessary.
2. At completion of the Work the Contractor shall remove from and about the Project site waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

B. If the Contractor fails to clean up as provided in the Contract Documents, the District may provide twenty-four (24) hour written notice to the Contractor and clean up, the cost of which shall be deducted from the amount due the Contractor under the Contract.

3.14 ACCESS TO WORK

A. During the performance of the Work, the District and its authorized representatives or any other persons deemed necessary by any of them acting within the scope of the duties entrusted to them, may at any time, and for any purpose, enter upon the Work, the shops where any part of such Work may be in preparation, or the factories where any materials for use in the Work are being or are to be manufactured. The Contractor shall furnish safe facilities therefore, and shall make arrangements with manufacturers to facilitate inspection of their processes and products to such extent as the District's interest may require.

3.15 ROYALTIES AND PATENTS

A. All fees or claims for any patented invention, article or arrangement that may be used upon or in any manner connected with the performance of the Work or any part thereof, shall have been included in the Contract Sum. The Contractor shall save, defend, hold harmless, and fully indemnify the District and all its officers and employees connected with the Project, the District Architect, other parties designated in Article 11, and all of their officers, agents, members, employees, authorized representatives, or any other persons deemed necessary by any of them acting within the scope of the duties entrusted to them, from all damages, claims for damage, costs, or expenses in law or equity, including attorney's fees, that may at any time arise or be set up for any infringement of the patent rights, copyright or trademark of any person or persons in consequence of the use by the District, or any of its officers, agents, members, employees, authorized representatives, or any other persons deemed necessary by any of them acting within the scope of the duties entrusted to them, of articles to be supplied under the Contract and of which the Contractor is not the patentee or assignee or has not the lawful right to sell the same. This is in addition to all other hold harmless and indemnity clauses in the Contract Documents.

3.16 INDEMNIFICATION

A. Consistent with California Civil Code Section 2782, the Contractor shall assume the defense of, indemnify and hold harmless the District and all its officers and employees connected with the Project, the District's Representatives, other parties designated in Article 11, and all of their officers, agents, members, employees, authorized representatives, or any other persons deemed necessary by any of them acting within the scope of the duties entrusted to them, from all claims, suits, actions, losses and liability of every kind, nature and description, including but not limited to attorney's fees, directly or indirectly arising out of, connected with or resulting from the performance of the Work. Such duties to release and save District harmless shall apply to liability incurred or claimed to have been incurred as a result of negligence, regardless of responsibility for such negligence, including the active negligence of the District, the District Representatives, other parties designated in Article 11, and all of their agents, officers, members, employees, authorized representatives or any other persons deemed necessary by any of them. This indemnification shall not be valid in the instance where the loss is caused by the sole negligence, willful neglect or intentional tort of any person-indemnified hereinafter.

B. In the event that the Contractor and its insurance carrier(s) in bad faith refuse to negotiate and compensate a third party or parties for property damage or personal injuries which arise
out of the Contractor's performance of the Work, the District shall have the right to estimate the amount of damages and to pay the same, and the amount so paid shall be deducted from the amount due the Contractor under this Contract; or an appropriate amount shall be retained by the District until all suits or claims for said damages shall have been settled or otherwise disposed of and satisfactory evidence to that effect shall have been furnished to the District.

3.17 COMPUTERIZED JOB COST REPORTING SYSTEM

A. The Contractor and its subcontractors with contracts over $1,500,000 shall maintain computerized monthly job cost reporting systems which shall be adequate to meet the documentation and reporting requirements of the District. Such job cost reporting systems shall comply with acceptable cost accounting practices and principles and shall conform to acceptable standards, procedures and guidelines used in the construction industry for projects similar to the Work.

B. Such job cost reporting system's format and configuration shall follow the general format, which is consistent with the Contractor's original unaltered Contract bid estimate of the costs. Original Project budgets for each division of the cost code accounts shall be traceable to the estimate in the event of an audit.

C. The District's minimum requirements are as follows:

1. The system capability shall provide a status of the cost for the Project on a monthly and cumulative basis.

2. The system shall provide a comparison analysis of the original budgeted costs, actual costs, remaining cost to complete and projected cost to complete, including variances, if any.

3. Adjustments to the original budgets shall be identified and traced separately including adjustments for changes in the Work (e.g., potential change orders, change orders, and disputes/claims).

D. In addition to the District's other rights under the Contract Documents, the District shall have the right to review the Contractor's computerized job cost reports upon notice to the Contractor. Failure to maintain computerized monthly job cost reports in accordance herewith shall constitute a waiver by the Contractor of its rights to seek additional compensation for delay, disruption, loss of productivity and total cost claims.

ARTICLE 4 - (Not Used.)

ARTICLE 5 - SUBCONTRACTORS

5.01 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

A. Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within five (5) working days after receiving bids, shall furnish in writing to the District, in addition to those in the Subcontractor's Listing Form, the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each portion of the Work including lower tier Subcontractors. The District will promptly notify the Contractor in writing stating whether or not the District, after due investigation, has reasonable objection to any such proposed person or entity.

B. The Contractor shall not contract with a proposed person or entity to which the District has made reasonable and timely objection.
C. If the District has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the District has no reasonable objection. The District shall not be responsible for added costs, if any, of the Contractor retaining another person or entity.

5.02 SUBCONTRACTOR RELATIONS

A. By appropriate agreement the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the District. Each subcontract agreement shall preserve and protect the rights of the District under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. The Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

B. The Contractor shall require that each Subcontract (including, but not limited to contracts for provision of services, supply of goods, lease of equipment or tools, or labor) contain the following provision:

"Subcontractor does hereby release Contractor and the District, and save Contractor and the District harmless, from and against all claims and liabilities of every nature (including but not limited to injury to or death of Subcontractor's employees, injury or damage to property or persons, attorneys' fees, and court costs) directly or indirectly arising from the performance of this agreement, or, arising out of the failure of Subcontractor to comply with the requirement of the Subcontractor to provide a safe place to work (including as required by sections 3300, 6401 and 6406 of the California Labor Code) and from any claims, loss, damage, injury, death or liability however caused or incurred, including injury to or death of Subcontractor's employees, resulting directly or indirectly from the nature of the work or provision of supplies or rental of equipment or tools covered by this agreement. Such duties to release and save Contractor and the District harmless shall apply to liability incurred or claimed as a result of negligence, regardless of responsibility for such negligence, including the active negligence of the Contractor or the District, provided; however, that nothing in this agreement purports to or should be understood to provide for indemnity of Contractor or the District for Contractor's or the District's sole negligence or willful misconduct."

C. The Contractor agrees to assign the above-described indemnification rights to the District upon the occurrence of the following events:

1. The making of any claim, institution of any proceeding to recover damages or establish liability as to the District, or the notification of an intent to bring any claim as against the District for any loss, damage, injury, or relief from conditions arising out of or in anyway related to the Work; and

2. Written demand from the District to the Contractor for assignment of the express indemnification rights contained in the Subcontracts or other contracts for the provision of services, supply of goods, lease of equipment or tools, or labor.

5.03 CONTINGENT ASSIGNMENT OF SUBCONTRACTS
A. Except as otherwise provided herein, each subcontract agreement for a portion of the Work is assigned by the Contractor to the District provided that:

1. assignment is effective only after termination of the Contract by the District for cause pursuant to Article 14 of these General Conditions, and only for those subcontract agreements which the District accepts by notifying the Subcontractor in writing; and

2. assignment is subject to the prior rights, if any, of the surety, obligated by the bond provided under the Contract.

ARTICLE 6 - CONSTRUCTION BY DISTRICT OR BY SEPARATE CONTRACTORS

6.01 DISTRICT'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

A. The Contractor is alerted to the Project conditions of the areas in which work will be performed under the Contract. Certain governmental departments, public or private utility companies, and other contractors employed by the District may be working simultaneously with and in the vicinity of the Contractor's work areas, and the District may award other contracts which may similarly affect the Contractor's work.

1. Utility Relocation Work: The Contractor shall cooperate fully with all utility forces of the District or forces of other public or private agencies engaged in relocating, altering, or otherwise rearranging of any facilities which interfere with the progress or proper completion of the Work, and shall schedule the Work so as to minimize interference with said relocating, altering, or other rearranging of facilities.

B. When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the contractor who executes each separate District/Contractor Agreement.

C. The District reserves the right to perform other or additional work, within or adjacent to the limits of work specified at any time by the use of other forces or contractors. In the event that another contractor, in the course of performing work on behalf of the District, gives the Contractor written notice concerning work to be performed at the location(s) where the Contractor is already performing Work, and if the District grants approval, the Contractor shall fully cooperate with said contractor and shall schedule and coordinate its Work with the work of the other contractor and shall assume the following mutual responsibilities at no additional cost to the District.

1. The Contractor and the other contractor shall both execute identical agreements mutually indemnifying each other from any loss, damage, or injury that may be incurred as a result of the performance of work by the other while both are performing work in these areas.

2. The Contractor and the other contractor shall each add the other as an additional insured under their respective liability policies.

3. The party seeking to use portions of the construction site of the other to perform its work shall pay all direct costs incurred by the other party to accommodate its operations.

4. If the Contractor claims that delay or additional cost is involved because of such action by the District, the Contractor shall make such claim as provided elsewhere in the Contract Documents.

D. The District shall not be a party to any of the agreements between the Contractor and the other contractor and shall have no liability to the other party with regard to the lack of
coordination and cooperation or the inability of a party to obtain work areas from the other party. The Contractor agrees to indemnify and hold harmless the District for any claims or losses that it or the other contractor may incur as a result of their inability to successfully negotiate the joint use of property under the control of one of the parties.

6.02 MUTUAL RESPONSIBILITY

A. The Contractor shall afford all such other contractors reasonable opportunity for storage of their materials, shall ensure that the execution of its Work properly connects and coordinates with work of all other pertinent contractors, and shall cooperate with said other contractors to facilitate the progress of the Work in such a manner as the District may direct.

B. Notice of Conflicting Conditions: Where the Contractor's Work is associated with that of another contractor, the Contractor shall examine the adjacent work and report in writing to the District any visible defect or condition preventing the proper execution of its Contract. If it proceeds without giving notice, the Contractor shall be held to have accepted the work or material and the existing conditions, and shall be responsible for any defects in its own Work consequent thereon, and shall not be relieved of any obligation or any guarantee because of any such condition or imperfection. This provision shall be included in any and all other contracts or subcontracts for Work to be performed where such a conflict could exist.

C. To the extent that any part of the Contractor's Work is to interface with work performed or installed by other contractors, the Contractor shall inspect and measure the in-place work and promptly report to the District any defect in such in-place work that will impede or increase the cost of the Contractor's interface unless corrected. The District 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 a default or omission in the Contract Documents, issue a change order. If the Contractor fails to measure, inspect and/or report defects that are reasonably discoverable, all costs of accomplishing the interface acceptably shall be borne by the Contractor. The foregoing does not apply to latent defects. The Contractor shall report latent defects in another contractor's work at any time such defects become known, and the District or its authorized representatives shall promptly thereafter take such steps as may be appropriate.

D. The Contractor shall notify the District in writing when another contractor on this Project fails to coordinate its work with the Work of this Contract as directed.

E. The Contractor shall suspend any part of the Work herein specified or shall carry on the same in such manner as may be specified or shall carry on the same in such manner as directed by the District when such suspension or prosecution is necessary to facilitate the work of other contractors or workers. No damages or claims by the Contractor will be allowed therefore other than an extension of the time as specified in this Contract for the completion of the Work. Such an extension will be for a period of time, as the District shall consider the Contractor to have been delayed in the Completion of the Work by reason of the work of other contractors or workers.

F. The Contractor shall prepare coordination drawings as necessary, as determined by the District, to satisfactorily coordinate and interface the Work of its Contract with the work of all other contracts thereby avoiding conflicts that may otherwise arise.

G. At any time during the progress of the Work, the District shall have authority to require the Contractor to attend any conference of any or all of the contractors engaged in the Work, and any notice of such conference shall be duly observed and complied with by the Contractor.

6.03 COORDINATION
A. If the District determines that the Contractor is failing to coordinate its Work with the work of other contractors as directed, the District may upon seventy-two (72) hour written notice:

1. Withhold any payment otherwise owed hereunder until the Contractor complies with the District's directions.

2. Direct others to perform portions of the Contract and charge the cost of Work against the Contract amount.

3. Terminate any and all portions of the Contract for the Contractor's failure to perform in accordance with the Contract.

6.04 DISTRICT'S RIGHT TO CLEAN UP

A. If a dispute arises among the Contractor, separate contractors and the District as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials, rubbish, and excess materials and equipment, the District may, after twenty-four (24) hour written notice, clean up and allocate the cost among those responsible as it determines to be just.

ARTICLE 7 - CHANGES IN THE WORK

7.01 ADDITIONS, DELETIONS AND REVISIONS

A. The District, before the date of Project Completion, may order additions, deletions, or revisions in the Work herein required, and the Contractor shall promptly comply with such orders and proceed with the work, which shall be performed under the applicable requirements of the Contract Documents. Such additions, deletions, and revisions will be authorized by a Contract Modification as defined in Article 1.03 of the Contract General Conditions.

B. Additions, deletions, and revisions, which result in a change in the Contract Sum or Contract Time, shall be effected by a written Contract Modification, which has been approved by the District. Those additions, deletions, and revisions which do not result in a change in the Contract Sum or Contract Time, shall be effected by a written directive from the District such as a response to a Contractor generated Request for Information. All addenda and change orders are subject to approval by the Division of the State Architect. See, the California Code of Regulations, Title 24, Part 1, section 4-338, under “Change Orders.”

C. Contract Modifications made pursuant to Article 7 of these General Conditions and extensions of Contract Time necessary by reason thereof, shall not in any way release any guarantees/warranties given by the Contractor pursuant to the provisions of the Contract Documents, nor shall such Contract Modifications relieve or release the sureties of bonds executed pursuant to such provisions. The sureties, in executing such bonds, shall be deemed to have expressly agreed to such Contract Modification and to any extension of time made by reason thereof. The Contractor shall be responsible for giving notice of any change affecting the Work, Contract Sum or Contract time, which is required by the provisions of any bond to be given to a surety.

7.02 CONTRACT MODIFICATION PROCEDURES

A. Initiation: Additions, deletions, and revisions may be initiated by either the Contractor or the District. Contractor initiated Contract Modifications shall be in the form of a Request for Change (RFC). Notice and procedure requirements for RFCs are addressed in Article 2.07 of these General Conditions. The District will initiate Contract Modifications by issuing a Proposed Change Order (PCO), which will include a detailed description of the proposed modification with supplementary or revised Drawings and Specifications and request a quotation of cost of such additions, deletions or revisions and time of completion from the
Contractor. The District reserves the right to order in writing such work arising from unforeseen or other anticipated conditions on a force account basis as provided in Paragraph 7.03 as may be determined by the District to be required for proper completion of the Work.

B. Cost Proposal Time Period: The Contractor shall submit a PCO cost proposal to the District within twenty one (21) calendar days upon receipt of the PCO. If the Contractor fails to submit a PCO cost proposal within twenty one (21) calendar days, or the price cannot be agreed upon, the District may issue a Unilateral Change Order instructing the Contractor to proceed with the proposed modification for subsequent inclusion in a Contractor Modification based on the District's estimate of the cost. All requests for time extensions pursuant to Paragraph 8.02 or claims for damages for delay caused by the District's processing of Contract Modifications will be reduced by the additional time in excess of that allowed for the Contractor to submit a cost proposal as provided hereinabove.

C. Cost Proposal Breakdown: The Contractor shall furnish two (2) copies of its cost proposal, and it shall include a complete itemized breakdown of labor, material, equipment, taxes, insurance, bonds, and markup for overhead and profit for both additions and deletions on a form supplied by the District. A complete itemized breakdown is also required for Subcontractor cost proposal on the same form as required for the Contractor. At a minimum, the following documentation shall be provided to support Contractor and Subcontractor computations: material quantities, and types of products; labor breakdown by trade classification, wage rates, and estimated hours; equipment breakdown by make, type, size, rental rates, and equipment hours; taxes, insurance and bonds; justification for any adjustment in Contract Time including a schedule analysis identifying critical schedule activities delayed by the PCO.

D. Contractor Overhead and Profit: The Contractor's profit and overhead shall be based on a markup calculation and not a margin calculation. The markup for overhead and profit on Contract Modifications will be determined as follows:

1. For Work performed by the Contractor, the markup shall be equal to fifteen percent (15%) of the direct cost as defined herein. Costs of tax and insurance shall not be marked up.

2. For Work performed by a Subcontractor, the Contractor markup shall be five percent (5%) of the direct cost of the Subcontractor and the Subcontractor markup shall be fifteen percent (15%) of his own direct cost. Costs of tax and insurance shall not be marked up.

3. For Work performed by a Sub-Subcontractor, the Contractor markup shall be five percent (5%) of the direct cost of the Sub-Subcontractor, the Subcontractor markup shall be five percent (5%) of the Sub-Subcontractor direct cost, and the Sub-Subcontractor markup shall be fifteen percent (15%) of his own direct cost. Costs of tax and insurance shall not be marked up.

4. All tiers lower than the Sub-Subcontractor shall have their markup included in the Sub-Subcontractor markup.

5. In all cases the total markup on the direct cost shall not exceed twenty five percent (25%). There shall be no compound markup.

The table below summarizes the allowable markups:

<table>
<thead>
<tr>
<th>Work Done By</th>
<th>Contractor</th>
<th>Sub</th>
<th>Sub-Sub</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>15%</td>
<td></td>
<td></td>
<td>15%</td>
</tr>
<tr>
<td>Sub-Contractor</td>
<td>5%</td>
<td>15%</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Sub-Sub-Contractor</td>
<td>5%</td>
<td>5%</td>
<td>15%</td>
<td>25%</td>
</tr>
</tbody>
</table>
E. Direct Cost Defined: Direct costs shall only include the basic wage rates for labor, labor burden, material and equipment required for the Contract Modification.

1. Labor rates will not be recognized when in excess of those prevailing in the locality and time the Work under Contract Modification is being performed. The costs for all supervision, including general superintendents and foreman, shall be included in the markup defined herein. Working foreman will be considered a direct cost if the individual is on the project site only installing Work under Contract Modification with no other work being performed at the time. A breakdown of the payroll rates for each trade used for Contract Modifications, shall be furnished to the District within 30 calendar days of the Contract Notice to Proceed.

2. Labor burden shall only include fringe benefits by governing trade organizations. No other costs will be included as labor burden.

3. Material costs directly required for the performance of the Contract Modification. Such costs may include the cost of transportation. If a trade reduction by an actual supplier is available to the Contractor, it shall be credited to the District. If the materials are obtained from a supplier or source owned wholly by or in part by the Contractor, payment thereof will not exceed the current wholesale price for the materials. The term “trade reduction” includes the concept of cash discounting.

   a. For general building construction, material shall be based on the most current Lee Saylor Book with a thirty percent (30%) reduction for material and labor figures.

   b. For concrete work, material and labor costs shall be based on the most current Lee Saylor Book.

   c. For electrical work, material costs shall be based on the most current Biddle Book, end column, with a ten percent (10%) reduction. Costs of all major equipment and/or material unlisted shall be based on vendor’s invoices. Copies of all invoices shall be provided as support documentation with each Contract Modification cost proposal.

   d. For mechanical work, material costs shall be based on the most current Trade Service Corporation Manual with a thirty percent (30%) reduction. Costs on all major equipment and/or material unlisted shall be based on vendor’s invoices. Copies of all invoices shall be provided as support documentation with each Contract Modification cost proposal.

4. Equipment Costs: The allowance for equipment costs (both rental as well as Contractor-owned equipment) shall be based on eighty (80) percent of the Association of Equipment Distributors (AED) Blue Book rental rates. Hourly, daily, weekly, or monthly rates shall be used, whichever is lower. Hourly rates including operator shall not be used. Unless otherwise specified, manufacturer’s ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rental rates.

   a. The actual time to be paid for equipment shall be the time that the equipment is in productive operation on the Work under Contract Modification. In computing the hourly rental of equipment, any time less than thirty (30) minutes shall be considered one-half (1/2) hour. No payment will be made for time while equipment is inoperative due to breakdown, or for non-workdays. In addition, the rental time shall not include the time required to move the equipment to and
from the project site. No mobilization or demobilization will be allowed for equipment already on site. If such equipment is not moved by its own power, then loading and transportation costs will be paid in lieu of rental time thereof. However, neither moving time nor loading and transportation costs will be paid if the equipment is used on the Project Site in any other way than upon the work directly related to the Contract Modification.

b. Individual pieces of equipment having a replacement value of one thousand dollars ($1,000) or less shall be considered to be small tools or small equipment, and no payment will be made since the costs of these tools and equipment is included as part of the markup for overhead and profit defined herein.

c. Payment to the Contractor for the use of equipment as set forth above shall constitute full compensation to the Contractor for the cost of fuel, power, oil, lubricants, supplies, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators), and any and all costs to the Contractor incidental to the use of the equipment.

5. Labor Productivity Rates: All Contract Modification work involving mechanical and electrical trades shall use labor productivity rates based on the following: Electrical labor productivity rates shall be based on the most current edition of N.E.C.A Column 1 with a five percent (5%) reduction. Wet side mechanical labor productivity rates shall be based on the most current edition of "M.C.A. Standards" with a twenty percent (20%) reduction. Dry side mechanical labor productivity rates shall use SMACNA Standards at a twenty (20%) percent reduction.

F. Costs Included as part of the Markup for Project General Conditions (hereinafter "Overhead"), and Profit: All Contract Modification costs not specifically listed above as a direct cost shall be included in the markup for general conditions, including overhead and profit. No separate allowance or itemization for general conditions, including overhead costs shall be allowed. Below is a list of costs, which is not intended to be comprehensive, of the type of costs included in the markup for overhead and profit for all Contract Modifications including Force Account Work.

1. Field and home office personnel including, but not limited to, principals, project managers, superintendents, supervisory foremen, estimators, project engineers, detailers, draftsmen, schedulers, consultants, watchmen, payroll clerks, administrative assistants, and secretaries.

2. All field and home office expenses including, but not limited to, field trailers, parking, storage sheds, office equipment and supplies, telephone service and long distance telephone calls, fax machines, temporary utilities, sanitary facilities and services, janitorial services, small tools and equipment with a cost under $1000 each, portable scaffolding, blocking, shores, appliances, job vehicles, security and fencing, conformance to regulatory requirements including compliance to safety regulations, safety programs and meetings, cartage, warranties, as-buils, as well as any related maintenance costs.

3. Administrative functions such as, but not limited to, reviewing, coordinating, distributing, processing, posting, recording, estimating, negotiating, expediting, engineering, drawing, detailing, revising shop drawings, carting, layout, cleaning, protecting the work, and other incidental Work related to the Contract Modifications.

4. All other costs and taxes required to be paid, but not included under direct costs as defined above.

G. Miscellaneous Requirements:
1. For individual items within a Contract Modifications that only include deleted work of a Contractor or Subcontractors that would receive fifteen percent (15%) for work performed, the District shall receive a credit markup of ten percent (10%). Neither the Contractor nor the Subcontractor shall be allowed a positive markup on their respective Subcontractors to administer the credit Contract Modification.

2. When both additions and credits are involved in any one Contract Modification, the Contractor shall calculate its labor productivity and costs based on the net change in the quantity of the work for each item listed. For example, if a Contract Modification adds 14 light fixtures on one drawing and deletes 5 on another drawing, the "net change in quantity" is 9, and the labor productivity rates and costs shall be based on the net add of 9 light fixtures.

3. The Contractor shall be solely responsible for determining which of its Subcontractors receive Contract Modifications. No additional compensation will be provided the Contractor for the Subcontractor's cost to review, post, coordinate and perform related tasks to administer Contract Modifications that do not result in directs cost charges from said Subcontractor. Such costs are considered normal business costs that are contractually determined prior to bid between the Contractor and its subcontractors, and that such costs shall be included in the Total Lump Sum Bid.

4. Taxes: Federal excise tax shall not be included. The District will issue an exemption on request.

5. Insurance and Bond Premiums: The actual cost to the Contractor of the following will be allowed with no markup for overhead and profit: Federal Insurance Contributions Act taxes, bond premiums, Federal and State Unemployment taxes; and net actual premium paid for public liability, workers' compensation, property damage, and other forms of insurance required by the District.

H. Records: The Contractor shall maintain its records in such a manner as to provide a clear distinction between the direct costs of Contract Modifications and the cost of the original Work. This requirement pertains to all types of Contract Modifications, as well as the Contractor's Requests for Changes and Claims.

I. Notice of Delay: Contractor shall notify the District of all anticipated delays resulting from proposed time extensions included with Contract Modification cost proposals, and Request for Changes.

J. Change Order: When the District and Contractor agree on the total cost and time of a PCO, the District will prepare a Change Order to formally implement the work described in the PCO.

K. Oral Instructions: No oral instruction of any person whomsoever shall in any manner or degree modify or otherwise affect the terms of this Contract.

7.03 FORCE ACCOUNT CHANGE ORDER

A. General: When Work, a definite price for which has not been agreed upon in advance, is to be paid for on a force account basis, all direct costs necessarily incurred and paid by the Contractor for labor, material and equipment used in the performance of such work, shall be subject to the approval of the District and compensation will be determined as set forth herein.

1. The District will issue a Force Account Change Order to proceed with the Work on a force account basis, and the District will establish a not to exceed budget.
2. With the exception of labor productivity rates for mechanical and electrical work, all requirements regarding direct cost for labor, labor burden, material, equipment and markups on direct costs for overhead and profit described in Article 7.01 and 7.02 of these General Conditions shall apply to Force Account Change Orders. However, the District will only pay for actual costs verified in the field by the District on a daily basis.

3. The Contractor shall be responsible for all cost related to the administration of Force Account Change Orders. The markup for overhead and profit for Contractor Modifications shall be full compensation to the Contractor to administer Force Account Change Orders.

B. Notification: The Contractor shall notify the District at least twenty-four (24) hours prior to proceeding with any of the force account work. In addition, the Contractor shall notify the District when it has consumed eighty percent (80%) of the budget, and shall not exceed the budget unless specifically authorized in writing by the District. The Contractor will not be compensated for force account work in the event the Contractor fails to timely notify the District regarding the commencement of force account work, or exceeding the force account budget.

C. Reports: The Contractor shall diligently proceed with the work, and on a daily basis, submit a daily force account report on a form supplied by the District no later than 5:00 p.m. that day. The report shall contain a detailed itemization of the daily labor, material, and equipment used on the force account work. The names of the individuals performing the force account work shall be included on the daily force account reports. The type and model of equipment shall be identified and listed. The District will review the information contained in the reports, and sign the reports no later than the next work day, and return a copy of the report to the Contractor for their records. The District will not sign, nor will the Contractor receive compensation for work the District cannot verify. The Contractor will provide a weekly force account summary indicating the status of each Force Account Change Order in terms of percent complete of the NTE budget and the estimated percent complete of the work.

D. Agreement: In the event the Contractor and District reach a negotiated, signed agreement on the cost of a Contract Modification while the work is proceeding based on a Force Account Change Order, the Contractor’s signed daily force account reports shall be discontinued and all previously signed reports shall be invalid.

7.04 UNILATERAL CHANGE ORDERS

A. General: When time does not allow for the Contract Modification to be negotiated through the PCO process, or when the District and the Contractor are unable to agree on the cost or time required to complete the change in the Work described in the PCO, the District may issue a Unilateral Change Order instructing the Contractor to proceed with the Work based on the District’s estimate of cost and time to perform the change in the Work, if any. Upon receipt of a Unilateral Change Order, the Contractor shall proceed with the ordered Work.

B. Protest: Should the Contractor disagree with any terms or conditions set forth in a Unilateral Change Order, which the Contractor has not executed, the Contractor shall submit a written RFC within seven (7) calendar days of receipt of said Unilateral Change Order and before proceeding with the Work thereof. If a written RFC is not submitted as required, the Contractor hereby waives all rights to additional compensation for said work, and payment will be made as set forth in the Unilateral Change Order and such payment shall constitute full compensation for Work included therein or required thereby. After the RFC has been filed, and after the Unilateral Change Order work is completed in the field, the Contractor shall notify the District within seven (7) calendar days of its intent to submit a claim for the cost differential between the Contractor’s actual cost and the District’s estimate included in the Unilateral Change Order. The Contractor shall then submit a claim in accordance with the requirements of Article 2.07 of these Contract General Conditions. The Contractor shall waive its rights to claim if notice is not provided as stipulated above.
7.05 UNIT PRICE CHANGE ORDERS

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established Unit Price for each Bid Item of unit price Work times the estimated quantity of each item as indicated in the Schedule of Bid Prices. The estimated quantities of unit price Bid Items are not guaranteed and are solely for the purpose of comparing Bids and determining an initial Contract Total Lump Sum Bid. Determination of that actual quantities and classifications of Unit Price Work will be made by the District in accordance with Section 01027 - Application for Payment.

1. Each Unit Price bid on the Schedule of Bid Prices shall include an amount considered by the Contractor to cover Contractor's markup for overhead and profit provided in Paragraph 7.02.

B. Procedure: For pre-determined unit prices and quantities, a Unit Price Change Order will be executed on a fixed unit price basis. An adjustment in the Contract Unit Price may be made for changes which result in an increase or decrease in the quantity of any unit price Bid Item of the Work in excess of thirty percent (30%) of the estimated quantity indicated on the Schedule of Bid Prices, or for eliminated items of Work.

C. Quantity Increases: Should the total quantity of any item of Work required under the Contract exceed the estimated quantity indicated on the Schedule of Bid Prices by more than thirty percent (30%), the Work in excess one-hundred thirty percent (130%) of such estimated quantity will be paid for by adjusting the Contract Unit Price as hereinafter provided, or at the District's option, payment for the Work involved in such excess will be made on a contract modification procedure or force account basis as provided in Paragraph 7.02 or 7.03.

1. Such adjustment of the Contract Unit Price will be the difference between the Contract Unit price and the actual unit cost, which will be determined as hereinafter provided, of the total pay quantity of the item. If costs applicable to such item of work include fixed costs, such fixed costs will be deemed to have been recovered by the Contractor by payment made for one hundred thirty percent (130%) of the Schedule of Bid Price quantity for such item, and in computing the actual unit cost; such fixed costs shall be excluded. Subject to the above provisions, such actual unit cost will be determined by the District in the same manner as if the Work were paid for on contract modification procedure or force account basis as provided in Paragraph 7.02 or 7.03, or such adjustment will be as agreed to by the Contractor and the District.

2. The payment for the total pay quantity of such item of Work will in no case exceed the payment which would be made for the performance of 130 percent of the estimated quantity as indicated on the Schedule of Bid Prices at the original Contract Unit Price.

D. Quantity Decreases: Should the total quantity of any item of Work required under the Contract be less than seventy percent (70%) of the estimated quantity indicated in the Schedule of Bid Prices, an adjustment in compensation will not be made unless the Contractor submits a written RFC as provided in Paragraph 2.07. If the Contractor so requests, the quantity of said item performed will be paid for by adjusting the Contract Unit Price as hereinafter provided, or at the District's option, payment for the Work involved will be made on a force account basis as provided in Paragraph 7.03, provided however, that in no case shall the payment for such Work be less than that which would be made at the Contract Unit Price.

1. Such adjustment of the Contract Unit Price will be the difference between the Contract Unit price and the actual unit cost, which will be determined as hereinafter provided, of the total pay quantity of the Item, including fixed costs. Such actual unit cost will be
determined by the District in the same manner as if the Work were paid for by a contract modification procedure or on a force account basis as provided in Paragraph 7.02 or 7.03; or such adjustment will be as agreed to by the Contractor and the District.

2. The payment for the total pay quantity of such item of Work will in no case exceed the payment which would be made for the performance of 70 percent of the estimated quantity as indicated on the Schedule of Bid Prices at the original Contract Unit Price.

E. Deleted Items: Should any Contract Bid item of Work be deleted in its entirety, payment will be made to the Contractor for its actual direct costs incurred in connection with such deleted Contract Bid item if incurred prior to the date of notification in writing by the District of such deletion.

1. If acceptable material is ordered by the Contractor for the deleted item prior to the date of notification of such deletion by the District, and if orders for such material cannot be canceled, it will be paid for at the actual cost to the Contractor. In such case, the material paid for shall become the property of the District and the District will pay for the actual cost of any further handling. If the material is returnable to the vendor and if the District so directs, the material shall be returned and the Contractor will be paid for the actual cost of charges made by the vendor for returning the material. The actual cost of freight in returning material will be paid for.

2. The actual costs or charges to be paid by the District to the Contractor for any deleted Contract item will be computed in the same manner as if the Work were to be paid on contract modification or force account basis as provided in Paragraph 7.02 or 7.03.

7.06 AUDITS

A. The District shall have the right to examine and audit all books, estimates, records, contracts, documents, bid documents, bid cost data, subcontracts, job cost reports, and other data of the Contractor, Subcontractors, and suppliers including computations, and projections related to bidding, negotiating, pricing, or performing the Work, or Contract Modification in order to evaluate the accuracy, completeness, and currency of the cost or pricing data at no additional cost to the District.

B. The Contractor shall make available at its office at all reasonable time the materials described in Subparagraph 7.06A herein before for examination, audit, or reproduction, until three (3) years after final payment under this Contract.

C. For this contract, the Contractor shall insert a clause containing all the provisions of Article 7 herein before, including this Paragraph, in all subcontracts over Ten Thousand Dollars ($10,000).

ARTICLE 8 - TIME

8.01 PROGRESS AND COMPLETION

A. Time is of the essence. The Contractor shall commence the Work of the Contract within five (5) calendar days from issuance of written Notice to Proceed from the District and shall diligently prosecute the Work to Project Completion.

B. The Notice to Proceed will be issued by the District any time within two months from the date of execution of the Agreement.

C. The continuous prosecution of the Work by the Contractor shall be subject only to the delays defined hereinafter. The start of Work shall include attendance at pre-construction conferences, preparation and submittal of Shop Drawings, equipment lists, Schedule of Values,
CPM construction schedules, requests for substitutions and other similar activities. Submittals shall be prepared in accordance with the Contract Documents and shall be made within the time limits required. It may be necessary that certain portions of the work be completed at different times to minimize disruption of school activities and maintain continued smooth operations of the District. The Contractor shall coordinate with the District and include these interface activities in the Contract Schedule.

D. The Work of this Contract shall be brought to Substantial Completion, as determined by the District, in the manner provided for in the Contract Documents and in the numbers of calendar days set forth as follows, from and after the receipt by the Contractor of the written Notice to Proceed.

1. CONTRACT TIME: The Contract Time shall be as defined in the Instructions to Bidders for calendar days beginning with and including the official date of Notice to Proceed to the official date of Notice of Completion, both issued by the District.

   a. Notice of Completion is a document issued by the District to the Contractor acknowledging that the Work is complete and the building is ready for occupancy by the District in its entirety.

   b. Notice of Project Completion is a document issued by the District to the Contractor acknowledging that the Project is complete.

2. The time limit for the Work as specified shall not be affected by the acceptance of any of the alternate(s); provided that said Alternates were incorporated into the Contract within 6 months after Notice to Proceed.

E. Failure to reach the completion dates as provided hereinabove, as determined by the District, within the required number of calendar days, and in the manner required by the Contract Documents, shall subject the Contractor to liquidated damages as stipulated hereinafter, unless extensions of time are granted in accordance with the provisions hereinafter.

F. The Contractor shall at all times keep on the premises sufficient material and employ sufficient supervision and workers to prosecute the Work at the rate necessary to reach completion dates required hereinabove of the Work herein required within the times specified in the Agreement and in accordance with the initial Contract schedule. Work shall not start and the Project be left in an incomplete state for an indeterminate period of time, while equipment and materials are in transit.

G. It shall be the responsibility of the Contractor to maintain its schedule so as not to delay the progress of the Project or the schedules of other contractors. The Contractor is required by virtue of this Contract to cooperate in every way possible with other contractors in order to maintain its Contract duration. Except as otherwise provided, no additional compensation will be paid for such cooperation. If the Contractor delays the progress of the project or the progress of other contractors, it shall be the responsibility of the Contractor to take some or all of the steps outlined hereinafter to improve its progress.

H. If, in the opinion of the District, the Contractor falls behind the Contract and current update of the Contract schedule and is not entitled to an extension of time, as presented in these Contract Documents, the Contractor shall take some or all of the steps outlined below to improve its progress at no additional cost to the District, and shall submit operational plans to demonstrate the manner in which the desired rate of progress may be regained.

I. Whenever it becomes apparent that the Contractor due to its own actions has fallen behind the required rate of progress, or delays the progress of other contractors, some or all of the following steps must be taken.
1. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of Work.

2. When permitted in writing by the District, work overtime or increase in amount of construction equipment sufficient to substantially eliminate the backlog of work.

3. Reschedule activities to achieve maximum practical concurrence of accomplishment of activities.

4. Expedite delivery of materials and equipment such as by airfreight.

5. Accelerate the priority of manufacture or fabrication of Work on order with the manufacturer, vendor, or supplier should such priority lists exist as a normal course of its business. Said acceleration shall also apply to shipment preparation.

6. Any other means deemed appropriate.

J. If the District directs the Contractor to take measures previously described, the Contractor shall bear all costs of complying, including additional administrative costs for the District and the District representatives.

K. Should the Contractor at any time during the progress of Work, refuse, neglect, or be unable for avoidable reasons to supply sufficient materials, supervision, or workers to prosecute the Work at the rate necessary to complete the Work within the time specified in this Contract, in accordance with the currently accepted updated construction schedule, the District shall have the right to terminate the Contract as hereinafter set forth or it may give this Contractor written notice, specifying the default and requiring its correction. If the Contractor does not comply with such notice from the District within three (3) days of the date of services thereof, the District shall have the right to provide the materials and workers to finish said Work. The sums necessary to meet the expenses thereby incurred shall be deducted from any monies due or which may thereafter become due under the Contract, and paid to persons supplying such materials and doing such Work. The amount of any such payments shall be deducted from the construction fund set aside for the purposes of this Contract and charged to the Contractor as if paid to it.

8.02 DELAYS AND EXTENSIONS OF TIME

A. Unavoidable Delays:

1. For the purposes of these Contract Documents the term "Unavoidable Delay" shall mean an interruption of the Work beyond the control of the Contractor, and which could have not been avoided by the Contractor's exercising care, prudence, foresight, and diligence. Moreover, the Contractor must demonstrate that the "Unavoidable Delay" actually extended the most current Contract Project Completion Date.

   a. The Contractor will be entitled to a time extension for the following types of "Unavoidable Delay" but at no additional compensation: Acts of God; acts of the public enemy; inclement weather conditions; fires; floods; windstorms; tornadoes; earthquakes; wars; riots; insurrections; epidemics; quarantine restrictions; strikes; lockouts; sit-downs; slowdowns; other labor trouble; labor shortages; material shortages; fuel shortages; freight embargoes; acts of government agencies outside the District; acts of public utilities; priorities or privileges established for the manufacture, assembly or allotment of material by order, decree, or otherwise of the United States. This list is not intended to be comprehensive, and similar types of delay will not entitle the Contractor to additional compensation or a compensable time extension.
b. The Contractor shall be entitled to a compensable time extension for an "Unavoidable Delay" caused by a Contract Modification initiated or caused by the District provided such unavoidable delay is critical, extends the most current Contract Completion date, and is not concurrent with a Contractor caused delay or other type of Unavoidable delay previously defined. All other types of "Unavoidable delay" shall not entitle the Contractor to a compensable time extension which shall be the total amount included in the Contract Modification.

c. The Contractor shall be entitled to a non-compensable time extension in the event a compensable "Unavoidable Delay" is concurrent with either a Contractor generated "Avoidable Delay," or a non-compensable "Unavoidable Delay."

B. Avoidable Delays:

1. The term "Avoidable Delay" shall include, but is not limited to the following:

   a. Any delay that could have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor;

   b. Any delay in the prosecution of parts of the Work, which may in itself be unavoidable, but which does not necessarily prevent or delay the prosecution of other parts of the Work, nor delay the specified Project Completion date;

   c. Any delay caused by the untimely review by the Contractor of the Contract Drawings and Specifications pursuant to Document 00700 paragraph 3.01E;

   d. Any delay arising from an interruption in the prosecution of the Work resulting from a reasonable interference from other contractors employed by the District, but does not delay the specified Project Completion date.

C. Inclement Weather Delays:

1. Inclement weather shall not be a prima facie reason for the granting of a non-compensable time extension, and the Contractor shall make every effort to continue Work under prevailing conditions. Such efforts by the Contractor shall include, but are not limited to, providing temporary gravel roads; installing a rain de-watering system; protecting interior and exterior areas exposed to rain, wind, and extreme temperatures; and installing protective covers at roof, window or other openings; and providing temporary heat where required for work to proceed without delay.

2. The District may classify an inclement weather day as a non-compensable "Unavoidable Delay," provided the Contractor made efforts to work during inclement weather and to avoid the impacts of inclement weather to its schedule. If such an event occurs, and the Contractor is prevented by inclement weather or conditions from proceeding with at least seventy-five percent (75%) of the scheduled labor, material and equipment resources for at least five (5) hours per work day on activities shown as critical on the most current and accepted schedule update, the delay will be classified as an "Unavoidable Delay," and the Contractor will be granted a non-compensable time extension. The Contractor is to notify the District, in writing, on each day this occurs.

3. Regardless of the type and severity of the inclement weather, the Contractor shall be responsible for all costs to make efforts to mitigate the impacts of inclement weather during the Contract duration.

D. Notice of Delay: The Contractor shall promptly notify the District in writing of any anticipated delay in the prosecution of the Work, and, in any event, promptly upon the occurrence of a delay. Said notice shall constitute an application for an extension only if the notice requests
such extension and sets forth the Contractor's estimate, if feasible, of the additional time required together with a full recital of the cause of delay relied upon. The District may take steps to prevent the occurrence or continuance of the delay and may determine to what extent the Project Completion is delayed thereby. The determination of the existence of any delay for which an extension of time will be granted will be based on whether such delay can be demonstrated by the Contractor to extend the Contractor's current critical path on the construction schedule or require the formulation of a new extended critical path. If notice of a delay is not submitted on or prior to three (3) consecutive working days after the start of the occurrence of such a delay, the Contractor thereby admits the occurrence had no effect on the length of its duration of Work, and no extension of time is necessary, and no extension of time will be granted by the District. In either case the Contractor will not be entitled to extra compensation.

E. Extensions of Time:

1. In the event it is deemed necessary by the District to extend the time of completion of the Work to be done under these Contract Documents beyond the required dates of the completion herein specified, such extensions shall in no way release any guarantees/warranties given by the Contractor pursuant to the provisions of the Contract Documents, or the Contract let hereunder, nor shall such extension of time relieve or release the sureties on the bonds executed pursuant to said provision. The sureties in executing such bonds shall be deemed to have expressly agreed to any such extension of time. The amount of time allowed in any extension of time shall be limited to the period of the delay-giving rise to the same as determined by the District. The granting of an extension of time because of a delay shall in no way operate as a waiver on the part of the District of the right to collect damages or of any other rights to which the District are entitled. All guarantees and warranties shall begin after final completion.

2. Should the Contractor, any Subcontractor of any tier or any supplier of any tier seek an extension of time for the completion of the Work under the provisions of this Paragraph, the Contractor and/or Subcontractor and/or supplier must submit justification for the extension of the time requested and otherwise comply with all provisions of these Contract Documents with respect to requests for extensions of time.

3. Neither this provision, nor any other provision of the Contract Documents, are intended by the parties to be contrary to any express provision of law. The parties specifically agree, acknowledge and warrant that neither this provision, nor any other provision of the Contract Documents, has for its object, directly or indirectly, the exemption of the District, the Architect, their consultants, and their respective directors, officers, members, employees, and authorized representatives from responsibility of their own sole negligence, violation of law or other willful injury to the person or property of another.

8.03 NOTICE OF LABOR DISPUTES

A. Whenever the Contractor has knowledge that any actual or potential labor dispute is delaying or is threatening to delay the timely performance of its Contract, the Contractor shall immediately give notice thereof, including all relevant information with respect thereto, to the District. In addition, the Contractor shall take all appropriate measures to eliminate or minimize the effect of such labor dispute on the currently accepted construction Schedule, including but not limited to such measures as: promptly seeking appropriate injunctive relief; filing appropriate charges with the National Labor Relations Board under the applicable provisions of the Labor Management Relations Act of 1947, as amended; filing appropriate damage actions; taking such measures as establishing a reserved gate, as appropriate; if reasonably feasible, seeking other sources of supply or service; or any other measures that may be appropriately utilized to limit or eliminate the effect of the labor dispute. To the extent the Contractor fails to initiate measures that are appropriate, it is not entitled to an extension of time. In addition, any delay impact on any other Contractor's schedule or on the
Construction Schedule will be considered as a Contractor-caused delay under any and all applicable provisions of the Contract.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.01 CONTRACT SUM

A. Payment to the Contractor at the lump sum price fixed in the Contract for performing all Work required under the Contract, as adjusted for any Contract Modifications approved as hereinbefore specified, shall be full compensation for furnishing all labor, materials, equipment and tools necessary to the Work, and for performing and completing, in accordance with these Contract Documents, all Work required under the Contract, and for all expenses incurred by the Contractor for any purpose in connection with the performance and completion of said Work.

9.02 SCHEDULE OF VALUES

A. Within 10 days of the date of commencement shown in the Notice to Proceed the contractor shall submit a schedule of values to the owner for review. This schedule of values shall breakdown the contract price into various estimated items of work, together with the contractor's allowance for overhead, insurance and profit. The contractor's overhead, insurance, profit and other such costs, shall be prorated through all items so that the sum of all items in the schedule of values shall equal the contractor's total lump sum bid. This breakdown, which must be approved by the owner, will be the basis for determining the value of work performed for purposes of making payments to the contractor.

B. The contractor's schedule of values shall include a separate line item for "project closeout" (with an assigned value attributed to it.)

C. The contractor's schedule of values shall include a separate line item for "building commissioning " (with an assigned value attributed to it.)

D. The Contractor shall not submit an application for payment without an approved schedule of values.

9.03 PROGRESS PAYMENTS

A. Subject to the conditions set forth in these General Conditions, and to the authorization of the District or the authorized representatives of the District, payment shall be made upon demand of the Contractor and pursuant to the Contract Documents as follows.

B. The District will, on or about the twentieth (20th) day of each month after receiving the Contractor's monthly Schedule update, make an estimate of the value of the Work done by the Contractor completed after that included in the last preceding estimate in performance of the Contract. The monthly value of the Work described shall be estimated by the District pursuant to the applicable schedule of values prepared in accordance with Paragraph 9.02. Estimates need not be based on strict measurements, but may be approximate only, and will be in due proportion to the total amount, considering payments previously made, that will have become due for such Work satisfactorily completed under the Contract. No allowance will be made for materials or equipment not incorporated into the Work.

C. On the 25th of each month, the Contractor shall submit to the District Representative for review an Application for Payment filled out and signed by the Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as otherwise set forth in the Contract Documents.

1. No payment shall be made for materials and equipment not incorporated in the Work.
D. The Application for Payment shall identify the amount of the Contractor's total earnings to date.

E. Monthly progress payment amounts to the Contractor shall be based upon completed Work activities or percentages of Work activities completed prior to the end of the payment period. The District following the formal approval of the Schedule of Values shall transmit a detailed payment procedure to the Contractor.

F. Monthly payment applications shall be based on information developed at monthly Application for Payment Approval Meetings and shall be prepared by the Contractor. Submission of Schedule updates for same period of Progress Payment Application shall be a condition precedent to making progress payment applications. Contractor shall submit monthly Schedule update information to the District three (3) working days after the Construction Schedule Approval Meeting and before submission of the progress payment application. No progress payment shall be made to the Contractor until all cost information requested by the District is submitted and reviewed.

G. As soon as practicable after making of each progress estimate, the District will pay to the Contractor in a manner provided by law, an amount equal to ninety percent (90%) of the value, based upon Contract prices, of labor and materials incorporated in the Work at the Project site up until midnight of the twenty-fifth (25th) day of the current month less the aggregate of previous payments, provided that payments may be withheld at any time that the Work, in the District’s estimation, is not proceeding in accordance with the Contract, or as otherwise provided in Paragraph 9.05. When the District determines that the Work is fifty percent (50%) complete, the Contractor is making satisfactory progress and there is no specific cause for greater withholding, progress payments may be made not to exceed an amount the lesser of either ninety-five percent (95%) of the value of the Work and labor, equipment and material furnished or ninety-five percent (95%) of the Contract Sum.

1. The payment shall be made within 30 calendar days after application has been made and certified by the District.

H. In accordance with the provisions of the California Public Contract Code, the Contractor will be permitted to substitute securities for any moneys withheld by the District to ensure performance under the Contract.

I. Payment for material stored on or off the Site will not be allowed. Where advance payment is allowed at the sole discretion of the District necessary to keep the Project on schedule for very large, long lead items, proof of off-site material purchases (invoices and checks) and appropriate insurance coverage will be required. The Contractor shall furnish to the District written consent from the Surety approving the advanced payment for materials stored off site. The maximum prepayment allowed by the District shall be 75 percent of the actual value of the item being considered. The District and the District Representative shall be the sole judges of fair market value. The Contractor shall protect stored materials from damage. Damaged materials, even though paid for, shall not be incorporated into the work.

J. No inaccuracy or error in said monthly estimates shall operate to release the Contractor or Surety from damages arising from such Work or from the enforcement of each and every provision of the Contract Documents, and the District shall have the right subsequently to correct any error made in any estimate for payment.

K. The granting of any progress payment, or the receipt thereof by the Contractor, shall not constitute acceptance of the Work or any portion thereof, and shall in no way lessen the liability of the Contractor to replace unsatisfactory Work or material, though the unsatisfactory character of such Work or material may not have been apparent or detected at the time such payment was made.
L. It is mutually understood and agreed that the District may withhold from any payment otherwise due Contractor so much as may be necessary to protect the District to insure completion of the project pursuant to the requirements of this Contract. The failure or refusal of the District to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bonds furnished under this Contract.

M. Only Contract Modifications completely approved and executed shall be included on the Payment Authorization and only that portion of the Change Order work actually performed shall be submitted for payment. Submit breakdown for each Contract Modification by Specification Section number on Application for Payment.

9.04 PAYMENT AUTHORIZATION

A. The District will, after receipt of the Contractor's Application for Payment, issue a Payment Authorization to the Controller's Office for such amount as the District and District Representative determine is properly due. The District will notify the Contractor in writing of the reasons for withholding authorization in whole or in part as provided hereinafter.

B. A Payment Authorization will be issued by the District, based on the District's representation of observations at the site and the data comprising the Application for Payment, that the Work has progressed to the point stated in the Application for Payment and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion. The issuance of a Payment Authorization will further constitute a representation that the Contractor is reasonably entitled to payment in the amount authorized. However, the issuance of a Payment Authorization will not be a representation that the District has:

1. Made exhaustive or continuous on-site inspections to check the quality or quantity of the Work;

2. Reviewed construction means, methods, techniques, sequences or procedures;

3. Reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the District to substantiate the Contractor's right to payment; or

4. Made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.05 DECISIONS TO WITHHOLD PAYMENT

A. The District may decide not to authorize payment and may withhold a Payment Authorization in whole or in part, to the extent reasonably necessary to protect itself, if in its opinion the representations required by Subparagraph 9.04 B cannot be made. If the District is unable to authorize payment in the amount of the Application, the District will notify the Contractor as provided in Subparagraph 9.04 A. If the Contractor and District cannot agree on a revised amount, the District will promptly issue a Payment Authorization for the amount it deems proper. The District may also decide not to authorize payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Payment Authorization previously issued, to such extent as may be necessary in its opinion to protect itself from loss because of:

1. Defective Work not remedied;

2. Third party claims filed or reasonable evidence indicating probable filing of such claims;
3. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

4. Damage to the District or another contractor;

5. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

6. Failure to carry out the Work in accordance with the Contract Documents;

7. Failure to timely submit Contract Modification cost breakdowns in accordance with the Contract Documents;

8. Failure to timely submit schedules, schedule updates and reports in accordance with the Contract Documents;

9. Failure to timely maintain updated “as-built” Contract Documents;

10. Failure to submit Coordination Drawings in accordance with the General Requirements;

11. Failure to submit Record Documents in accordance with the General Requirements;

12. Failure to submit certified payroll records in accordance with the Contract Documents; or

13. Failure to timely comply with other requirements of the Contract Documents.

B. When the above reasons for withholding authorization are removed, authorization will be made for amounts previously withheld.

9.06 PARTIAL OCCUPANCY OR USE

A. Whenever, in the opinion of the District, the Work or any part thereof is in a condition suitable for use, and the best interest of the District requires such use, the District may take possession of, connect to, open for public use, or use the Work or a part thereof at no additional cost to the District. When so used, maintenance and repair due to ordinary wear and tear or vandalism of District’s responsibility will be made at the District’s expense. The use by the District of the Work or part thereof shall in no case be construed as constituting completion of the Work. Such use shall neither relieve the Contractor of any of its responsibilities under the contract, nor act as a waiver by the District of any of the conditions thereof.

B. Such partial occupancy or use may commence whether or not the portion has achieved Substantial Completion. The District shall determine the stage of the progress of the Work.

C. Immediately prior to such partial occupancy or use, the Contractor and District shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

D. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

E. Contractor shall perform final cleaning of portions of the Work to be partially occupied or used as specified in the General Requirements.
9.07 PROJECT COMPLETION AND FINAL PAYMENT

A. When the Contractor considers that the Work is complete including all contractual requirements, including but not limited to all start-up services, warranties, guarantees, as-built, etc., and requests that the District prepare a Notice of Completion, Contractor shall notify the District in writing. Within seven (7) days from receipt of the Contractor's written notification, the District will make an inspection to determine whether the Work is complete. If the District determines the work is not complete, the District will provide the Contractor with a deficiency list (Punch List) of all items that must be corrected or completed before the District would consider the Work complete. This list will be provided to the Contractor within fourteen (14) calendar days from receipt of the Contractor's written notification. Once the Contractor has completed all items on the deficiency list, the Contractor can request a second inspection by the District to verify the Work is complete. If the Work is not complete, the District will follow the same procedure as for the first inspection, and the Contractor shall reimburse the District and the District's representatives for all of their costs related to the second inspection and any inspection thereafter. When the Work is considered completed, the District shall prepare a Notice of Completion, which shall establish the date of Completion.

B. If additional inspections are required, to include special inspections such as fire alarm certification, all costs of the District and District representatives conducting such additional inspections shall be deducted from progress payments owed the Contractor.

C. The remaining value of the Work performed under this Contract, if unencumbered, shall be processed for payment after thirty-five (35) days after the date the Certificate of Completion is filed by the District. Acceptance by the Contractor of said final payment shall constitute a waiver of all claims against the District arising under the Contract Documents. As a condition precedent to final payment, the Contractor shall furnish a "release" pursuant to the following subparagraph.

1. The Contractor and each assignee under any assignment in effect at the time of final payment shall, if required by the District, execute and deliver at the time of final payment as a condition precedent to final payment, a release in form and substance satisfactory to and containing such exemptions as may be found appropriate by the District, discharging the District, and the District's Consultants, and their directors, officers, members, employees, agents and authorized representatives, of and from all liabilities, obligations and claims arising under this Contract.

9.08 LIQUIDATED DAMAGES

A. Determination of Damages: The actual fact of the occurrence of damages and the actual amount of the damages which the District would suffer if the Work were not completed within the specified time set forth are dependent upon many circumstances and conditions which could prevail in various combinations and, from the nature of the case, it is impracticable and extremely difficult to fix the actual damages. Damages which the District would suffer in the event of delay include, but are not limited to, costs of renting equivalent space, expenses of prolonged employment of an architectural, engineering and construction management staff; costs of administration, inspection and supervision; and the loss suffered by the public or school children within the District by reasons of the delay in the construction of the project to serve the public at the earliest possible time or being disruptive to the school teachers or children. Accordingly, the parties hereto agree, and by execution of this Contract, the Contractor acknowledges that the Contractor understands, has ascertained and agrees, that the amounts herein set forth shall be presumed to be the amounts of damages sustained by the failure of the Contractor to complete the specified Work within the times specified.

1. The Contract Time is restricted by the District's contractual commitments and will suffer substantial damages from breach of such and from costs incurred for leasing additional space when the Project is not substantially completed on time. Therefore, the Contractor
shall take whatever measures are necessary to meet the established time limit, including working outside normal working hours and shift work.

B. Agreed Amount of Damages: It is understood and agreed by both parties to the Contract that in case all the Work called for under the Contract is not completed within the time limits as specified, or within the time limits as extended in accordance with these Specifications, damage will be sustained by the District, and that it is actual damages which the District will sustain in the event of and by reason of such delay.

1. The Contractor and the District agree that the sum specified in the Instructions to Bidders represents the parties' reasonable estimate of the approximate damages which the District will sustain for each and every calendar day’s delay beyond the time specified for Completion, or as extended in accordance with the Specifications.

2. The District will sustain damage which are difficult to ascertain by include the following additional expenses:
   a. Debt service.
   b. Administrative costs.
   c. District representatives and consultants costs.
   d. Temporary student and administrative facilities.

3. It is therefore agreed that the Contractor shall pay such liquidated damages as herein provided, and in case the same is not paid, agrees that the District may deduct the amount therefore from any money due or that may become due the Contractor under the Contract. Liquidated damages will continue to the time at which the Work reaches Project Completion as determined by the District.

C. It is further agreed that payment of liquidated damages under one of the aforementioned conditions will not relieve the Contractor from separate liquidated damage liability under the other condition, each to the full extent of the specified amount, regardless of whether the times for which liquidated damages are to be paid do or do not run concurrently, or whether either liability is or is not a consequence of the other.

D. Payment of Damages:

1. In the event the Contractor shall become liable for liquidated damages, the District, in addition to all other remedies provided by law, shall have the right to withhold any and all retained percentages of payments which would otherwise be or become due the Contractor until the liability of the Contractor has been finally determined. The District shall have the right to use and apply such retained percentages, in whole or in part, to reimburse the District for all liquidated damages due or to become due to the District. Any remaining balance of such retained percentages shall be paid to the Contractor only after discharge in full of all liability incurred by the Contractor. If the retained percentage is not sufficient to discharge all such liabilities of the Contractor, the Contractor and its sureties shall continue to remain liable to the District until all such liabilities are satisfied in full. Should the retention of monies due or to become due to the Contractor be insufficient to cover such damages, the Contractor forthwith shall pay the remainder to the District.

**ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY**

**10.01 SAFETY PRECAUTIONS AND PROGRAMS**
A. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Work.

B. The Contractor shall designate in writing a responsible member of the Contractor's organization at the site as Project safety representative whose duty shall be the prevention of accidents. This person shall be available twenty-four (24) hours a day, seven (7) days a week by telephone or other approved means.

C. In the event the Contractor encounters on the site material reasonably believed to be hazardous which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected, immediately advise the District, and render the hazard harmless. The Work in the affected area shall not thereafter be resumed except by written notification of the District.

D. The Contractor shall be required to perform all Work relating to hazardous materials as required by the Contract Documents.

E. Health, Safety, And Fire Prevention: The Contractor, his subcontractors, agents and employees shall FULLY COMPLY with ALL of the provisions and requirements of CAL/OSHA, Title 8 CALIFORNIA CODE OF REGULATIONS, Industrial Relations, and all other safety codes having jurisdiction over the Project.

10.02 SAFETY OF PERSONS AND PROPERTY

A. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

1. Employees on the Work and other persons who may be affected thereby;

2. The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and

3. Other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

B. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

C. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, erecting barricades, fencing, railings, and walkways as necessary, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

D. When use or storage of hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel and in compliance with all safety regulations.

E. The Contractor shall promptly remedy damage and loss to property referred to in previous subparagraphs caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under the previous subparagraphs, except damage or loss attributable to the sole negligent acts or omissions of
the District. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.16 in these General Conditions.

F. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety. The structure is designed to support the loads of the finished building. No provision is included for stresses or loads imposed by construction operations. If the Contractor desires to place such loads in excess of the design load, it shall submit drawings and calculations prepared by, and bearing the seal of a California-licensed structural engineer of the proposed method for supporting such loads for the District's review and approval. No loading of any kind in excess of design loads shall be placed on any part of the building structure prior to the District's approval of the submitted drawings and calculations. The costs of the District's review shall be reimbursed to the District by the Contractor.

G. The Contractor shall be responsible for each operation and all Work, both permanent and temporary. It shall protect its Work and materials from damage due to construction operations, the action of the elements, the carelessness of its subcontractors, vandalism, or any other cause whatever, until Project Completion and Acceptance of the Work. Should improper Work of any trade be covered by another contractor and damage or defects result, the whole Work affected shall be made good by the contractor performing the improper Work to the satisfaction of the District without expense to the District.

10.03 EMERGENCIES

A. In an emergency affecting safety of persons or property, the Contractor shall act to prevent threatened damage, injury or loss, and shall as promptly as conditions permit notify the insurance carriers and the District of the nature of the emergency and circumstances related thereto. Immediately thereafter, the Contractor shall prepare a written report setting forth in detail the action taken and describing in detail all circumstances and conditions which are related to such action. Additional compensation or extension of time claimed by the Contractor on account of an emergency, if caused by fault of the District, shall be determined as provided in Paragraph 2.06 and Article 7.

10.04 SAFETY PERMITS

A. A State Industrial Safety Permit shall be obtained and paid for by the Contractor if:

1. Any building, structure, false work or scaffolding more than 3 stories high or the equivalent of 35'-0" is to be constructed.

2. The demolition of any building, structure, false work or scaffolding more than 3 stories high or the equivalent of 35'-0".

3. A trench 5'-0" deep or deeper is constructed for foundation purposes into which a person must descend.

B. The Contractor shall obtain and pay for all other required safety permits.

10.05 LOSS CONTROL REQUIREMENTS

A. Contractors and subcontractors participating in this SEWUP project will be expected to comply with the following safety and loss control requirements:

1. The Emergency Response Plans (with particular emphasis on access and egress routes).

2. District procedures regarding dealing with the media.
3. Hard hats will be mandatory on all SEWUP projects when there is an exposure to falling objects, as per Cal OSHA Construction Safety orders.

4. All construction employees will be required to be attired in workpants, shirt and appropriate boots or closed toe shoes.

5. No alcohol will be allowed on SEWUP construction sites at any time.

6. Smoking will be allowed in designated areas only.

7. All contractors will agree to conduct and fund post-injury drug screening of their employees. Those employees failing the test will be removed permanently from the job site. In addition, any contractor that shows a pattern of employees failing the tests will be reported to SEWUP, who can use the information as a factor in assessing their "responsibility" in connection with future projects.

8. Controlling access to the construction site will be a very high priority, and contractors will be required to take whatever preventative measure, such as barriers, fencing, etc., deemed necessary by either the SEWUP consultant or local school official.

9. Contractors will be required to respond to any school complaints about objectionable levels of dust or noise and will be required to provide the appropriate abatement as quickly as possible.

10. Construction personnel cannot enter school grounds other than the construction site unless accompanied by District personnel, and they are allowed only 'incidental' contact with students. Violations of these requirements by any construction employee will result in a mandatory background check of that employee – including fingerprinting – as required by state law.

11. The SEWUP Safety Representative, General Contractor or Construction Manager has the right to correct an unsafe act or condition. The General Contractor or Construction Manager has the right and authority to bill the non-compliant contractor for the costs associated with the correction.

12. Fall protection is mandatory on all SEWUP projects in accordance with Cal OSHA, OSHA and any other appropriate code.

13. Any contractor displaying, in the opinion of the General Contractor or SEWUP consultant, a repeated disregard for safety can be removed from the job-site and their name forwarded to SEWUP, who will use the expulsion as a factor in assessing their suitability for future projects.

14. All contractors and sub-contractors must provide a copy of their Injury & Illness Prevention Program to the General Contractor or Construction Manager to be filed at the job site.

15. A site specific Injury & Illness Prevention Program shall be available on site with either the General Contractor or Construction Manager. All contractors shall abide by this program.

16. Personal radios, headsets, walkmans and CD players are not allowed on the job-site.

17. All work activities must comply with applicable Cal OSHA, OSHA, EPA, ANSI, and local laws pertaining to safety.
18. The General Contractor or Construction Manager shall assume overall responsibility for project safety compliance with the applicable safety regulations and the site specific Injury & Illness Prevention Program.

19. All contractors must attend the pre-construction safety meeting.

20. All contractors shall identify their competent person(s) to the General Contractor or Construction Manager.

21. The SEWUP Safety Representative will conduct visits to the job site at the request of the District, General Contractor, Construction Manager, JPA, or SEWUP. Contractors will be required to cooperate with the consultant and take the appropriate corrective action deemed necessary with timeframes established regarding the corrective action.

22. The SEWUP Safety Representative has the authority, during the course of the job site inspection, to suspend those aspects of the job site that are considered "imminently dangerous" until appropriate corrective action is completed.

23. The SEWUP Safety Representative may require a follow-up meeting or contact if there is a death, serious and willful claim, serious disabling injury, adverse loss experience, major fire, or serious 3rd party claim.

24. Any contractors’ employee observed providing or selling cigarettes or other smoking materials to students shall be removed from the job site until further notice.

25. No sexual reference or preference shall be permitted on any piece of clothing or the hardhat. Any employee observed disregarding this policy shall be removed from the job site until further notice.

26. All contractors’ employees shall park in their designated parking area. Any sticker attached to the employees’ vehicle that displays any form of sexual preference or reference shall be removed prior to parking at the site. Each employee will provide their license plate number to the General Contractor or Construction Manager. Any employee disregarding this policy shall be removed from the site until further notice.

27. All contractors shall control the break time activities of the employees to assure the cleanup of all soda cans, food wrappers, plastic bottles, or food containers from the break area. Such areas shall be cleaned immediately after the break and all waste placed in trash receptacles. No glass containers are permitted on the site.

28. Theft or willful damage to any property of the owner, student, or other contractors will be prosecuted fully.

29. No guns, switchblades, or knives with blades greater than 2” shall be allowed on the job site. Any employee disregarding this policy shall be removed from the site until further notice.

30. All contractors will advise those non-English speaking employees in their native language either in a written format or via an interpreter of these policies.

31. All non-SEWUP members or guest who visit the job site will be required to sign a hold harmless agreement. All such persons shall be required to be appropriately attired to include a hardhat.
Article 11 – INSURANCE AND BONDS

11.01 CONTRACTOR PROVIDED INSURANCE (For all projects)

A. INSURANCE REQUIREMENTS

The Contractor shall maintain in full force and effect and cause its subcontractors to maintain, for the period covered by the Contract, the following insurance:

1. **Comprehensive or commercial general liability insurance** with limits not less than $1,000,000 per each occurrence combined single limit for bodily injury and property damage, including coverage for contractual liability, personal injury, independent contractors, explosion, collapse and underground (XCU), broad form property damage, products liability, and completed operations.

   a. Should any of the required insurance be provided under a form of coverage that includes an annual general aggregate limit or provides that claims investigation or legal defense costs be included in such annual general aggregate limit, such annual general aggregate limit shall be **two times** the occurrence limits stipulated.

   b. Should any of the required insurance be provided under a claims-made form, Contractor shall maintain such coverage continuously throughout the term of this contract, and without lapse, for a period three years beyond the contract expiration, to the effect that, should occurrences during the contract term give rise to claims made after expiration of the contract, such claims shall be covered by such claims-made policies.

2. **Comprehensive or business automobile liability insurance** with limits not less than $1,000,000 per each occurrence combined single limit for bodily injury and property damage, including coverage for owned, non-owned, and hired automobiles, as applicable.

3. **Workers' Compensation**, including Employers' Liability Insurance with limits not less than $1,000,000 each accident, occurrence or disease and $1,000,000 aggregate.

   a. The Workers' Compensation Insurance shall cover any compensation payable under the provisions of the act of legislature of the State of California, known as the "Workmen's Compensation Insurance and Safety Act" approved May 26, 1913, and all acts amendatory and supplemental thereto. If the Contractor fails to maintain such insurance, the District, at its sole option and without incurring any further obligation to provide insurance, may take out Workers' Compensation Insurance to cover any compensation payable under the provisions of the Act by reason of any employee of the Contractor being injured or killed, and to deduct and retain the amount of the premium for such insurance from any sums due the Contractor. If the injury occurs to any employee of the Contractor for which the employee, or its dependents in the event of its death, is entitled to compensation from the District under the provisions of said Act, or for which compensation is claimed from the District, the District may retain from the sums due the Contractor under these Contract Documents an amount sufficient to cover such compensation, as fixed by said Act, until such compensation is paid; and if the District is compelled to pay such compensation, it will deduct and retain from such sums the amount so paid.

   b. The Contractor shall sign and file with the District the following certification prior to performing the Work of the Contract:
"I am 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 I will comply with such provisions before commencing the performance of the Work of this Contract."

4. **Builder's Risk Insurance** on an All-Risk Form covering the new Work under the Contract, excluding earthquake and flood but including ensuing perils, with limits not less than the Contract Sum and any deductible not to exceed $10,000.
   a. Coverage for debris removal limits not less than $1,000,000.
   b. Such policy shall name the District as loss payee and shall be issued by carrier(s) satisfactory to the District and licensed through the Department of Insurance to conduct insurance business in California.
   c. In the event of any damage except earthquake and flood, it shall be the Contractor's responsibility to perform at its expense all required repair and replacement including damage to adjacent areas.
   d. The Contractor shall be responsible for all losses not covered by the policy, excluding earthquake and flood, including the deductibles.

5. In the event that the Contractor employs professional engineering services, the Contractor shall require the retained engineers to carry professional liability insurance with limits not less than $1,000,000 each claim with respect to negligent acts, errors, or omissions in connection with professional services to be provided under this Agreement and any deductible not to exceed $50,000 each claim. The Contractor shall provide the District with Certificates of Insurance for any such policy.

6. In the event that the Contractor is performing abatement of hazardous or contaminated materials work or employs a subcontractor or entity for abatement of hazardous or contaminated materials, the Contractor shall furnish or require the subcontractor or entity to maintain environmental liability insurance with limits not less than $1,000,000, policy written on an occurrence form, with any deductible not to exceed $25,000, including coverage for Contractor's pollution legal liability for contaminated soils, asbestos, lead, underground storage tanks, and other hazardous materials which may be encountered at the site.

B. **INSURANCE BY OTHERS:**

For General Liability, Environmental Pollution Liability and Automobile Liability Insurance, the Contractor shall include as additional named insureds, the District, the Architect, the District's Consultants, and all authorized agents and representatives, and members, directors, officers, trustees, agents and employees of any of them.

C. **FORM OF POLICIES AND OTHER INSURANCE REQUIREMENTS:**

1. Before commencement of the Work of this Contract, certificates of insurance shall be furnished to the District, with complete copies of policies to be furnished to the District promptly upon request.

2. Approval of the insurance by the District shall not relieve or decrease the extent to which the Contractor or subcontractor of any tier may be held responsible for payment of any and all damages, except damage caused by earthquake or flood, resulting from its operations. All policies of insurance and certificates shall be satisfactory to the District.
3. Liability insurance shall be on an occurrence basis; and said insurance shall provide that the coverage afforded thereby shall be primary coverage (and non-contributory to any other existing valid and collectable insurance) to the full limit of liability stated in the declaration, and such insurance shall apply separately to each insured against whom claim is made or suit is brought, but the inclusion of more than one (1) insured shall not operate to increase the insurer's limits of liability.

4. Each such policy shall provide that no cancellation, non-renewal nor any reduction in its coverage shall occur without the carrier giving to the District at least thirty (30) days' written notice prior thereto. All notices shall be made to:

   Sadiq B. Ikharo
   Vice Chancellor of General Services
   Peralta Community College District
   333 East 8th Street
   Oakland, CA 94606

   L. Mark Sennette
   Director of Capital Projects
   Peralta Community College District
   333 East 8th Street
   Oakland, CA 94606

5. The Contractor shall file with the District a certificate of the required new or renewed policy at least ten (10) days before the effective date of such cancellation, change or expiration, with a complete copy of new or renewed policy.

6. If, at any time during the life of this Contract, the Contractor fails to maintain any item of the required insurance in full force and effect, all Work of this Contract may, at District's sole option, be discontinued immediately, and all Contract payments due or that become due will be withheld, until notice is received by the District as provided hereinbefore that such insurance has been restored to full force and effect and that the premiums therefor have been paid for a period satisfactory to the District.

7. Any failure to maintain any item of the required insurance may, at District's sole option, be sufficient cause for termination of this Contract.

E. Insurance companies shall be legally authorized, licensed and admitted through the California Department of Insurance to engage in the business of furnishing insurance in the State of California. All insurance companies shall have an "A-,VIII" in Bests Rating Guide and shall be satisfactory to the District.

11.02 CONTRACTOR ADDITIONAL INSURANCE REQUIREMENTS (For all projects)

A. Notice to the District: Further the policy will provide not less than thirty (30) days prior written notice to District's Program Administrator or its Designee of any material change in the insurance or cancellation or non-renewal.

B. Additional Insured: The District will be endorsed as "additional insured" on Contractor's and Subcontractors' policy or policies. Contractor and Subcontractors shall furnish Certificates of Insurance evidencing said coverage before commencing work on the Project.

C. Contractor Construction Equipment Insurance: Any policies maintained by the contractor and subcontractors on their owned and/or rented equipment and materials shall contain a provision requiring the insurance carriers to waive their rights of subrogation against the Owner and all other indemnitees named in the contract.

D. Professional Liability Insurance (Errors & Omissions): In the event any contract specifications requires your firm to provide professional services, such as but not limited to, architectural, engineering, construction management, surveying, design, etc., a certificate of insurance must be provided prior to commencing work evidencing such coverage with a limit of not less than $1,000,000. Any material change in limits, coverages or loss of aggregate limit due to outstanding claims must be reported to the District within 30 days of any such event.
E. **Environmental and Asbestos Abatement Coverages:** If this Agreement involves the removal of asbestos, the removal/replacement of underground tanks or the removal of toxic chemicals and substances, the Contractor will be required to provide adequate coverages, with limits not less than $1,000,000 per claim basis, for such exposures subject to requirements and approval of the District.

F. **Hold Harmless clause:** Work done on the premises, or in connection with the prosecution of this contract by the Contractor, shall be at the Contractor’s risk and the Contractor shall assume any and all liability and shall hold harmless the District, their agents, servants or employees, from claims or demands, cost expenses, loss or damage due to bodily injury, sickness or disease, including death to employees of the Contractor or any other person, or damage of property including loss of use thereof suffered by employees of the Contractor or any other person; arising out of the performance of the contract, whether such are based upon negligence of the District or any other person, firm, corporation or organization for whom such contract is being performed, their agents, employees or otherwise.

11.03 **PROOF OF CARRIAGE OF INSURANCE**

A. Before work is started, the Contractor shall forward to the Owner two copies of a Certificate of Insurance or Memorandum of Insurance, evidencing that all required Contractor Furnished Insurance is in force, executed by an authorized representative of the insurance company, and naming Owner as additional insured as outlined below.

B. Certificates and insurance for contractor furnished insurance policies shall include the following clause:

    "This policy shall not be cancelled or reduced in required limits of liability or amounts of insurance until notice has been mailed to the District. Date of cancellation or reduction may not be less than Thirty (30) days after date of mailing notice."

C. Certificates of insurance for contractor furnished insurance policies shall state in particular those insured, extent of insurance, location and operation to which insurance applies, expiration date, and cancellation and reduction notice.

D. Certificates of insurance for contractor furnished insurance policies shall clearly state that the District is named as an additional insured under the policy described and that such insurance policy shall be primary to any insurance or self-insurance maintained by the District.

E. Contractor furnished policies will be written by an insurer of satisfactory character including a Best’s rating of not less than A- VIII and an admitted carrier in the State of California. If requested by the District, a certified copy of the actual policies with appropriate endorsement(s) and other documents shall be provided to the District.

F. In the event the contractor or any subcontractor fails to furnish and maintain required insurance or to furnish satisfactory evidence thereof, the Owner may procure and maintain such coverages for all parties on behalf of the contractor. Contractor shall furnish all necessary information and pay the premium cost to the District immediately upon presentation of a premium invoice.

G. Subcontractors. Should a contractor engage a subcontractor, the same conditions will apply to each subcontractor. Each subcontractor must be covered by insurance of the same character and in the same amounts as the Contractor, naming the Contractor and the Owner as additional insureds. Copies of certificates of insurance for subcontractors must be filed with the District within thirty (30) working days after issuance of a Notice to Proceed and at least five (5) working days before the subcontractor begins work on the site. Failure to provide evidence of such insurance shall result in the subcontractor being excluded from the
site until proper coverage is verified. The cost of any resulting delay will be borne by the contractor.

11.04 PERFORMANCE BOND AND PAYMENT BOND

A. At the time of execution of the Contract, the Contractor shall file with the District the following bonds:

1. A Corporate Surety Bond, in a sum not less than 100 percent of the amount of the Contract, to guarantee the faithful performance of the Contract.

2. A Corporate Surety Bond, in a sum not less than 100 percent of the amount of the Contract, to guarantee the payment of wages for services engaged and of all bills contracted for materials, supplies, and equipment used in the performance of the Contract.

B. Corporate sureties on these bonds and on bonds accompanying bids shall be legally authorized, licensed and admitted through the California Department of Insurance to engage in the business of furnishing surety bonds in the State of California. All sureties shall have an "A-,
VIII" rating in Bests Rating Guide and shall be satisfactory to the District. The Contractor will submit surety bonds on forms provided by the District.

C. The amount of the Contract, as used to determine the amount of the bonds, shall be the amount based on the Contract Sum.

D. Failure of the successful Bidder to execute the Contract and deliver the required bonds and insurance within the 10-day period may constitute a default, and Bid Guarantee may be forfeited. Thereupon, the Owner at its sole option may award the Contract to the next acceptable Bidder, waive the time limit, or readvertise for Bids. The money and proceeds from the check or bond, as the case may be, shall be applied towards payment of damages to PCCD caused by the delay on the construction schedule, and secondly, the necessity of accepting a higher or less desirable proposal due to this delay caused by the failure or refusal on the part of the successful bidder to execute the Contract. The amount of the check or bond, as the case may be, shall not constitute a limitation upon the right of the Owner to recover for the full amount of such damage.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.01 UNCOVERING OF WORK

A. No Work shall be covered until inspected by the District.

B. If a portion of the Work is covered contrary to the District’s request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the District, be uncovered for the District’s observation and be replaced at the Contractor’s expense without change in the Contract Time.

C. If a portion of the Work has been covered which the District has previously inspected, the District may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Contract Modification, be paid by the District. If such Work is not in accordance with the Contract Documents, the Contractor shall pay for all costs to uncover and replace the Work, as well as related disruptions and delays.

12.02 CORRECTION OF REJECTED AND FAILING WORK

A. The Contractor shall promptly correct Work rejected by the District or failing to conform to the requirements of the Contract Documents, whether observed before or after Project Completion.
and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the District representative's services and expenses made necessary thereby and at the labor rates included in contracts between District and District representatives.

C. If, within one (1) year after the date of Project Completion, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the District to do so. This period of one (1) year shall be extended with respect to portions of Work first performed after Project Completion by the period of time between Project Completion and the actual performance of the Work. This obligation under this Subparagraph shall survive acceptance of the Work under the Contract and termination of the Contract. The District will give such notice promptly after discovery of the condition.

C. The Contractor shall remove from the site those portions of the Work, which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the District.

D. If the Contractor fails to correct non-conforming Work within a reasonable time as determined by the District, the District may correct it in accordance with Paragraph 2.03. If the Contractor does not proceed with correction of such non-conforming Work within a reasonable time fixed by written notice from the District, the District may correct it and store the salvable materials or equipment and dispose of non-salvable material at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the District may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including reimbursement to the District of compensation for the District representatives' services and expenses made necessary thereby. If such proceeds of sale do not cover costs, which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the District.

E. The Contractor shall bear the cost of correcting destroyed or damaged Work of the District or separate contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

F. Nothing contained in this Paragraph shall be construed to establish a period of limitation with respect to other obligations, which the Contractor might have under the Contract Documents. Establishment of the time period of one (1) year as described hereinbefore relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.03 CORRECTION OF DEFECTIVE WORK

A. The Contractor shall be responsible for and shall replace any defective Work, whether due to faulty materials or errors in workmanship, which may be discovered in any part of the Work within one (1) year after its acceptance by the District and the District's filing of Certificate of Completion, or within such longer period as provided elsewhere in the Contract Documents or by law.
B. Except as otherwise expressly provided elsewhere in the Contract Documents, the Contractor agrees to correct any defective work performed and any defective materials furnished hereunder for a period of one (1) years from Acceptance of the Work of this Contract by the District and the District’s filing of the Notice of Project Completion.

1. The Contractor further agrees to correct any defective work performed in installation of equipment manufactured by others but installed by the Contractor.

C. Testing shall not be construed as operation or a continuation of the work. The Contractor, after receipt of notice, shall promptly make good at its expense all defects developing during the warranty period except where such is attributable to abuse. This agreement to correct defective work shall continue for corrected or replaced articles, or, if only parts of such articles are corrected or replaced, for such corrected or replaced parts, until one (1) year after date of re-deliver or correction.

D. If the District does not require correction or replacement of a defective or non-conforming article (a non-conforming article meaning an article that does not conform to that which is called for in the Contract Documents), the Contractor, if required by the District within a reasonable time after notice of defect or non-conformance, shall pay to the District such portion of the Contract price as is equitable in the circumstances as determined by the District.

E. This agreement to correct defective work, and all similar agreements applicable to Subcontractors', manufacturers' or suppliers' equipment used in or as a part of the Work (whether on equipment of the nature above specified or otherwise) shall inure to the benefit of the District without necessity of separate transfer or assignment thereof.

F. The remedies provided for in this clause shall not be restrictive but shall be cumulative and shall be in addition to all other legal remedies the District may possess with respect to latent defects or frauds.

12.04 ACCEPTANCE OF NON-CONFORMING WORK

A. If in the judgment of the District, it is undesirable or impracticable to replace any defective or non-conforming Work, the compensation to be paid to the Contractor shall be reduced by such amount as in the judgment of the District and its authorized representatives shall be equitable.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.01 GOVERNING LAW

A. The Contractor shall keep itself fully informed of and comply with all Federal, State and Local laws and orders of any properly constituted authority in any manner affecting this contract, the performance of the Work or those persons engaged therein, including but not limited to Titles 19, 21, and 24 of the California Code of Regulations, California Code of Regulations Title 16, Chapter 8, Paragraph 810-887, Title 1, Division 5 of the California Government Code (Section 4000, et seq., "Public Work and Public Purchases"), the California Public Contract Code, The California Contractor’s Licensing law and Title 2, Division 2, Part 23, Chapter 2 of the California Education Code (Section 39100, et seq., "Construction of School Buildings"). The Contractor shall examine the Contract Documents for compliance with these Codes and Regulations and shall promptly notify the District and the Architect of any discrepancies.

B. All construction and materials of this contract shall be in full accordance with the latest rules and regulations and requirements of the California Building Code (1995 Edition) and the requirements of Titles 19 and 24 and other applicable provisions of the California Code of Regulations (California Administrative Code) unless otherwise specified in the General Requirements (Division 1), CAL-OSHA, the State Division of Industrial Safety of the
Department of Industrial Relations, the Public Utilities Commission of the State of California, State Fire Marshal, the latest rules of the National Fire Protection Association, the Department of Public Health of the City and County of San Francisco, State and National laws and regulations, and of any other bodies or officials having jurisdiction or authority over same, and they shall be observed and complied with by the Contractor and any and all persons, firms and corporations employed by or under it. Authorized persons may at any time enter upon any part of the Work to ascertain whether such laws, ordinances, regulations or orders are being complied with. No additional costs will be paid or extensions of time granted as a result of such compliance. Each of the above-referenced provisions are incorporated by reference as if fully set forth herein.

C. The Contractor shall maintain in his project office a current copy of Titles 19 and 24 of the California Code of Regulations at all times during construction on this Project. Whenever the Drawings and Specifications require higher standards than are required by the regulations, the Drawings and Specifications shall govern. Whenever the Drawings and Specifications require something, which will violate the regulations, the regulations shall govern.

13.02 SUCCESSORS AND ASSIGNS

A. The Contractor shall constantly give its personal attention to the faithful prosecution of the Work. It shall keep the Work under its personal control and shall not assign by power of attorney or otherwise, nor subcontract the whole or any part thereof, except as herein provided and in accordance with the California Contractors Subletting laws.

B. All transactions with subcontractors will be made through the Contractor, and no subcontractor shall relieve the Contractor of any of its liabilities or obligations under the Contract.

C. When any subcontractor fails to prosecute a portion of the Work in a manner satisfactory to the District representative, the Contractor shall remove such subcontractor immediately upon written request of the District, and shall request approval of a new subcontractor to perform the Work pursuant to California Public Contract Code Section 4107, at no added cost to the District.

D. The Contract shall not be assigned except upon the approval of the District.

13.03 WRITTEN NOTICE

A. The addresses given in the Agreement are hereby designated as the legal address of the Contractor and the District, but any such address may be changed at any time by notice in writing, delivered to the other party. The delivery at such legal address or the depositing in any post office or post office box regularly maintained by the United States Postal Service, in a paid wrapper, directed to the other party at such address, of any drawing, notice, letter or other communication, shall be deemed legal and sufficient service thereof upon that party.

13.04 RIGHTS AND REMEDIES

A. Duties and obligations imposed by the Contract Documents and rights and remedies available there under shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

B. Except as otherwise specifically provided herein, no action or failure to act by the District or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.
TESTS AND INSPECTIONS

A. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Contractor shall make arrangements for such tests, inspections and approvals through the District Inspector in accordance with the Uniform Building Code, California Building Code and applicable state laws or regulations. The Contractor shall give the District a minimum of 48 hours notice, excluding weekends and District holidays, of when and where tests and inspections are to be made so the District may arrange and observe such procedures. Tests and testing laboratories shall conform to California Code of Regulations Title 24, Part 1, Section 4-335.

1. The District will retain the services of testing agencies or consultants to perform such tests or inspections and render such services as may be required to verify that the Work fulfills the requirements and intent of the Contract Documents. Such services will be performed in a manner consistent with the requirements of the District and the various agencies having jurisdiction over the Work and in accordance with reasonable standards of architectural and engineering practice.

2. The District reserves the right to modify the scope of, or to reallocate, any of the testing and inspection services specified in the various Sections of the Contract Documents to be performed by a testing agency or consultant retained by the District in connection with the Work.

3. The Contractor shall bear the cost of special inspections or observations if additional such inspections or observations are occasioned by the Contractor's unexcused delay, or as a result of work that is rejected and corrected. Repeat Inspection or inspections requested and subsequently canceled, may be subject to back charges.

B. If the District or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included herein, the District will order the performance of such services by qualified independent testing agencies, or consultants as may reasonably be required. The District shall bear such costs except as otherwise provided herein.

C. If such procedures for testing, inspection or approval reveal failure of the portion of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the District representatives' and consultants' services and expenses.

1. If the District's observation of any inspection or testing undertaken pursuant to Paragraph 13.05 reveals a failure in any one of a number of identical or similar items or elements incorporated in the Work to comply with (a) the requirements of the Contract Documents or, (b) with respect to the performance of the Work, with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, the District will have the authority to order inspection and testing of all such items or elements of the Work, or of a representative number of such items or elements of the Work, as it may consider necessary or advisable.

2. The Contractor shall bear all costs thereof, including reimbursement to District for the District representatives' and consultants' additional services, if any are required, made necessary thereby. However, neither the District's authority to act under Paragraph 13.05 nor any decision made by the District's representative in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the District to the Contractor, any Subcontractor, or any of their agents or employees, or any other person performing any of the Work.
D. The failure of District, Architect and its representatives and consultants, or District's Project Inspector to observe or inspect the Work, or to detect deficiencies in the Work, or to inform Contractor of any deficiencies which may be discovered, shall not relieve Contractor, its subcontractors regardless of tier, or suppliers from their responsibility for construction means, methods, techniques, sequences and procedures, construction safety, nor from their responsibilities to carry out the work in accordance with the Contract Documents and to detect and correct defective work. The term "defective work" means work that is unsatisfactory, faulty, omitted incomplete, deficient, or does not conform to the requirements of the Contract Documents, directives of Architect or the requirements of any inspection, reference standard, test, or approval specified in the Contract Documents, or has been damaged prior to final completion, unless responsibility for the protection of such work has been assumed by District through beneficial occupancy (or substantial completion, where applicable) in accordance with the General Conditions.

E. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor.

F. If the District representatives are to observe tests, inspections or approvals required by the Contract Documents, the District shall do so promptly and, where practicable, at the normal place of testing. If the testing location is outside the nine (9) county Bay Area, the Contractor shall bear the travel-related costs, including transportation, lodging, meals, long-distance telephone calls and facsimile transmittals, and associated expenses of the District.

G. The Contractor shall furnish promptly, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection and test as may be required by the District. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

1. The District reserves the right to charge to the Contractor any additional cost of inspection or test when material or workmanship is not ready at the time specified or when re-inspection or re-test is necessitated by prior rejection or unexcused delay.

H. All materials, equipment, and workmanship used in the work of Project shall be subject to inspection and special inspection or testing at all times during Construction and/or manufacture in accordance with California Code of Regulations Title 24, Part 1, Section 4-333(c) and 4-335.

I. The District shall supply an inspector(s) who shall observe construction in progress. The inspector shall act under the direction of the Architect and the Peralta Community College District or the District's authorized representative. The general duties of the Inspector in fulfilling his or her responsibilities shall be in accordance with Sections 4-333, 4-336, 4-337 and 4-342 of the California Code of Regulations, Part 1 of Title 24. Inspector to be approved by the Division of the State Architect. Project Inspectors shall have the following responsibilities and limitations on authority:

1. Observe installations and work in progress as a basis for determining conformance of the work, materials and equipment with the Construction Documents. Project Inspector will report any discrepancies observed to Architect, District, and Contractor. Only the Architect has the authority to make approvals or rejections.

2. Only Architect shall interpret the requirements of the Construction Documents. If any item is ambiguous, Architect shall make a written interpretation. If Contractor requests changes or modifications to the Construction Documents, Architect shall make a written determination on the requested changes or modifications.

3. Prepare an inspection report for each inspection performed.
4. Review the monthly progress payment request before Contractor submits it to the Architect.

5. Assist the Architect in reviewing the test and inspection results of testing laboratories.

6. The Project Inspector is not authorized to permit deviations from the requirements of the Contract Documents unless such deviation has been approved by the District and the Architect.

7. The Project Inspector is not authorized to advise on or issue directions to Contractor about any aspect of construction means, methods, techniques, sequences or procedures, or relating to safety programs in connection with the Project.

J. All inspection shall be scheduled through the District Inspector by issuing an inspection request using the District standard form.

13.06 EQUAL OPPORTUNITY

A. Nondiscrimination provisions shall be in accordance with and pursuant to the provisions of the Peralta Community College District Policy on Equal Opportunity.

B. To be eligible for award of the contract, the Contractor must agree to comply with all applicable requirements authorized by the Peralta Community College District Policy where applicable.

C. It is the policy of the District that in connection with all work performed under contracts, there will be no discrimination against any prospective or active employee engaged in the work because of race, color, ancestry, national origin, religious creed, sex, age, handicap, or marital status. The Contractor agrees to comply with applicable Federal and California laws including, but not limited to, the California Fair Employment Practice Act, beginning with Government Code Section 12900 and Labor Code Sections 1735, 1777.5, 1777.6 and 3077.5. In addition, the Contractor agrees to require like compliance by any subcontractors employed on the work.

13.07 APPRENTICES

A. Contractors must comply with certain apprenticeship obligations set forth in the Labor Code (LC Section 1777.5). Every such apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he or she is employed, and shall be employed only at the work of the craft or trade to which he or she is registered.

B. Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4 (commencing with Section 3070) of Division 3, are eligible to be employed as apprentices on public works. The employment and training of each apprentice shall be in accordance with the apprenticeship standards and apprentice agreements under which he or she is training.

C. When the Contractor to whom the contract is awarded by the state or any political subdivision, or any Subcontractor under him or her, in performing any of the work under the contract or subcontract, employs workers in any apprenticeable craft or trade, the contractor and Subcontractor shall apply to the joint apprenticeship committee administering the apprenticeship standards of the craft or trade in the area of the site of the public work for a certificate approving the Contractor or Subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected. However, approval as established by the joint apprenticeship committee or committees shall be subject to the approval of the administrator of Apprenticeship. The joint apprenticeship committee or committees, subsequent to approving the subject Contractor or Subcontractor, shall arrange
for the dispatch of apprentices to the Contractor or Subcontractor in order to comply with this section. Every Contractor and Subcontractor shall submit contract award information to the applicable joint apprenticeship committee, which shall include an estimate of journeyman hours to be performed under the contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. There shall be an affirmative duty upon the joint apprenticeship committee or committees administering the apprenticeship standards of the craft or trade in the area of the site of the public work to ensure equal employment and affirmative action in apprenticeships for women and minorities. Contractors or Subcontractors shall not be required to submit individual applications for approval to local joint apprenticeship committees provided they are already covered by the local apprenticeship standards. The ration of work performed by apprentices to journeymen who shall be employed in the craft or trade on the public work may be the ration stipulated in the apprenticeship standards under which the joint apprenticeship committee operates, but, except as otherwise provided in this section, in no case shall the ratio be less than one hour of apprentices work for every five hours of labor performed by a journeyman. However, the minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeymen.

D. Any ratio shall apply during any day or portion of a day when any journeyman, or the higher standard stipulated by the joint apprenticeship committee, is employed at the job site and shall be computed on the basis of the hours worked during the day by journeymen so employed, except for the land surveyor classification. The Contractor shall employ apprentices for the number of hours computed as above before the end of the contract. However, the Contractor shall endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the job site. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of a joint apprenticeship committee, may order a minimum ration of not less than one apprentice for each five journeymen in a craft or trade classification.

E. The Contractor or Subcontractor, if he or she is covered by this section, upon issuance of the approval certificate, or if he or she has been previously approved in the craft or trade, shall employ the number of apprentices or the ration of apprentices to journeymen stipulated in the apprenticeship standards. Upon proper showing by the contractor that he or she employs apprentices in the craft or trade in the state on all of his or her contracts on an annual average of not less than one hour of apprentice work for every five hours of labor performed by a journeyman, or in the land surveyor classification, one apprentice for each five journeymen, the Division of Apprenticeship Standards may grant a certificate exempting the contractor from the 1-to-5 hourly ratio as set forth in this section. This section shall not apply to contracts of General Contractors or to contracts of specialty Contractors not bidding for work through a general or prime contractor, when the contract of General Contractors or those specialty Contractors involve less than thirty thousand dollars ($30,000) or 20 working days. Any work performed by a journeyman in excess of eight hours per day or 40 hours per week, shall not be used to calculate the hourly ratio required by this section.

F. "Apprenticeable craft or trade," as used in this section, means a craft or trade determined as an apprenticeable occupation in accordance with rules and regulations prescribed by the Apprenticeship Council.

G. A Contractor to whom the contract is awarded, or any Subcontractor under him or her, who, in performing any of the work under the contract, employs journeymen or apprentices in any apprenticeable craft or trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any craft or trade in the area of the site of the public work, to which fund or funds other contractors in the area of the site of the public work are contributing, shall contribute to the fund or funds in each craft or trade in which he or she employs journeymen or apprentices on the public work in the same amount or upon the same basis and in the same manner as the other Contractors do, but where the trust fund administrators are unable to accept the funds, Contractors not signatory to the trust
agreement shall pay alike amount to the California apprenticeship Council. The Contractor or Subcontractor may add the amount of the contributions in computing his or her bid for the contract. The Division of Labor Standards Enforcement is authorized to enforce the payment of the contributions to the fund or funds.

H. The prime Contractor is responsible for compliance with the above to include their Subcontractors.

I. All decisions of the joint apprenticeship committee under this section are subject to Section 3081. (Amended by Stats. 1989, Ch. 1224.)

13.08 WAGES AND PAYROLLS

A. It is hereby understood and agreed that all provisions of Section 1770 et seq. of the California Labor Code are required to be incorporated into every contract for any public work or improvement and are provisions of this Contract. Applicable Labor Code provisions control over any conflicting provision contained herein.

B. It is hereby understood and agreed that all provisions of California Labor Code Sections 1770 et seq. and sections 1610, et seq. are incorporated as provisions of this Contract, including but not limited to the following:

1. The Contractor shall pay to all persons performing labor in and about the Work provided for in this Contract not less than the general prevailing rate of wages as determined by the Director of the California Department of Industrial Relations for their respective crafts and employment, including such wages for holiday and overtime work. The bidder is cautioned to inspect the minimum wage rates as rates are updated periodically.

2. The Contractor shall insert in every subcontract or other arrangement which it may make for the performance of any Work or labor on the Work provided for in this Contract, a provision that said subcontractor shall pay to all persons performing labor or rendering service under said subcontract or other arrangement the general prevailing rate of wages determined as set forth herein after for the respective crafts and employment, including such wages for holiday and overtime work.

3. The Contractor shall keep or cause to be kept an accurate record showing the name, place or residence, occupation, and per diem pay, of each person engaged in the execution of this Contract, and every subcontractor who shall undertake the performance of any part of the Work herein required shall keep a like record of each person engaged in the execution of the subcontract. All of said records shall at all times be open to the inspection of and examination of the District and its authorized representatives.

4. The Contractor shall submit its monthly-certified payrolls with its progress payment applications to the District.

5. Should the Contractor, or any Subcontractor who shall undertake the performance of any part of the Work herein required, fails or neglects to pay to the persons who shall perform labor under this Contract, subcontract or other arrangement for the Work the general prevailing rate of wages as herein specified, it shall forfeit, and in the case of any subcontractor so failing or neglecting to pay said wage, the original contractor and the subcontractor shall jointly and severally forfeit, to the District the sum of fifty dollars ($50.00) per day for each laborer, worker or mechanic employed for each calendar day or portion thereof, while said person shall be so employed and not paid said highest general prevailing rate of wages. The District will deduct the amount, which would otherwise be due on said payment the amount of said forfeiture, or forfeitures as so certified.
6. No person performing labor or rendering service in the performance of any contract or subcontract for the Work herein required shall perform labor for a longer period than forty (40) hours per week, or five (5) days of eight (8) hours each, excepting those in crafts in which a shorter work day now prevails by agreement in private employment. Any Contractor or subcontractor who violates this provision shall be liable for the same penalties and forfeitures as those specified in Subparagraph 5 above for each laborer, mechanic or artisan employed for each calendar day or portion thereof wherein such laborer, mechanic or artisan is compelled or permitted to work more than the days and hours specified herein. Provided, that if it is so stipulated in the General Conditions, the number of days and hours of labor per week may be extended beyond the limitations above mentioned, but not to exceed eight (8) hours in any one calendar day, or six (6) days in any calendar week. In the event that emergency conditions shall arise making a change advisable during the performance of the Contract, or any portion thereof, the hours and days of labor may be extended beyond the limits hereinabove expressed, but not to exceed an additional 8 hours per day, upon the written authority of the District. Failure of the contractor to perform its contract within the time provided shall not be deemed to constitute an emergency.

C. Certification of Payroll Records: In accordance with Section 1776 of the California Labor Code:

1. The Contractor shall, and shall require that its Subcontractors, keep an accurate payroll record, 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 it or her in connection with this Contract.

2. The payroll records shall be certified and shall be submitted to the District within five (5) days of each of the payroll periods of the Contractor and his subcontractors, and at least once monthly. Pay requests shall not be processed until certified payroll records have been submitted up-to-date. In addition, the payroll records shall be available for inspection at all reasonable hours at the job site office of the Contractor on the following basis:

   a. A certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or its or her authorized representative on request.

   b. A certified copy of all payroll records shall be made available for inspection or furnished upon request to a representative of the District.

   c. A certified copy of all payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the District or the Department of Industrial Relations.

3. The Contractor shall file a certified copy of the payroll records with the entity that requested such records within ten (10) days after receipt of a written request.

4. Any copy of payroll records made available for inspection as copies and furnished upon request of the public or any public agency by the District shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the Contractor awarded the Contract or performing the Contract shall not be marked or obliterated.

5. The Contractor shall inform the District of the location of the payroll records, including the street address, city and county, and shall, within five (5) working days, provide a notice of a change of location and address.
6. In the event of noncompliance with the requirements of said Section 1776, the Contractor shall have 10 days in which to comply subsequent to receipt of written notice specifying in what respects such Contractor must comply with said section. Should noncompliance still be evident after such 10-day period, the Contractor shall, as a penalty to the District, forfeit twenty-five dollars ($25.00) for each calendar day, or a portion thereof of non-compliance, for each worker, until strict compliance is effected. Upon the request of the Department of Industrial Relations, or the District, such penalties shall be withheld from progress payments then due. All penalties and forfeitures set forth herein shall at the expiration of ninety (90) days after completion of the contract and formal acceptance of the work by the District, be forwarded to the State Treasurer if requested by the Division of Labor Standards Enforcement.

7. The responsibility for compliance with Section 1776 shall be on the Contractor.

8. No progress payments will be processed until the Contractor has submitted, to the District, certified payrolls pursuant to Section 1770 et seq. of the California Labor Code for the periods involved for all employees including those of subcontractors. The District will not be liable to the Contractor for costs arising from the delay in making progress payments.

9. If the District receives formal notice either by service or summons or registered mail of a suit commenced to recover the withheld amounts within the ninety (90) day period following contract completion, it shall retain them until a final court judgment is obtained. It shall distribute the withheld amounts in accordance with said judgment.

10. Should the District not have withheld sufficient funds to cover all penalties and forfeitures due, it shall notify the Department of Labor Standards Enforcement of the judgment and provide whatever assistance is requested by the Division of Labor Standards Enforcement to recover penalties due for failure to pay prevailing wage.

11. Should there be a reasonable belief on the part of the District that prevailing wages are not being paid by the contractor or his subcontractors, it may conduct an investigation to determine if this is the case. After a full investigation, if the District determines that the prevailing wage is not being paid, it shall withhold fifty dollars ($50.00) per day per worker (in accordance with Labor Code 1775) whom it determines is not being paid the prevailing wage from the next progress payment due, or final payment. Alternatively, the District may notify the Division of Labor Standards Enforcement, requesting a full investigation. Should the result of the investigation conclude that the prevailing wage was not being paid, the District will withhold the amount indicated above in the manner set forth herein.

12. The statutory penalties for willful noncompliance with prevailing wage requirements may be enforced after a formal determination of non-compliance. A willful violation may result in debarment of one (1) to three (3) years in accordance with Labor Code Section 1777.1.

13. The District retains the right to consider the contractor's willful failure to pay prevailing wage in awarding future contracts, to the extent permitted by law.

D. Copies of such prevailing rates of per diem wages are on file at the Office of the Division of Labor Statistics and Labor Prevailing Wage Unit, 525 Golden Gate Avenue, San Francisco, California 94102 or at Peralta Community College District, Facilities Planning and Construction, 50 Phelan Avenue, Room B-601, San Francisco, CA 94112, (415) 239-3046.

13.09 TEMPORARY FACILITIES
A. The Contractor shall obtain permits for, install and maintain in safe condition, whatever scaffolds, hoisting equipment, barricades, walkways, or other temporary structures, which may be required to accomplish the work on the construction project. Such structures shall be adequate for the intended use and capable of safely accepting all loads that may be imposed upon them. They shall be installed and maintained in accordance with all applicable State and Local codes and regulations. The Contractor is responsible for maintaining access to the buildings at all times.

B. The Contractor shall provide, maintain, and remove all weather protection required to protect the work or District property.

C. The Contractor is responsible for parking and storage as required by the Contractor, Subcontractors, and Suppliers on this project. The Contractor shall provide, maintain, and remove all work required to comply with the Storm Water Run-off Plan.

D. The Contractor shall provide and maintain temporary heat from an approved source whenever in the course of the work it may become necessary for curing and drying of materials, or to warm spaces as may be required for the installation of materials or finishes. If new permanent HVAC equipment is used for this purpose, equipment warranty periods shall not start at this time. All warranties begin at project completion and acceptance by PCCD.

E. The Contractor shall provide and maintain any and all facilities that may be required for dewatering in order that work may proceed on the project. If it is necessary for dewatering to occur continually, the Contractor shall have on hand whatever spare parts or equipment that may be required to prevent interruption of dewatering.

F. The Contractor shall provide and maintain all utility services necessary to perform the work under this Contract. These may include, but are not limited to, electricity, water, gas, sewer and telephone, including charges and installation fees. Contractor shall furnish and maintain all means of distribution of utility services required within the site to properly complete the project. Electrical work shall be consistent with Division of Industrial Safety "Electrical Safety Orders (ESO), Public Utilities Commission "Rules of Overhead Line Construction" (G.O. 95), the Division of the State Architect, and CAL-OSHA. The Contractor shall provide and maintain adequate fire extinguishers and safety kits to be used in the event of an emergency.

G. Materials, tools, accessories, etc., shall be stored only where directed by the District. Storage area shall be kept neat and clean. Security of stored items shall be the Contractor's responsibility.

H. When flammable materials are stored on site, extra precaution including clear identification shall be the responsibility of the Contractor and in accordance with all applicable Federal, State, and Local laws.

I. The Contractor shall provide and maintain temporary toilets in quantities and locations as required by CAL/OSHA and other local codes and regulations. They shall be maintained and supplied in a usable and sanitary condition at all times.

J. If water at construction site is determined to be non-potable by Job Inspector, Contractor shall provide and maintain adequate potable water stations at site until final completion of Construction Project.

K. The Contractor shall maintain an office at the project site, which will be his headquarters for this Project. Any communications delivered to this office shall be considered as delivered to the Contractor. Location and size of office shall be such that it will adequately serve the needs of the Contractor's superintendent and assistants in the performance of their duties.
L. The Contractor shall also provide and maintain an office for the use of the Inspector and Architect on the site at a location to be determined by the Owner and/or the Owner's representative. This office will be watertight and of adequate size to accommodate a desk, chair, filing cabinet, plan rack, two stools, and large plan table, all provided by the Contractor. This office shall be provided with windows, lighting, heat and a non-coin operated telephone, all to be paid for by the Contractor for the duration of the Project.

M. The Contractor shall promptly remove all such temporary facilities when they are no longer needed for the work or for completion of the Project, mutually agreed upon by the Contractor and the District.


13.10 CONFLICT OF INTEREST
A. Contractor understands the following and certifies that it does not know of any facts which constitutes a violation:

1. Contractor hereby certifies that no current Board member or employee of the Peralta Community College District, and no one who has been a Board member or who has been employed by the Peralta Community College District within the past two years, has participated in bidding, selling or promoting this contract. Furthermore, Contractor certifies that no such current or former Board member or employee has an ownership interest in this contract, nor shall any such current or former Board member or employee derive any compensation, directly or indirectly, from this contract. Contractor understands that any violation of this provision of the contract shall make the agreement voidable by the District.

2. Government Code of the State of California, Section 87100 et. seq. regarding Public officials; state and local; financial interest;

B. No public official at any level of state or local government shall make, participate in making or in any way attempt to use his official position to influence a governmental decision in which he knows or has reason to know he has a financial interest.

13.11. SUPERVISION BY THE DIVISION OF THE STATE ARCHITECT
A. The District (Owner) shall notify the Division of the State Architect ("ORS") of the start of construction as required by California Code of Regulations, Title 24, Part 1, Section 4-331, and by California Education Code Sections 39152, 39153, 81142, and 81143.

B. As required by California Code of Regulations, Title 24, Part 1, section 4-334, during construction, reconstruction, repair, alteration of or addition to any school building, the ORS shall make such inspection as in its judgment is necessary or proper for enforcement of the act and the protection of the safety of the pupils, the teachers and the public. If at any time as the work progresses and prior to the issuance of the final approval, it shall be found by the ORS that modifications or changes are necessary to secure safety, orders shall be issued by the DSA for such modifications or changes.

13.12 INSTRUCTIONS AND MANUALS
A. Three copies each of all maintenance instructions, application/installation instructions and service materials called for in the Contract Documents shall be provided by the Contractor. These shall be complete as to drawings, details parts lists, performance data and other information that may be required for the Owner to easily maintain and service the materials and equipment installed under this Contract.
B. All manufacturer’s application/installation instructions shall be given to the Inspector at least ten (10) days prior to first material application or installation of the item by the Contractor.

C. The maintenance instructions and manuals, along with any specified guarantees, shall be delivered by the Contractor to the Architect for review prior to submission to the Owner. The Contractor or appropriate Subcontractors shall instruct Owner’s personnel in the operation and maintenance of the more complex equipment prior to final acceptance of the Project.

13.13 AS-BUILT DRAWINGS

A. The Contractor and all his subcontractors shall maintain a separate complete set of contract drawings at the work site, which will be used solely for the purpose of recording changes made in any portion of the work during the course of construction, regardless of the reason for the change. As changes occur, they will be included or marked on this record set on a daily basis if at all possible to keep them up to date at all times. Actual locations to scale shall be identified on the drawings for all runs of mechanical and electrical work, including all site utilities, etc., installed underground, in walls, floors, and furred spaces, or otherwise concealed areas. Deviations from the drawings shall be shown in detail. All main runs, whether piping, conduit, ductwork, drain lines, etc., shall be located in addition, by dimension and elevation. Where appropriate, the source document of the change shall be noted, i.e., RFI #, etc.)

D. Progress payments may be delayed or withheld until such time as the record set (AS BUILT DRAWINGS) is brought up to date to the satisfaction of the Architect. The Contractor shall verify that all changes in the work are included in the AS-BUILT drawings and shall deliver the complete set thereof to the Architect for his review and satisfaction prior to submittal to the Owner. A necessary condition for release of final retention shall be submission of complete set of AS BUILT drawings to the Owner as approved by the Architect. These drawings shall be submitted to the Owner with request for final payment.

13.14 PREVAILING WAGES

A. The District reserves the right to monitor Prevailing Wages in the work force in accordance with the rights given the District by the Labor Code and the Contractor agrees to cooperate with the District at no additional cost to the District.

13.15 ASBESTOS MATERIALS

A. No materials containing asbestos shall be used or installed in the work on District contracts unless the Contractor has prior written approval from the manager of the District’s Asbestos Control Program.

13.16 ASBESTOS ABATEMENT

A. No construction or demolition operations as required by the contract documents shall simultaneously operate in the proximity of an asbestos work area or affect in any way the asbestos abatement work, including air fiber levels. The General Contractor will be fully responsible for any costs associated with delays and/or additional testing directly or indirectly resulting from such interferences. All air samples above the specified criteria of 0.01 f/cc outside asbestos work areas will be required to be analyzed by transmission electron microscopy (TEM) at the Contractor’s expense.

13.17 SCHOOL FACILITIES UNDER CONSTRUCTION OR RENOVATION; USE OF LEAD PAINT, PLUMBING, ETC. PROHIBITED

A. New School facilities under construction, or school facilities undergoing a modernization or renovation program, shall not utilize lead-based paint, lead plumbing and solders, or other

13.18 RECYCLING PROGRAM

A. It is the expressed intent of the PCCD to minimize waste and waste generation in all activities under its control and oversight. To that end, the Contractor shall be required to divert, to the maximum extent feasible, all materials from solid waste to other uses. Specific requirements are detailed as follows:

E. The Contractor shall be required to separate construction and demolition debris materials by type and arrange for pick-up or drop-off and re-use or recycle of said materials. Materials shall include, at a minimum, wood (re-usable dimensional lumber, re-usable wood pallets and recyclable untreated wood), ferrous and non-ferrous metals, cardboard, excavation soil, concrete, and asphalt, as appropriate, given the nature of the job. Materials need not be recycled if an appropriate re-use, employing a local firm, such as Building Resources, can be made.

D. The contractor shall provide the District, in advance, a list of material types that will likely become surplus throughout the course of the project and a plan for intended disposition. The Contractor is responsible for the removal of all construction and demolition debris generated by the project. The PCCD Recycling Coordinator can provide the Contractor with a list of acceptable companies that provide recycling and re-use service for construction and demolition debris. The PCCD Recycling Program will provide the Contractor with recycling services for the following materials: aluminum cans, glass bottles, white paper, and mixed paper.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.01 TERMINATION BY THE DISTRICT FOR CAUSE

A. The District may terminate the Contract if the Contractor:

1. Refuses or fails to supply enough properly skilled workers or proper materials;

2. Persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or

3. Otherwise is guilty of substantial breach of a provision of the Contract Documents.

B. When any of the above reasons exist, the District may without prejudice to any other rights or remedies of the District and after giving the Contractor and the Contractor's surety seven days' written notice, terminate employment of the Contractor and may:

1. Take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

2. Accept assignment of subcontracts pursuant to Paragraph 5.03; and

3. Finish the Work by whatever reasonable method the District may deem expedient.

C. When the District terminates the Contract for one of the reasons stated in Article 14 of these General Conditions, the Contractor shall not be entitled to receive further payment until the Work is finished.

D. If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the District representatives' services and expenses made necessary thereby,
such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor and/or the Surety shall pay the difference to the District. The amount to be paid to the Contractor or District, as the case may be, upon application, and be an obligation for payment that shall survive termination of the Contract.

14.02 SUSPENSION BY THE DISTRICT FOR CONVENIENCE

A. The District may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine.

B. An adjustment shall be made for increases in the cost of performance of the Contract caused by suspension, delay or interruption. No adjustment shall be made to the extent:

1. That performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

2. That an equitable adjustment is made or denied under another provision of this Contract.

14.03 TERMINATION BY THE DISTRICT FOR CONVENIENCE

A. The District may terminate the performance of Work under this Contract in accordance with this clause in whole, or from time to time in part, whenever the District shall determine that such termination is in the best interest of the District. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the contract is terminated, and the date upon which such termination becomes effective.

B. After receipt of a notice of termination, and except as otherwise directed by the District, the Contractor shall:

1. Stop Work under the contract on the date and to the extent specified in the notice of termination;

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

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

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

5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts with the approval or ratification of the District, in writing, to the extent it may require. Its approval or ratification shall be final for all the purposes of this clause;

6. Transfer title to the District, and deliver in the manner, at the times, and to the extent, if any, directed by the District, (a) the fabricated or un fabricated parts, Work in process, completed Work, supplies, and other material produced as a part of, or acquired in connection with the performance of, the Work terminated by the notice of termination, and (b) the completed or partially completed drawings, information, and other property which, if the contract had been completed, would have been required to be furnished to the District;
7. Use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices that the District directs or authorizes, any property of the types previously referred to herein, but the Contractor (a) shall not be required to extend credit to any purchaser, and (b) may acquire any such property under the conditions prescribed and at a price or prices approved by the District. The proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the District to the Contractor under this contract or shall otherwise be credited to the price or cost of the Work covered by this contract or paid in such other manner as the District may direct;

8. Complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

9. Take such action as may be necessary, or as the District may direct, for the protection and preservation of the property related to this contract, which is in the possession of the contractor, and in which the District has or may acquire an interest.

C. After receipt of a notice of termination, the Contractor shall submit to the District its termination claim, in the form and with the certification the District prescribes. Such claim shall be submitted promptly but in no event later than one (1) year from the effective date of termination, unless one or more extension in writing are granted by the District upon request of the Contractor made in writing within such 1-year period or authorized extension. However, if the District determines that the facts justify such action, it may receive and act upon any such termination claim at any time after such one-year period or extension. If the Contractor fails to submit its termination claim within the time allowed, the District may determine, on the basis of information available to the District, the amount, if any, due to the Contractor because of the termination. The District shall then pay to the Contractor the amount so determined.

D. Subject to the previous provisions, the Contractor and the District may agree upon the whole or any part of the amount or amounts to be paid to the Contractor because of the total or partial termination of Work under this Paragraph. The amount or amounts may include a reasonable allowance for profit on Work done. However, such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of Work not terminated. The contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing following, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the District to agree upon the whole amount to be paid to the Contractor because of the termination of Work under this Paragraph, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this Subparagraph.

E. If the Contractor and the District fail to agree, as the previous subparagraph provides, on the whole amount to be paid to the Contractor because of the termination of Work hereunder, the District shall determine, on the basis of information available to the District, the amount, if any, due to the Contractor by reason of the termination and shall pay to the Contractor the amounts determined as follows:

1. For all Contract Work performed before effective date of the notice of termination, the total (without duplication of any items) of:
   a. The cost of such Work;
   b. The cost of settling and paying claims arising out of the termination of Work under subcontracts or orders as previously provided. This cost is exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the Contractor before the effective date of the notice of termination.
These amounts shall be included in the cost on account of which payment is made for the cost of Work previously provided; and

c. A sum, as profit on the cost of the Work as previously provided, that the District determines to be fair and reasonable. But, if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed, and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

2. The reasonable cost of the preservation and protection of property incurred as previously provided. The total sum to be paid to the Contractor shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract Price of Work not terminated. Except for normal spoilage, and except to the extent that the District shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor the fair value, as determined by the District, of property which is destroyed, lost, stolen, or damaged, to the extent that it is undeliverable to the District, or to a buyer as previously provided.

F. The Contractor shall have the right to dispute as provided hereinafter in the Subparagraph entitled "Remedies," from any determination the District makes under the previous subparagraphs. But, if the Contractor has failed to submit its claim within the time provided and has failed to request extension of such time, it shall have no such right of appeal. In any case where the District has determined the amount owed, the District shall pay to the Contractor the following:

1. If there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the District or;

2. If a "Remedies" proceeding is initiated, the amount finally determined in such "Remedies" proceeding.

G. In arriving at the amount due the Contractor under this clause there shall be deducted:

1. All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this contract;

2. Any claim which the District may have against the Contractor in connection with this Contract; and

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

H. If the termination hereunder were partial, before the settlement of the terminated portion of this contract, the Contractor may file with the District a request in writing for an equitable adjustment of the price or prices specified in the contract relating to the continued portion of the contract (the portion not terminated by the notice of termination). Such equitable adjustment as may be agreed upon shall be made in the price or prices. Nothing contained herein shall limit the right of the District and the Contractor to agree upon the amount or amounts to be paid to the continued portion of the contract when the contract does not contain an established contract price for the continued portion.

I. Remedies: All claims, counter-claims, disputes and other matters in question between the District and the Contractor arising out of or relating to this Contract or its breach will be decided in a court of competent jurisdiction within the State of California.

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J. The Contractor understands and agrees that the forgoing termination of Contract for convenience provisions shall be interpreted and enforced pursuant to cases interpreting and enforcing similar provisions in federal procurement contracts.

END OF DOCUMENT
SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.

B. Related Section:

1. Division I Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Owner: Peralta Community College District
333 East 8th Street
Oakland, Ca 94606

100 Filbert Street
Oakland, Ca 94607

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of, but is not limited to, the following:

1. Build-out of existing unimproved spaces into art studios on 4th floor; and improvements/alterations to labs, classrooms, and offices on 1st, 2nd, 3rd, and 5th floors.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to area of Work as indicated on plans.
2. Loading Areas, Walkways and Entrances: Keep loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of loading areas and entrances by construction operations.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify the Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.
E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division I General Requirements: Requirements of Sections in Division I apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100
SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Requests for Information (RFIs).
4. Project meetings.

B. Related Sections:
1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Preinstallation conferences.
6. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 KEY PERSONNEL

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect and Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow five working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: The District or the Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
   g. Procedures for RFLs.
   h. Procedures for testing and inspecting.
   i. Procedures for processing Applications for Payment.
   j. Distribution of the Contract Documents.
   k. Submittal procedures.
   l. Sustainable design requirements.
   m. Preparation of record documents.
   n. Use of the premises and existing building.
   o. Work restrictions.
   p. Working hours.
   q. Owner's occupancy requirements.
   r. Responsibility for temporary facilities and controls.
   s. Procedures for moisture and mold control.
   t. Procedures for disruptions and shutdowns.
   u. Construction waste management and recycling.
   v. Parking availability.
   w. Office, work, and storage areas.
   x. Equipment deliveries and priorities.
   y. First aid.
   z. Security.
   aa. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: The District or Construction Manager will conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected
by the installation and its coordination or integration with other materials and installations that
have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager
of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular
activity under consideration, including requirements for the following:
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility problems.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written recommendations.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required
corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring
information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate
whatever actions are necessary to resolve impediments to performance of the Work and reconvene
the conference at earliest feasible date.

D. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals, typically
weekly, or more frequently if needed.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each
contractor, subcontractor, supplier, and other entity concerned with current progress or involved in
planning, coordination, or performance of future activities shall be represented at these meetings.
All participants at the meeting shall be familiar with Project and authorized to conclude matters
relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other
items of significance that could affect progress. Include topics for discussion as appropriate to
status of Project.

   a. Contractor’s Construction Schedule: Review progress since the last meeting. Determine
whether each activity is on time, ahead of schedule, or behind schedule, in relation to
Contractor’s construction schedule. Determine how construction behind schedule will be
expedited; secure commitments from parties involved to do so. Discuss whether schedule
revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFI's.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310
SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Start-up construction schedule.
2. Contractor's construction schedule.
3. Daily construction reports.
4. Material location reports.
5. Field condition reports.
6. Special reports.

B. Related Sections:

1. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
2. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 INFORMATIONAL SUBMITTALS

A. Format: Submit required submittals in PDF electronic file format and hard copies upon request.

B. Start-up construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Daily Construction Reports: Submit at weekly intervals.

E. Material Location Reports: Submit at weekly intervals.

F. Field Condition Reports: Submit at time of discovery of differing conditions.

G. Special Reports: Submit at time of unusual event.

H. Qualification Data: For scheduling consultant.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include not less than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Owner-Furnished Products and Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   g. Seasonal variations.
h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Completion of mechanical installation.
c. Completion of electrical installation.
d. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.
B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Installation.
   h. Work by Owner that may affect or be affected by Contractor's activities.
   i. Testing and commissioning, if required.
   j. Punch list and final completion.
   k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
b. Total cost assigned to activities shall equal the total Contract Sum.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
10. Dollar value of activity (coordinated with the schedule of values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
5. Changes in the critical path.
6. Changes in total float or slack time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320
SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:

1. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.


1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's
construction schedule.
   a. Submit revised submittal schedule to reflect changes in current status and timing for
      submittals.

4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action, informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's and Construction Manager's final release or approval.
   g. Scheduled dates for purchasing.
   h. Scheduled dates for installation.
   i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will not be
   provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction
   activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and
      related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial
      submittals for portions of the Work are indicated on approved submittal schedule.
   3. Coordinate transmittal of different types of submittals for related parts of the Work so processing
      will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect and Construction Manager reserve the right to withhold action on a submittal
         requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for
   review shall commence on Architect's and Construction Manager's receipt of submittal. No extension of
   the Contract Time will be authorized because of failure to transmit submittals enough in advance of the
   Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if
      coordination with subsequent submittals is required. Architect and Construction Manager will
      advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial
      submittal.
   3. Resubmittal Review: Allow 15 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or
      other parties is indicated, allow 21 days for initial review of each submittal.

D. Identification and Information: Place a permanent label or title block on each paper copy submittal item
   for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 5 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of subcontractor.
   g. Name of supplier.
   h. Name of manufacturer.
   i. Submittal number or other unique identifier, including revision identifier.
   j. Number and title of appropriate Specification Section.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Other necessary identification.

E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Include the following information on an inserted cover sheet:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Name of subcontractor.
   h. Name of supplier.
   i. Name of manufacturer.
   j. Number and title of appropriate Specification Section.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Other necessary identification.
5. Include the following information as keywords in the electronic file metadata:
a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by the Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use District standard form and provide locations on form for the following information:

   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Indication of full or partial submittal.
   j. Drawing number and detail references, as appropriate.
   k. Transmittal number, numbered consecutively.
   l. Submittal and transmittal distribution record.
   m. Remarks.
   n. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor’s letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager] on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect’s and Construction Manager’s action stamp.

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
L. Use for Construction: Use only final submittals that are marked with approval notation from Architect’s and Construction Manager’s action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

2. Action Submittals: Submit seven paper copies of each submittal, unless otherwise indicated. Architect, through Construction Manager, will return two copies.

3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.

5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer’s catalog cuts.
   b. Manufacturer’s product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Notation of coordination requirements.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.
   b. Seven paper copies of Product Data, unless otherwise indicated. Architect, through Construction Manager, will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

3. Submit Shop Drawings in the following format:
   a. Three opaque (bond) copies of each submittal. Architect, through Construction Manager, will return one copy.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical
with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

F. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Submit subcontract list in the following format:

   a. PDF electronic file.

G. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

H. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.


J. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

K. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

L. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
M. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

N. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

O. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

P. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

Q. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330
SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager (CM), or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:
   1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.
1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory- Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRRL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 Insert standard; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRRL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST’s National Voluntary Laboratory Accreditation Program.

H. Manufacturer’s Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.

   a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.


   1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

   1. Schedule times for tests, inspections, obtaining samples, and similar activities.
1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Construction Manager (CM), and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through CM, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400
SECTION 01410 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS AND DESCRIPTION OF THE WORK

A. This Section specifies codes, laws, rules and regulations applicable to the project.

B. Nothing in these Contract Documents shall be construed to permit work not conforming to the latest edition of the aforementioned codes, laws, rules and regulations. Drawings may include regulatory requirements.

1.2 CODES, LAWS, RULES AND REGULATIONS

A. All work shall meet or exceed the applicable requirements of the latest editions of the following codes, including all adopted amendments and supplements:

10. California Code of Regulations, Title 8, Construction Safety (CAL-OSHA)
11. California Code of Regulations, Title 19, Public Safety, State Fire Marshal Regulations
12. California Health and Safety Code, Division 22
13. All Applicable NFPA Standards

B. All applicable federal, state and local laws, and the rules and regulations of governing utility districts and the various other authorities have jurisdiction over the construction and completion of the project, including the latest rules and regulations of the State Fire Marshal, CAL/OSHA and the State Safety Orders, and the California Labor Code, shall apply to the contract throughout, and they shall be deemed to be included in the contract the same as though printed in these Specifications.

C. Contractor shall furnish, without extra charge, any additional labor and/or materials when required by the compliance with the codes, laws, rules and regulations, though the work is not mentioned in these Specifications or shown on the Drawings.

D. When Specifications or Drawings call for materials or construction of a higher quality or larger size than required by governing codes, laws, rules and regulations, the provisions of the Specifications or Drawings shall take precedence.

END OF SECTION 01410
SECTION 01420 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS
   A. General: Basic Contract definitions are included in the Conditions of the Contract.
   B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
   C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
   D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
   E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
   F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
   G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
   H. "Provide": Furnish and install, complete and ready for the intended use.
   I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS
   A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
   B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
### ABBREVIATIONS AND ACRONYMS

#### A. Industry Organizations:
Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

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<th>Abbreviation</th>
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<th>Phone Number</th>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association, Inc. (The)</td>
<td>(703) 358-2960</td>
</tr>
<tr>
<td>AAADM</td>
<td>American Association of Automatic Door Manufacturers</td>
<td>(216) 241-7333</td>
</tr>
<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
<td>(202) 737-0202</td>
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<tr>
<td>AAMA</td>
<td>American Architectural Manufacturers Association</td>
<td>(847) 303-5664</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
<td>(202) 624-5800</td>
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<tr>
<td>AATCC</td>
<td>American Association of Textile Chemists and Colorists</td>
<td>(919) 549-8141</td>
</tr>
<tr>
<td>ABAA</td>
<td>Air Barrier Association of America</td>
<td>(866) 956-5888</td>
</tr>
<tr>
<td>ABMA</td>
<td>American Bearing Manufacturers Association</td>
<td>(202) 367-1155</td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
<td>(248) 848-3700</td>
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<td>ACPA</td>
<td>American Concrete Pipe Association</td>
<td>(972) 506-7216</td>
</tr>
<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies, Inc. (The)</td>
<td>(205) 257-2530</td>
</tr>
<tr>
<td>AF&amp;PA</td>
<td>American Forest &amp; Paper Association</td>
<td>(800) 878-8878 (202) 463-2700</td>
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<td>AGA</td>
<td>American Gas Association</td>
<td>(202) 824-7000</td>
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<td>AGC</td>
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<td>(703) 548-3118</td>
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<tr>
<td>AHA</td>
<td>American Hardboard Association (Now part of CPA)</td>
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<tr>
<td>AHAM</td>
<td>Association of Home Appliance Manufacturers</td>
<td>(202) 872-5955</td>
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<td>AI</td>
<td>Asphalt Institute</td>
<td>(859) 288-4960</td>
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<td>AISI</td>
<td>American Iron and Steel Institute</td>
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<td>AITC</td>
<td>American Institute of Timber Construction</td>
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<td>ALCA</td>
<td>Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)</td>
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<td>ALSC</td>
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<td>Air Movement and Control Association International, Inc.</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>AOSA</td>
<td>Association of Official Seed Analysts, Inc.</td>
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<td>APA</td>
<td>Architectural Precast Association</td>
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<td>APA</td>
<td>APA - The Engineered Wood Association</td>
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<td>API</td>
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<td>ASCE</td>
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<td>ASCE/SEI</td>
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<td>September 27, 2011</td>
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<tr>
<td><a href="http://www.copper.org">www.copper.org</a></td>
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<tr>
<td>CEA Canadian Electricity Association</td>
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<td><a href="http://www.canelect.ca">www.canelect.ca</a></td>
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<tr>
<td>CEA Consumer Electronics Association</td>
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<td><a href="http://www.ce.org">www.ce.org</a></td>
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<td>CFFA Chemical Fabrics &amp; Film Association, Inc.</td>
</tr>
<tr>
<td><a href="http://www.chemicalfabricsandfilm.com">www.chemicalfabricsandfilm.com</a></td>
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<tr>
<td>CGA Compressed Gas Association</td>
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<td><a href="http://www.cganet.com">www.cganet.com</a></td>
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<td>CIMA Cellulose Insulation Manufacturers Association</td>
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<td><a href="http://www.cellulose.org">www.cellulose.org</a></td>
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<tr>
<td>CISCA Ceiling &amp; Interior Systems Construction Association</td>
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<td><a href="http://www.cisca.org">www.cisca.org</a></td>
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<td>CISPI Cast Iron Soil Pipe Institute</td>
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<td><a href="http://www.cispi.org">www.cispi.org</a></td>
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<td>CLFMI Chain Link Fence Manufacturers Institute</td>
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<td><a href="http://www.chainlinkinfo.org">www.chainlinkinfo.org</a></td>
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<td>CRRC Cool Roof Rating Council</td>
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<td><a href="http://www.coolroofs.org">www.coolroofs.org</a></td>
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<td>CPA Composite Panel Association</td>
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<td><a href="http://www.pbmdf.com">www.pbmdf.com</a></td>
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<tr>
<td>CPPA Corrugated Polyethylene Pipe Association</td>
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<td><a href="http://www.cppa-info.org">www.cppa-info.org</a></td>
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<td>CRI Carpet and Rug Institute (The)</td>
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<td><a href="http://www.carpet-rug.com">www.carpet-rug.com</a></td>
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<td>CRSI Concrete Reinforcing Steel Institute</td>
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<td><a href="http://www.crsi.org">www.crsi.org</a></td>
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<td>CSA Canadian Standards Association</td>
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<td>(Formerly: IAS - International Approval Services)</td>
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<td>CSSB Cedar Shake &amp; Shingle Bureau</td>
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munkam/Nelson
Project No. 0802C

REFERENCES
01420 - 6
GA  Gypsum Association  
www.gypsum.org

GANA  Glass Association of North America  
www.glasswebsite.com

GRI  (Part of GSI)

GS  Green Seal  
www.greenseal.org

GSI  Geosynthetic Institute  
www.geosynthetic-institute.org

HI  Hydraulic Institute  
www.pumps.org

HI  Hydronics Institute  
www.gamanet.org

HMMA  Hollow Metal Manufacturers Association  
(Part of NAAMM)

HPVA  Hardwood Plywood & Veneer Association  
www.hpva.org

HPW  H. P. White Laboratory, Inc.  
www.hpwhite.com

IAS  International Approval Services  
(Now CSA International)

IBF  International Badminton Federation  
(Now BWF)

ICEA  Insulated Cable Engineers Association, Inc.  
www.icca.net

ICRI  International Concrete Repair Institute, Inc.  
www.icri.org

IEC  International Electrotechnical Commission  
www.iec.ch

IEEE  Institute of Electrical and Electronics Engineers, Inc. (The)  
www.ieee.org

IESNA  Illuminating Engineering Society of North America  
www.iesna.org

IEST  Institute of Environmental Sciences and Technology  
www.iest.org

IGCC  Insulating Glass Certification Council  
www.igcc.org

(202) 289-5440

(785) 271-0208

(202) 872-6400

(610) 522-8440

(973) 267-9700

(908) 464-8200

(703) 435-2900

(410) 838-6550

(770) 830-0369

(847) 827-0830

41 22 919 02 11

(212) 419-7900

(212) 248-5000

(847) 255-1561

(315) 646-2234

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<td>IGMA</td>
<td>Insulating Glass Manufacturers Alliance</td>
<td><a href="http://www.igmaonline.org">www.igmaonline.org</a></td>
<td>(613) 233-1510</td>
</tr>
<tr>
<td>ILI</td>
<td>Indiana Limestone Institute of America, Inc.</td>
<td><a href="http://www.iliain.com">www.iliain.com</a></td>
<td>(812) 275-4426</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
<td><a href="http://www.iso.ch">www.iso.ch</a></td>
<td>41 22 749 01 11</td>
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<tr>
<td>ISSFA</td>
<td>International Solid Surface Fabricators Association</td>
<td><a href="http://www.issfa.net">www.issfa.net</a></td>
<td>(877) 464-7732</td>
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<tr>
<td>ITS</td>
<td>Intertek Testing Service NA (Now ETL SEMCO)</td>
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<td>(702) 567-8150</td>
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<td>ITU</td>
<td>International Telecommunication Union</td>
<td><a href="http://www.itu.int/home">www.itu.int/home</a></td>
<td>41 22 730 51 11</td>
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<tr>
<td>KCMA</td>
<td>Kitchen Cabinet Manufacturers Association</td>
<td><a href="http://www.kcma.org">www.kcma.org</a></td>
<td>(703) 264-1690</td>
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<td>LMA</td>
<td>Laminating Materials Association (Now part of CPA)</td>
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<td>LPI</td>
<td>Lightning Protection Institute</td>
<td><a href="http://www.lightning.org">www.lightning.org</a></td>
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<td>MBMA</td>
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<td><a href="http://www.mbma.com">www.mbma.com</a></td>
<td>(216) 241-7333</td>
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<td>MFMA</td>
<td>Maple Flooring Manufacturers Association, Inc.</td>
<td><a href="http://www.maplefloor.org">www.maplefloor.org</a></td>
<td>(888) 480-9138</td>
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<td>Metal Framing Manufacturers Association, Inc.</td>
<td><a href="http://www.metalframingmfg.org">www.metalframingmfg.org</a></td>
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<td>MH</td>
<td>Material Handling (Now MHIA)</td>
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<td>MHIA</td>
<td>Material Handling Industry of America</td>
<td><a href="http://www.mhia.org">www.mhia.org</a></td>
<td>(800) 345-1815</td>
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<td>MIA</td>
<td>Marble Institute of America</td>
<td><a href="http://www.marble-institute.com">www.marble-institute.com</a></td>
<td>(704) 676-1190</td>
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<tr>
<td>MPI</td>
<td>Master Painters Institute</td>
<td><a href="http://www.paintinfo.com">www.paintinfo.com</a></td>
<td>(440) 250-9222</td>
</tr>
<tr>
<td>MSS</td>
<td>Manufacturers Standardization Society of The Valve and Fittings Industry Inc.</td>
<td><a href="http://www.mss-hq.com">www.mss-hq.com</a></td>
<td>(888) 674-8937</td>
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<tr>
<td>NAAMM</td>
<td>National Association of Architectural Metal Manufacturers</td>
<td></td>
<td>(604) 298-7578</td>
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<td>(703) 281-6613</td>
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<td>(630) 942-6591</td>
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<td>NACE International</td>
<td><a href="http://www.nace.org">www.nace.org</a></td>
<td>(800) 797-6623, (281) 228-6200</td>
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<td>NADCA</td>
<td><a href="http://www.nadca.com">www.nadca.com</a></td>
<td>(202) 737-2926</td>
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<tr>
<td>NAGWS</td>
<td><a href="http://www.aahperd.org/nagws/">www.aahperd.org/nagws/</a></td>
<td>(800) 213-7193, ext. 453</td>
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<tr>
<td>NAIMA</td>
<td><a href="http://www.naima.org">www.naima.org</a></td>
<td>(703) 684-0084</td>
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<td>NBGQA</td>
<td><a href="http://www.nbgqa.com">www.nbgqa.com</a></td>
<td>(800) 557-2848</td>
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<td>NCAA</td>
<td><a href="http://www.ncaa.org">www.ncaa.org</a></td>
<td>(317) 917-6222</td>
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<tr>
<td>NCMA</td>
<td><a href="http://www.ncma.org">www.ncma.org</a></td>
<td>(703) 713-1900</td>
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<tr>
<td>NCPI</td>
<td><a href="http://www.ncpi.org">www.ncpi.org</a></td>
<td>(262) 248-9094</td>
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<td>NCTA</td>
<td><a href="http://www.ncta.com">www.ncta.com</a></td>
<td>(202) 775-2300</td>
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<td>NEBB</td>
<td><a href="http://www.nebb.org">www.nebb.org</a></td>
<td>(301) 977-3698</td>
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<td>NECA</td>
<td><a href="http://www.necanet.org">www.necanet.org</a></td>
<td>(301) 657-3110</td>
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<td>NeLMA</td>
<td><a href="http://www.nelma.org">www.nelma.org</a></td>
<td>(207) 829-6901</td>
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<tr>
<td>NEMA</td>
<td><a href="http://www.nema.org">www.nema.org</a></td>
<td>(703) 841-3200</td>
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<tr>
<td>NETA</td>
<td><a href="http://www.netaworld.org">www.netaworld.org</a></td>
<td>(888) 300-6382, (269) 488-6382</td>
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<td>NFHS</td>
<td><a href="http://www.nfhs.org">www.nfhs.org</a></td>
<td>(317) 972-6900</td>
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<td>NFPA</td>
<td><a href="http://www.nfpa.org">www.nfpa.org</a></td>
<td>(800) 344-3555, (617) 770-3000</td>
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<td>NFRC</td>
<td><a href="http://www.nfrc.org">www.nfrc.org</a></td>
<td>(301) 589-1776</td>
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<td>National Glass Association</td>
<td><a href="http://www.glass.org">www.glass.org</a></td>
<td>(866) 342-5642, (703) 442-4890</td>
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<td>National Hardwood Lumber Association</td>
<td><a href="http://www.natlhardwood.org">www.natlhardwood.org</a></td>
<td>(800) 933-0318, (901) 377-1818</td>
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<td>National Lumber Grades Authority</td>
<td><a href="http://www.nlga.org">www.nlga.org</a></td>
<td>(604) 524-2393</td>
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<td>National Oak Flooring Manufacturers Association</td>
<td><a href="http://www.nofma.com">www.nofma.com</a></td>
<td>(901) 526-5016</td>
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</tr>
<tr>
<td>National Ornamental &amp; Miscellaneous Metals Association</td>
<td><a href="http://www.nomma.org">www.nomma.org</a></td>
<td>(888) 516-8585</td>
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<tr>
<td>National Roofing Contractors Association</td>
<td><a href="http://www.nrca.net">www.nrca.net</a></td>
<td>(800) 323-9545, (847) 299-9070</td>
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<tr>
<td>National Ready Mixed Concrete Association</td>
<td><a href="http://www.nrmca.org">www.nrmca.org</a></td>
<td>(888) 846-7622, (301) 587-1400</td>
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<td>National Sanitation Foundation International</td>
<td><a href="http://www.nsf.org">www.nsf.org</a></td>
<td>(800) 673-6275, (734) 769-8010</td>
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<td>National Stone, Sand &amp; Gravel Association</td>
<td><a href="http://www.nssga.org">www.nssga.org</a></td>
<td>(800) 342-1415, (703) 525-8788</td>
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<td>National Terrazzo &amp; Mosaic Association, Inc. (The)</td>
<td><a href="http://www.ntma.com">www.ntma.com</a></td>
<td>(800) 323-9736, (540) 751-0930</td>
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<td>National Tile Roofing Manufacturers Association (Now TRMA)</td>
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<td>National Wood Window and Door Association (Now WDMA)</td>
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<td>Omega Point Laboratories, Inc. (Now ITS)</td>
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<td>Precast/Prestressed Concrete Institute</td>
<td><a href="http://www.pci.org">www.pci.org</a></td>
<td>(312) 786-0300</td>
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<tr>
<td>Painting &amp; Decorating Contractors of America</td>
<td><a href="http://www.pdca.com">www.pdca.com</a></td>
<td>(800) 332-7322, (314) 514-7322</td>
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<td>Plumbing &amp; Drainage Institute</td>
<td><a href="http://www.pdionline.org">www.pdionline.org</a></td>
<td>(800) 589-8956, (978) 557-0720</td>
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<td>PVC Geomembrane Institute</td>
<td><a href="http://pgi-tp.cc.uiuc.edu">http://pgi-tp.cc.uiuc.edu</a></td>
<td>(217) 333-3929</td>
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<td>Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)</td>
<td><a href="http://www.landcarenetwork.org">www.landcarenetwork.org</a></td>
<td>(800) 395-2522, (703) 736-9666</td>
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<td>PTI</td>
<td>Post-Tensioning Institute</td>
<td><a href="http://www.post-tensioning.org">www.post-tensioning.org</a></td>
<td>(602) 870-7540</td>
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<td>RCSC</td>
<td>Research Council on Structural Connections</td>
<td><a href="http://www.boltcouncil.org">www.boltcouncil.org</a></td>
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<td>RFCI</td>
<td>Resilient Floor Covering Institute</td>
<td><a href="http://www.rfci.com">www.rfci.com</a></td>
<td>(301) 340-8580</td>
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<td>RJS</td>
<td>Redwood Inspection Service</td>
<td><a href="http://www.redwoodinspection.com">www.redwoodinspection.com</a></td>
<td>(888) 225-7339</td>
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<tr>
<td>SAE</td>
<td>SAE International</td>
<td><a href="http://www.sae.org">www.sae.org</a></td>
<td>(877) 606-7323</td>
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<td>SDI</td>
<td>Steel Deck Institute</td>
<td><a href="http://www.sdi.org">www.sdi.org</a></td>
<td>(724) 776-4841</td>
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<td>SDI</td>
<td>Steel Door Institute</td>
<td><a href="http://www.steeldoor.org">www.steeldoor.org</a></td>
<td>(847) 458-4647</td>
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<td>SEFA</td>
<td>Scientific Equipment and Furniture Association</td>
<td><a href="http://www.sefalabs.com">www.sefalabs.com</a></td>
<td>(877) 294-5424</td>
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<tr>
<td>SEI/ASCE</td>
<td>Structural Engineering Institute/American Society of Civil Engineers (See ASCE)</td>
<td></td>
<td>(516) 294-5424</td>
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<td>SGCC</td>
<td>Safety Glazing Certification Council</td>
<td><a href="http://www.sgcc.org">www.sgcc.org</a></td>
<td>(315) 646-2234</td>
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<td>SIA</td>
<td>Security Industry Association</td>
<td><a href="http://www.siaonline.org">www.siaonline.org</a></td>
<td>(866) 817-8888</td>
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<td>SIGMA</td>
<td>Sealed Insulating Glass Manufacturers Association (Now IGMA)</td>
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<td>(703) 683-2075</td>
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<td>SJI</td>
<td>Steel Joist Institute</td>
<td><a href="http://www.steeljoist.org">www.steeljoist.org</a></td>
<td>(843) 626-1995</td>
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<td>SMA</td>
<td>Screen Manufacturers Association</td>
<td><a href="http://www.smacentral.org">www.smacentral.org</a></td>
<td>(561) 533-0991</td>
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<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors' National Association</td>
<td><a href="http://www.smacna.org">www.smacna.org</a></td>
<td>(703) 803-2980</td>
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<td>SMPTE</td>
<td>Society of Motion Picture and Television Engineers</td>
<td><a href="http://www.smpte.org">www.smpte.org</a></td>
<td>(914) 761-1100</td>
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<tr>
<td>SPFA</td>
<td>Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)</td>
<td><a href="http://www.sprayfoam.org">www.sprayfoam.org</a></td>
<td>(800) 523-6154</td>
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<td>SPIB</td>
<td>Southern Pine Inspection Bureau (The)</td>
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<td>(850) 434-2611</td>
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<td>SPRI</td>
<td>Single Ply Roofing Industry</td>
<td><a href="http://www.spri.org">www.spri.org</a></td>
<td>(781) 647-7026</td>
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<td>SSINA</td>
<td>Specialty Steel Industry of North America</td>
<td><a href="http://www.ssina.com">www.ssina.com</a></td>
<td>(800) 982-0355</td>
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<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
<td><a href="http://www.sspc.org">www.sspc.org</a></td>
<td>(202) 342-8650</td>
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<td>STI</td>
<td>Steel Tank Institute</td>
<td><a href="http://www.steeltank.com">www.steeltank.com</a></td>
<td>(816) 472-7974</td>
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<td>SWI</td>
<td>Steel Window Institute</td>
<td><a href="http://www.steelwindows.com">www.steelwindows.com</a></td>
<td>(216) 241-7333</td>
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<td>SWRI</td>
<td>Sealant, Waterproofing, &amp; Restoration Institute</td>
<td><a href="http://www.swrionline.org">www.swrionline.org</a></td>
<td>(864) 646-8453</td>
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<tr>
<td>TCA</td>
<td>Tile Council of America, Inc.</td>
<td>(Now TCNA)</td>
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<td>TCNA</td>
<td>Tile Council of North America, Inc.</td>
<td><a href="http://www.tileusa.com">www.tileusa.com</a></td>
<td>(800) 907-7000</td>
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<td>TIA/EIA</td>
<td>Telecommunications Industry Association</td>
<td><a href="http://www.tiaonline.org">www.tiaonline.org</a></td>
<td>(703) 683-1010</td>
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<td>TPI</td>
<td>Truss Plate Institute, Inc.</td>
<td><a href="http://www.epistem.org">www.epistem.org</a></td>
<td>(303) 939-9700</td>
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<td>TPI</td>
<td>Turfgrass Producers International</td>
<td><a href="http://www.turfgrass.org">www.turfgrass.org</a></td>
<td>(800) 405-8873</td>
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<td>TRI</td>
<td>Tile Roofing Institute</td>
<td><a href="http://www.tileroofing.org">www.tileroofing.org</a></td>
<td>(719) 228-6800</td>
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<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
<td><a href="http://www.ul.com">www.ul.com</a></td>
<td>(800) 786-5539</td>
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<td>UNI</td>
<td>Uni-Bell PVC Pipe Association</td>
<td><a href="http://www.uni-bell.org">www.uni-bell.org</a></td>
<td>(972) 243-3902</td>
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<td>USAV</td>
<td>USA Volleyball</td>
<td><a href="http://www.usavolleyball.org">www.usavolleyball.org</a></td>
<td>(800) 938-7488</td>
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<td>USGBC</td>
<td>U.S. Green Building Council</td>
<td><a href="http://www.usgbc.org">www.usgbc.org</a></td>
<td>(315) 463-6463</td>
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<tr>
<td>USITT</td>
<td>United States Institute for Theatre Technology, Inc.</td>
<td><a href="http://www.usitt.org">www.usitt.org</a></td>
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</table>
WASTEC  Waste Equipment Technology Association  
www.wastec.org  
(800) 424-2869  
(202) 244-4700

WCLIB  West Coast Lumber Inspection Bureau  
www.wclib.org  
(800) 283-1486  
(503) 639-0651

WCMA  Window Covering Manufacturers Association  
www.wcmnet.org  
(212) 297-2122

WCSC  Window Covering Safety Council  
(Formerly: WCMA - Window Covering Manufacturers Association)  
www.windowcoverings.org  
(800) 506-4636  
(212) 297-2109

WDMA  Window & Door Manufacturers Association  
(Formerly: NWWDA - National Wood Window and Door Association)  
www.wdma.com  
(800) 223-2301  
(847) 299-5200

WI  Woodwork Institute (Formerly: WIC - Woodwork Institute of California)  
www.wiinet.org  
(916) 372-9943

WJC  Woodwork Institute of California  
(Now WI)

WMMPA  Wood Moulding & Millwork Producers Association  
www.wmmpa.com  
(800) 550-7889  
(530) 661-9591

WSRCA  Western States Roofing Contractors Association  
www.wsrca.com  
(800) 725-0333  
(650) 570-5441

WWPA  Western Wood Products Association  
www.wwpa.org  
(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl2

IAPMO  International Association of Plumbing and Mechanical Officials  
www.iapmo.org  
(909) 472-4100

ICC  International Code Council  
www.iccsafe.org  
(888) 422-7233

ICC-ES  ICC Evaluation Service, Inc.  
www.icc-es.org  
(800) 423-6587  
(562) 699-0543

UBC  Uniform Building Code  
(See ICC)

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl3
<table>
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<th>Acronym</th>
<th>Description</th>
<th>Contact Information</th>
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<tr>
<td>DOD</td>
<td>Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point <a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a></td>
<td>(215) 697-2664</td>
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<td>DSCC</td>
<td>Defense Supply Center Columbus (See FS)</td>
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<td>FED-STD</td>
<td>Federal Standard (See FS)</td>
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<tr>
<td>FTMS</td>
<td>Federal Test Method Standard (See FS)</td>
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<td>MIL</td>
<td>(See MILSPEC)</td>
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<tr>
<td>MIL-STD</td>
<td>(See MILSPEC)</td>
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<tr>
<td>UFAS</td>
<td>Uniform Federal Accessibility Standards Available from Access Board <a href="http://www.access-board.gov">www.access-board.gov</a></td>
<td>(800) 872-2253  (202) 272-0080</td>
</tr>
</tbody>
</table>

D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl4
CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfi | (800) 952-5210  (916) 574-2041 |

murakami/Nelson Project No. 0802C REFERENCES 01420 - 14
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420
SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections:
   1. Division 1 Section "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, Construction Manager testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

   1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame
for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of the work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air filtration system discharge.
4. Other dust-control measures.
5. Waste management plan.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.


1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

B. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: When possible, prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate project meetings specified in other Division 1 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.

3. Coffee machine and supplies.

4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 1 Section “Closeout Procedures”.

C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Division 1 Section “Summary.”

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
   1. Contractor responsible to provide all drinking water.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Where construction is adjacent to occupied areas, prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices. Verify dust will not interfere with existing building systems, including but not limited to fire alarm and HVAC systems. Coordinate with District and Construction Manager regarding existing building systems.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install two telephone line(s) for each field office.

1. Provide additional telephone lines for the following:
   a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect's office.
   e. Engineers' offices.
   f. Owner's office.
   g. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
4. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management and Disposal."

H. Lifs and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

J. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

L. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsurface contamination or pollution or other undesirable effects.

   1. Comply with work restrictions specified in Division 1 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Covered Walkway: When required, erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

   1. Construct covered walkways using scaffold or shoring framing.
   2. Provide overhead deck, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   3. Paint and maintain appearance of walkway for duration of the Work.
J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and occupants from fumes and noise.

1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant treated plywood.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL


B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged material.
4. Do not install material that is wet.
5. Discard, replace or clean stored or installed material that begins to grow mold.
6. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 01500
SECTION 01524 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections:

1. Division 1 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials. materials, including the following:
1. Demolition Waste:
   
a. Asphaltilc concrete paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
 oo. Transformers.

2. Construction Waste:
   
a. Site-clearing waste.
b. Masonry and CMU.
c. Lumber.
d. Wood sheet materials.
e. Wood trim.
f. Metals.
g. Roofing.
h. Insulation.
i. Carpet and pad.
j. Gypsum board.
k. Piping.
l. Electrical conduit.
m. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

4. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment.
      Provide connections, supports, and miscellaneous materials necessary to make items functional for
      use indicated.

B. Salvaged Items for Owner’s Use: Salvage items for Owner’s use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to approved storage area.
   5. Protect items from damage during transport and storage.

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door
   hardware attached to doors.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from
   exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit
   breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse
   facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and
   other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable
   waste by type at Project site to the maximum extent practical according to approved construction waste
   management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are
      removed from Project site. Include list of acceptable and unacceptable materials at each container
      and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and
      shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner’s property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphal tic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Clean and stack undamaged, whole masonry units on wood pallets.
D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
E. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.

C. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01524
SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
   B. Related Sections:
      1. Division 1 Section "Substitution Procedures" for requests for substitutions.
      2. Division 1 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS
   A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
      1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
      2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
      3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
   B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS
   A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
      1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect’s Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

   a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
   b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
3. Protect stored products from damage and liquids from freezing.
4. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner’s construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer’s disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer’s Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division I Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600
SECTION 01635 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 1 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
2. Divisions 2 through 16 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use standard form as provided by District.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from DSA.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost Information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.


   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

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SUBSTITUTION PROCEDURES
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1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Substitution request is fully documented and properly submitted.
   c. Requested substitution will not adversely affect Contractor's construction schedule.
   d. Requested substitution has received necessary approvals of authorities having jurisdiction.
   e. Requested substitution is compatible with other portions of the Work.
   f. Requested substitution has been coordinated with other portions of the Work.
   g. Requested substitution provides specified warranty.

B. Substitutions for Convenience are not permitted.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01635
SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes procedural requirements for cutting and patching.
   B. Related Sections include the following:
      1. Division 1 Section “Selective Demolition” for demolition of selected portions of the building for alterations.
      2. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
         a. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS
   A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
   B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS
   A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
      1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
      2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
      3. Products: List products to be used and firms or entities that will perform the Work.
      4. Dates: Indicate when cutting and patching will be performed.
      5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
      6. Construction Manager's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original Installer’s written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

END OF SECTION 01731
SECTION 01732 - SELECTIVE DEMOLITION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:
   1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.
   2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   3. Division 1 Section "Construction Waste Management and Disposal" for disposal of demolished materials.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Items that are historical, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, artwork, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. Qualification Data: For demolition firm.
B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shut off, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Predemolition Photographs and Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1. Comply with submittal requirements in Division 1 Section "Construction Waste Management and Disposal."

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: Hazardous materials are present in construction to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs and templates.
   1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division I Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

   a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing surfaces.

   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

   5. Maintain adequate ventilation when using cutting torches.

   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

   9. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect’s approval.

   1. Building Structure and Shell: 75 percent.

   2. Nonshell Elements: 50 percent.

C. Removed and Salvaged Items:

   1. Clean salvaged items.

   2. Pack or crate items after cleaning. Identify contents of containers.

   3. Store items in a secure area until delivery to Owner.

   4. Transport items to approved storage area.

   5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Roofing: If required, remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Consult with Architect and Construction Manager for patching or reinstallation of new roofing.

F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Division 1 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner’s property and legally dispose of them.
3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732
SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Project Record Documents.
6. Operation and Maintenance Data.

B. Related Sections:

1. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

   a. Project name.
   b. Date.
   c. Name of Architect and Construction Manager.
   d. Name of Contractor.
   e. Page number.

4. Submit list of incomplete items in the following format:
a. PDF electronic file.
b. Seven paper copies of product schedule or list, unless otherwise indicated. Architect, through Construction Manager, will return two copies.

1.6 WARRANTIES
A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project name, and name of Contractor.
   4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING
A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.


q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division I Section "Temporary Facilities and Controls." Division I Section "Construction Waste Management and Disposal."

3.2 PROJECT RECORD DOCUMENTS
A. Contractor shall continuously maintain "as-built" or record drawings of all work as the job progresses. A separate set of contract documents for this purpose only, shall be kept at the job site at all times.

B. These drawings shall be kept up-to-date, as indicated in the Supplementary General Provisions, and shall be so certified by the Owner’s at the time progress bills (invoices) are submitted for payment.

C. Deviations from the Contract documents shall be finally incorporated on the reproducible set in black ink.

D. Below grade utilities shall be measured for location and depth. Such measurements shall be to permanent features of the building.

E. Valves, disconnect switches, filters, panelboards, and similar items requiring periodic servicing or maintenance and requiring emergency access, shall be located and highlighted on the drawings with felt tip marking pen.

F. No work shall be permanently concealed until the required information has been legibly recorded.

G. This final and record set of "as-built" contract documents shall be signed and dated by the Owner’s and the Contractor, and shall be delivered to the Architect prior to the Owner’s acceptance of the project. This final and record set of "as-built" contract documents shall incorporate all of the information as described above. Provide assistance to Architect in interpreting final and record set of "as-built" contract documents in developing electronic version of final project record documents for Owner.

H. Changes to the Contract Documents so as to reflect the requirements of Addenda or Change Orders shall be incorporated on the "as-built" set, and these changes shall be identified by addendum or change order number and effective date.

I. When revised drawings are issued as the basis of, or along with, addenda, these revised contract documents shall be incorporated into the record set with appropriate annotation. The Owner’s will furnish the Contractor with reproducible transparencies of such revised Contract documents.

J. Shop Drawings: One complete set of reviewed shop drawings, including manufacturers’ printed catalog cuts and data, shall be collected and maintained for record purposes.

K. Project Specifications:
1. The Specifications book for record purposes shall be filed in a large 3-ring binder or binders.
2. Information, changes, and notes shall be recorded in the Specifications in blank area, such as page margins or the backs of opposite pages, or on separate sheets inserted in the binder. All such information, changes, and notes shall be recorded with red pen or red typewriter ribbon.
3. In each Section, in an appropriate location, record the manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
4. The record Specifications book shall be complete and shall include all documents and forms under Bidding Requirements, Contract Forms, and General Provisions (all “front-end” documents).

L. Addenda and Change Orders:
1. Addenda and change orders shall be incorporated into the front of the Specifications book in reverse chronological order. Use appropriate page dividers to identify addenda and change orders and to separate addenda from the Specifications.
2. In addition, changes to the Specifications affected by addenda or change orders shall be annotated on the affected page or pages of the Specifications or adjacent thereto.

M. Submission of Documents:
1. At completion of the project and before submitting invoices for final payment, deliver record documents to the Owner.
2. For project Drawings, include the reproducible transparency set along with one print. Submission of record documents shall be accompanied with a transmittal letter, in triplicate, containing the following information:
   a. Date of submission.
   b. Project title and number.
   c. Contractor's name and address.
   d. Title and number of each record document. (Shop drawings may be grouped in basic categories or divisions of work.)
   e. Certification that each document, as submitted, is complete and accurate.
   f. Signature of Contractor, or authorized representative.

3.3 OPERATING AND MAINTENANCE DATA

A. Submit two sets in final form, 15 days prior to final inspection, bound in 8-1/2 x 11 inch text pages, three-ring binders with durable plastic covers.

B. Prepare binder covers with printed title "OPERATING AND MAINTENANCE INSTRUCTIONS," title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Owner's Consultant, Contractor, Subcontractors, and major equipment suppliers.

F. Part 2: Operating and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractor and suppliers. Identify the following:
   1. Significant design criteria.
   2. List of equipment.
   3. Parts list for each component.
   4. Operating instructions.
   5. Maintenance instructions for equipment and systems.
   6. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

G. Part 3: Project documents and certificates, including the following:
   1. Shop drawings and product data.
   2. Air and water balance reports.
   3. Certificates.
   4. Photocopies of warranties and bonds.

H. The two copies of completed volumes will be returned, with Owner comments. Revise content of documents as required prior to final submittal.

I. Submit final volumes revised, within 10 days after final inspection.

END OF SECTION 01770
SECTION 01810 - COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements and a detailed description of the commissioning process. This Section supplements other Division 1 Commissioning Sections and applies to equipment installed under Divisions 15 and 16 as listed in this section.

B. Commissioning is intended to achieve the following objectives:

1. Verify that applicable equipment and systems are installed according to the manufacturer’s recommendations and that they receive adequate operational checkout by installing contractors.
2. Verify and document that performance of equipment and systems is proper for the application and meets the Owner’s operational requirements.
3. Verify that Operations and Maintenance (O&M) Manuals are complete.
4. Verify that the Owner’s operating personnel are trained in accordance with the specifications.

C. Related Sections and Divisions:

1. Mechanical Equipment Commissioning: Section 01811.
2. Electrical Equipment Commissioning: Section 01812
3. Division 15: Mechanical.
4. Division 16: Electrical.

1.2 COORDINATION

A. The Commissioning Team includes:

1. The Owner (or Owner’s Representative)
2. Commissioning Authority (CA).
3. Architect and design engineers (A/E Team).
4. General Contractor (Contractor).
5. Sub-contractors (Subs).

B. Items listed below require coordination between members of the Commissioning Team. Details regarding these items are given elsewhere in this Section.

1. Integrate commissioning activities into the master schedule. Work with the CA to ensure that commissioning activities are properly shown.
2. Equipment Start-up: Utilize start-up plans to coordinate equipment start-up, manufacturers’ testing, and other required testing to minimize duplication of work.
3. Testing, Adjusting, and Balancing: Coordinate testing, adjusting, and balancing with the CA so that the CA can witness the processes.
4. Functional Testing: Coordinate functional testing with the CA so that they can witness testing.
1.3 DEFINITIONS

A. Commissioning Process: A systematic process which verifies that the building systems perform as intended. The commissioning process coordinates system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning Authority (CA): An entity identified by the Owner Representative that plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

C. Functional Test (FT): A documented test of the dynamic functioning and operation of equipment and systems with the goal of verifying that the Design Intent is met. Test requirements are included in these specifications. Test procedures are developed and results documented by the CA. Test procedures are completed by the Contractor.

D. Start-up Plan: A written program that documents checks and tests to be completed prior to the equipment’s Functional Test. Startup Checklists are part of each Start-up Plan. The Checklists are completed by the Contractor and verified by the CA through site visits and inspections. The Start-up Plan shall be prepared by the Contractor.

1.4 COMMISSIONING PLAN

A. The Commissioning Plan is an independent document issued by the CA to the Commissioning Team. Where there is a conflict, the Specifications and Contract Documents take precedence over the Commissioning Plan.

B. The Commissioning Plan provides guidance in the execution of the commissioning process. The Commissioning plan outlines the specific inspections and tests that will be performed as part of the commissioning process for the project and assigns roles and responsibilities. A preliminary copy will be issued for use during the initial commissioning scoping meeting. After the scoping meeting, the CA will update and reissue it.

1.5 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned where applicable:

<table>
<thead>
<tr>
<th>Equipment Specified In</th>
<th>Commissioning Requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 15</td>
<td></td>
</tr>
<tr>
<td>General Occupancy Exhaust Fans and Controls</td>
<td>01811</td>
</tr>
<tr>
<td>Division 16</td>
<td></td>
</tr>
<tr>
<td>Lighting System and Controls</td>
<td>01812</td>
</tr>
</tbody>
</table>

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all testing equipment required by the Commissioning Process except data logging equipment. Data logging equipment is provided by the CA.

B. Provide any special equipment, tools, and instruments required for testing.
PART 3 - EXECUTION

3.1 MEETINGS

A. Construction Scoping Commissioning meeting: A commissioning scoping meeting will be held in conjunction with the pre-construction meeting within 60 working days after the Owner Representative has issued the Notice to Proceed. Attendance is mandatory for the Commissioning Team.

B. Miscellaneous Meetings. The CA will schedule other meetings, generally in conjunction with regularly scheduled site meetings as construction progresses. Meetings will cover coordination, deficiency resolution, and planning issues with particular subcontractors.

3.2 COMMISSIONING SUBMITTALS

A. The CA will request that specific equipment submittals be copied or routed to the CA for review and comments.

B. Commissioning submittal requests will be integrated into the normal submittal process and protocol of the construction team.

C. The CA will review and comment on submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functionality of the equipment and adequacy for developing test procedures.

3.3 START-UP PLANS AND START-UP CHECKLISTS

A. Undertake a full start-up checkout of each piece of equipment. The start-up testing must be successfully completed prior to formal functional testing of that system.

B. Equipment shall not be “temporarily” started until it has been started up in accordance with the manufacturer's written start up procedures as per the Start-Up plan.

C. Start-up Plans: The contractor shall prepare start-up plan for each piece of equipment listed in paragraph 1.4 of this section and submit it for approval by the CA within 45 days of receiving approved equipment submittals. Start-up plans shall consist of:

1. The manufacturer’s standard written start-up procedures per the manufacturer’s installation manuals, with check boxes by each procedure and a signature block at the end.
2. Field checkout sheets normally used by the sub-contractor.
3. Forms used by the sub-contractor to document tests required in the specifications.
4. Final startup checklists. The checklists for mechanical systems include sensor and actuator calibration as described in Section 01811.

D. Within 45 days of receiving approved submittals, the Contractor shall submit a commissioning package for the commissioned equipment. This package shall include the following information:

1. Equipment manufacturer's operating & maintenance instructions
2. Equipment manufacturer's installation and start-up manual
3. Start-up plans as required in this Section
4. Schedule of equipment installation, Contractor start-up, manufacturer’s start-up, and other tests required by the Specifications. Schedule shall state when documents in the start-Up Plan will be completed.
E. The subcontractors shall complete the documentation in accordance with paragraph 3.5C., during the start up of the equipment and submit the completed documentation to the CA prior to the scheduled functional testing. The CA will accept or reject each Start-up Plan submittal, noting each item as one of the following:

1. No Exceptions Noted.
2. Implement Exceptions Noted.
3. Revise and Resubmit.
4. Rejected.

F. Relevant subcontractors shall accompany the commissioning authority on up to 3 construction site visits prior to functional testing. The Contractor shall correct deficiencies found during site visits within 7 days of receiving a Corrective Action Report.

3.4 REQUIREMENTS FOR BEGINNING FUNCTIONAL TESTING

A. Complete the following prior to functional testing:

1. Arrange for the Commissioning Authority to be present during functional testing.
2. Completion of the start up plan documentation and submission of this documentation to the CA.
3. Correction of deficiencies identified during start-up.
4. Recording of pretest set points.

3.5 FUNCTIONAL TESTING

A. Undertake functional testing after the activities listed in Paragraph 3.4 are completed.

B. Perform functional testing under the observation of the commissioning authority who will record the results of the functional test procedures.

C. Perform all specified tests according to approved testing procedures and the following Control Signal Manipulation requirements:

1. Verify and test performance using actual conditions whenever possible.
2. Simulate conditions by imposing an artificial load when it is not practical to test under actual conditions and when written approval for simulated conditions is received from Commissioning Authority. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.
3. Alter set points when simulating conditions is not practical and when written approval to do so is received from Commissioning Authority.
4. Overwrite sensor values with a signal generator when actual or simulated conditions and altering set points are not practical. Do not use the sensor to act as the signal generator to simulate conditions or overwrite values.

D. The Commissioning Authority will review and approve functional testing results. Deficiencies found during testing shall be corrected by the Contractor within 7 days of receiving a Corrective Action Report from the CA. Deficiencies shall be retested until accepted by the Commissioning Authority. Where there is a dispute over a deficiency, the Engineer will be the final authority.

E. Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct, and retest problems is with the contractor.

F. All testing, retesting, and acceptance of functional testing shall be completed prior to Final Completion.
3.6 OPERATIONS & MAINTENANCE DOCUMENTATION

A. Provide a completed copy of the Operations & Maintenance Instructions, assembled in accordance with per Section 01770, to the CA for review prior to substantial completion. Follow the normal submittal procedure for this submittal. The CA will accept or reject the submittal, noting it as one of the following:

1. No Exceptions Taken.
2. Revise, No Resubmission Required.
3. Revise and Resubmit.
4. Rejected.

3.7 Provide the CA with access to the record documents. Correct record documents as noted by the CA prior to Final Inspection.

3.8 OPERATIONS AND MAINTENANCE TRAINING

A. Coordinate and schedule demonstration & training for all commissioned systems. Coordinate training of commissioned equipment with the CA who will oversee and approve its content and adequacy. Coordinate training with the owner who will provide videotaping services.

B. In addition to these general requirements, specific training requirements for commissioned equipment may be specified in Divisions 15 and 16.

3.9 PROJECT CLOSEOUT

A. The commissioning process shall be completed when the systems operate according to the Owner’s design intent and the Contract Documents, as determined by the CA.

B. The commissioning process may continue past Substantial Completion of the Project, until all non-compliance issues have been resolved. All testing, retesting, and acceptance of functional testing (with exception of seasonal and warranty-period tests as identified in the Commissioning Plan) shall be completed prior to Final Completion.

3.10 COST OF RETESTING

A. Costs for retesting beyond one retest shall be the responsibility of the Contractor if the Engineer determines that the contractor is responsible for the deficiency.

B. For a deficiency identified during functional retesting but not included in the approved Start-up Plan, the Engineer will direct and the Contractor shall retest the equipment until the CA accepts test results.

C. Retesting will not be considered a reason for a claim of delay or for a time extension by the Contractor.

3.11 DEFERRED TESTING

A. Unforeseen Deferred Tests: Checks or tests not completed due to the required occupancy condition, or other condition may be delayed upon approval of the Architect’s Engineer or CA.

END OF SECTION 01810
SECTION 01811 - MECHANICAL EQUIPMENT COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for mechanical equipment commissioning.

B. Related Sections and Divisions:
   1. Commissioning Requirements: Section 01810.
   2. Mechanical: Division 15.

1.2 SUBMITTALS

A. Provide submittal documentation relative to commissioning as described in Section 01810.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Part 2 in Section 01810.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

A. Refer to Section 01810 and related sections for information on and requirements for meetings, Start-up plans, Functional testing, operations and maintenance instructions, demonstration and training, and other Commissioning activities.

3.2 SENSOR CALIBRATION

A. Calibrate field-installed temperature, relative humidity, CO₂, and pressure sensors using the methods described below. Document Calibration procedures during execution of the Start-up Plan on the Startup Checklists. Alternate methods may be used, if approved by the Engineer.

B. Test instruments used for calibration shall have had a NIST certified calibration within the last 12 months. Sensors installed in the unit at the factory with provided calibration certification need not be field calibrated.

C. Sensors:
   1. Verify that sensor locations are appropriate and away from causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that determine a temperature difference, ensure that they are reading within 0.2 degrees F of each other.
4. For sensor pairs that determine a pressure difference, ensure that they are reading within 2 percent of each other.
5. Calibration: Put the equipment in operation. Take a reading with a calibrated test instrument within six inches of the site sensor. Verify that the sensor reading (via the permanent thermostat or gauge) is within the tolerances in the table below of the instrument-measured value. If not, calibrate or replace sensor.
6. Tolerances:

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Required Tolerance (Plus or Minus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside air, space air, duct air temperatures</td>
<td>0.4 degrees F</td>
</tr>
<tr>
<td>Flow rates, air</td>
<td>10 percent of design</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>10 percent</td>
</tr>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>100 ppm</td>
</tr>
</tbody>
</table>

3.3 TESTING REQUIREMENTS

A. Perform testing using testing procedures for all equipment per the requirements of this specification. Testing shall be performed under the observation of the Commissioning Authority who will record and document the testing results including the following minimum information:

1. Test number.
2. Date and time of the test.
3. Indication of whether the record is for a first test or retest following correction of a problem or issue.
4. Identification of the system, subsystem, assembly, or equipment.
5. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.
6. Expected performance of the systems and assemblies at each step of the test.
7. Narrative description of observed performance of the system, equipment, or assembly.
8. Notation to indicate whether the observed performance at each step meets the expected results.
9. Issue number, if any, generated as the result of the test.
10. Dated signatures of the person performing the test and of the witness.

END OF SECTION 01811
SECTION 01812 - ELECTRICAL EQUIPMENT COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for electrical equipment commissioning.

B. Related Sections and Divisions:
   1. Commissioning Requirements: Section 01810.
   2. Electrical: Division 16.

1.2 SUBMITTALS

A. Provide submittal documentation relative to commissioning as described in Section 01810.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Part 2 in Section 01810.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

A. Refer to Section 01810 and related Sections for information on meetings, start-up plans, functional testing, operations & maintenance instructions, demonstration and training requirements, and other commissioning activities. Refer to Division 16 for any additional electrical commissioning requirements.

3.2 TESTING REQUIREMENTS

A. Perform testing using testing procedures for all equipment per the requirements of this specification. Testing shall be performed under the observation of the Commissioning Authority (CA) who will record and document the testing results including the following minimum information:

1. Test number.
2. Date and time of the test.
3. Indication of whether the record is for a first test or retest following correction of a problem or issue.
4. Identification of the system, subsystem, assembly, or equipment.
5. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.
6. Expected performance of the systems and assemblies at each step of the test.
7. Narrative description of observed performance of the system, equipment, or assembly.
8. Notation to indicate whether the observed performance at each step meets the expected results.
9. Issue number, if any, generated as the result of the test.
10. Dated signatures of the person performing the test and of the witness.

3.3 LIGHTING SYSTEM AND CONTROLS TESTING REQUIREMENTS.

A. This is a performance test to verify lighting system operation, light levels, and energy usage.

B. Electrical subcontractor shall start-up and document lighting system and controls under the observation of the CA using a start-up plan prepared by the contractor. Prior to the beginning of functional testing, the building will be made ready for testing in the following manner:

1. Fluorescent lighting fixtures shall have a minimum “burn-in” period of 100 hours.
2. Building envelope is enclosed and windows and exterior doors are installed and closed.
3. Permanent power is established for all building lighting.
4. Ceiling tiles are in place.
5. For 5 rooms randomly selected by the CA, lighting illumination levels shall be tested during nighttime conditions (any time between an hour after sunset until an hour before sunrise). Rooms to be tested shall have interior doors installed prior to testing.

C. Electrical subcontractor shall perform functional testing and record the results of the functional test procedures under the observation of the Owner’s Representative.

D. Equipment & Components to be Tested: Lighting system and controls.

E. Functions, Modes, and Testing Conditions. Acceptance criteria and testing durations are described in paragraphs F. and G, below.

1. Occupancy sensors and timer controls for lighting
   a. Verify that all specified functions and features are set up, debugged and fully operable.
   b. Verify that sensor time delays are set properly.
   c. Test the sequence of operation for all features and modes and confirm that adjustable timing matches the design Specifications and record all settings.
2. Fluorescent Lamp Ballasts:
   a. Verify that fluorescent lamp ballasts operate correctly, including not exceeding an “A” sound rating.
3. Electric Lighting Photocell Controls:
   a. Test the photo sensor controls during the daytime when conditions are such that controls should be turning off electric lighting. Verify that the fixture turns off during the daytime.
   b. Verify that the fixture turns on when the photo sensor is completely covered.
   c. Verify that the photo sensor is in an appropriate location for the lights being controlled and is not being affected by direct sunlight or obstructions in a way that causes incorrect operation.

F. Required Monitoring: None

G. Acceptance Criteria

1. Lighting Controls: For the conditions, sequences and modes tested, the occupancy/timing controls, integral components and related equipment shall respond to changing conditions and parameters according to Drawings and Specifications and acceptable operating practice.
2. Fluorescent Lamp Ballasts: When operating, ballasts shall not exceed “A” sound rating.
3. Electric lighting photocell controls: During the daytime, fixtures controlled by photo sensors are off. Fixtures turn on at dusk and off at dawn or preset time.
4. Illumination Levels: Average light levels in the tested space at the workplane elevation shall not be less than 20 percent below the specified light level range for the space. Target illumination levels are:

Classrooms: (50 foot-candies)

H. Sampling Strategy for Identical Units:

1. Lighting Controls: Test all automatic interior lighting controls
2. Fluorescent Lamp Ballasts: Test each ballast in the rooms selected for the illumination level test.
3. Electric Lighting photocell controls: Test all photo sensors.
4. Illumination Levels: Rooms randomly selected by the CA shall be verified to achieve appropriate light levels
5. Power Density: Test lighting circuit(s) in rooms selected for illumination levels to verify ballasts are working within manufacturer’s tolerances.

END OF SECTION 01812
SECTION 03255 - EXPANSION ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of post-installed expansion anchors.

1.2 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, and all other Specification Sections apply to this Section.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC - 2007 California Building Code with DSA Amendments
2. ACI 355.1, American Concrete Institute, “State-of-the-Art Report on Anchorage to Concrete”.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or Owner’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Manufacturer’s Data: The Contractor shall submit the manufacturer’s ICC-ES report to the Architect for review.

1.5 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner’s Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
2. The Contractor shall immediately notify the Architect if the Owner’s Testing Agency indicates that quality assurance tests and inspection requirements have not been met.
B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner’s Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner’s Testing Agency shall provide special inspection to verify compliance with the specifications and the product’s ICC-ES report the for following items:
   a. Drill type, bit, and setting.
   b. Hole diameter, depth, and accuracy of location.
   c. Cleanliness and surface preparation of holes.
   d. Expansion anchor type and size.
   e. Installation of expansion anchors.
   f. Torque tightening.

3. The Owner’s Testing Agency shall conduct static tension load tests on installed anchors. Test 50% of each diameter of anchor, or test as scheduled on the Drawings. Tests shall be in accordance with ASTM E 488, “Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements”.
   a. Tests shall not begin until one full day after anchor installation.
   b. Scheduled test load shall be applied for two minutes during which the maximum allowable slip shall be 1/8 inch.
   c. If an anchor fails the tension load test, additional expansion anchors shall be tension load tested until 20 consecutively successful tests have been performed.
   d. Provide tension load tests for replacement expansion anchors.
   e. The Owner’s Testing Agency shall develop and utilize an effective method of field marking locations and results of expansion anchor tests.
      1) Field marking for test locations shall not affect exposed concrete appearance.
      2) A detailed drawing record of test locations and results shall be acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Expansion Anchors:

1. Anchors shall conform to Commercial Item Description A-A-1923A Type 4, carbon steel or stainless steel as indicated on the Drawings.

2. Expansion anchors for use in normal weight concrete:

3. Expansion anchors for use in lightweight concrete (installed directly to concrete or through bottom of light gage metal deck):
B. Patching Mortar: BASF’s “EMACO S66 CI”, Sika Corporation’s “SikaRepair 223”, or equal.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 LAYOUT

A. Inspect areas to be drilled to verify conditions of access, interferences, and existing materials.
   1. Verify location of reinforcement in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging reinforcement. Maintain a minimum clearance of one inch between reinforcement and anchors or dowels, unless otherwise shown on the Drawings.
   2. Locate post-tensioned tendon locations in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging tendons and tendon sheaths. Maintain a minimum clearance of one inch between tendon sheaths and anchors or dowels, unless otherwise shown on the Drawings.

3.3 TOLERANCES

A. Anchor hole locations shall conform to tolerances for the material being attached.

3.4 DRILLING AND PREPARATION OF HOLES

A. Holes shall not be drilled in concrete that has not achieved its specified compressive strength and not until a minimum of seven days after concrete has been cast.

B. Holes shall be drilled using the manufacturer’s recommended drill type, bit, and setting, unless otherwise noted on the drawings.

C. Hole diameter shall be as indicated by the manufacturer. Depth of hole shall be as indicated on the Drawings; however, in no case shall the embedment of expansion anchors be less than that required by the manufacturer.

D. Where drilling causes the concrete to spall or crack, the holes shall be considered defective work.

E. Dust and other contaminants shall be completely removed from holes by blowing with compressed air or other effective means.

3.5 ANCHOR INSTALLATION

A. Installation of anchors in the holes shall be in accordance with manufacturer’s recommendations.

B. Anchors shall be tightened as recommended by the manufacturer to the installation torque values.
3.6 REPLACEMENT ANCHORS AT FAILED TEST LOCATIONS

A. At failed tension load test locations:
   1. Remove anchor.
   2. Install replacement anchors in existing holes approved by the Owner's Testing Agency.
   3. Existing holes not approved by the Owner's Testing Agency shall be considered defective work.

3.7 DAMAGED REINFORCEMENT

A. Damage to existing reinforcement shall be considered defective work.

3.8 SURFACE REPAIRS AND FILLING OF ABANDONED HOLES

A. Clean and repair surfaces damaged by drilling or installation. Cleaning and repairing requirements shall be as directed by the Architect.

B. Abandoned holes shall be filled with patching mortar in accordance with the manufacturer's recommendations.

3.9 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 03 25 30
SECTION 05100 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of structural steel including bracing and shoring required for erection and related work.

1.2 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including general conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Cast-in-Place Concrete

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

2. AISC - American Institute of Steel Construction:
   a. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges, except as follows:
      1) Horizontal and vertical dimensions may not be shown entirely on the Structural Drawings.
      2) Division 1 requirements and those specified herein shall govern in case of conflict.
4. AWS - American Welding Society’s
   a. AWS D1.1 - Structural Welding Code - Steel.
5. SSPC - Steel Structures Painting Council, designations referenced herein.

1.4 DEFINITIONS

A. Structural Steel: As defined in Section 2 of AISC 303.
1.5 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or Owner’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Mill Analysis Reports: Contractor shall submit certified copies of mill analysis reports covering the chemical and physical properties of the structural steel to the Owner’s Testing Agency for review.

C. Certificates of Conformance: Contractor shall submit to the Owner’s Testing Agency for review manufacturer’s certificates of conformance for the following materials:

1. Bolts, nuts, washers
2. Welding electrodes, fluxes, shielding gases

D. Shop and Erection Drawings: Contractor shall submit shop drawings to the Architect for review. Shop drawings shall include, but not be limited to, anchor bolt sizes and layout, member sizes and materials, details of members, connections, weld sizes and profiles, sizes and spacing of bolts, surface preparations and finishes, and corresponding erection plans showing the marking, position and orientation of each member and connection. Detail drawings shall indicate the marking of each member as shown on the erection plans.

1. Complete horizontal and vertical control information may not be shown on the Structural Drawings and the Contractor shall obtain such information from the documents of other disciplines in order to provide a complete submittal. Prior to the preparation of detailed fabrication drawings, the Contractor shall prepare, submit, and obtain approval of coordinated erection drawings complete with horizontal and vertical dimensions.
2. The Contractor shall survey, review and confirm the as-built conditions prior to developing shop drawings. Field modifications to suit as-built conditions shall be at the Contractor’s expense.

E. Welding Procedure Specifications: Contractor shall submit welding procedure specifications (WPS) for each shop and field welding joint type and process to the Architect and the Owner’s Testing Agency for review.

1. The WPS shall be prepared and signed by a welding professional whose qualifications include a minimum of 5 years experience with the welding technologies proposed.
2. The WPS shall include, at a minimum, the information specified in AWS D1.1, Section 3 and the supplemental provisions of Annex H.
3. Prequalified WPS may be used provided they meet the requirements of AWS D1.1, Section 3 for prequalified welds.
4. Any single deviation from the AWS D1.1 requirements for prequalified welds shall necessitate qualification by test per AWS D1.1, Section 4. WPS that are qualified by testing shall conform the additional requirements of AWS D1.1, Annex IV and shall include the corresponding Procedure Qualification Records (PQRs).

F. Welder Performance Qualification Records (WPQR): Contractor shall submit WPQR for each shop and field welder to the Owner’s Testing Agency for review.

G. Contractor’s quality control test reports: The Contractor shall submit quality control test reports to the Architect and Owner’s Testing Agency for review.
1.6 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the Owner's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.

2. The Contractor shall immediately notify the Architect if the Owner's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. Owner's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the Owner. The Owner shall retain a testing agency, referred to herein as the Owner's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.

2. The Owner's Testing Agency shall submit written procedures, qualifications and reports as specified in ANSI/AISC 341, Appendix Q, Section Q4.

3. The Owner’s Testing Agency shall perform tests and inspections per CBC, Chapter 17A and as follows:

   a. Collect and review certified mill analysis reports.
   b. Review steel identification per CBC Section 2204A.1. Material that cannot be identified or has a questionable source shall be tested by the Contractor's Testing Agency.
   c. Collect and review certificates of conformance. Materials not accompanied by manufacturer certificates shall be tested by the Contractor’s Testing Agency.
   d. Welding Tests and Inspections:

      1) Personnel performing welding inspections and nondestructive testing shall meet the minimum qualifications specified in AWS D1.1, Section 6.
      2) Review shop and field WPS in accordance with AWS D1.1 and D1.8.
      3) Confirm welders, welding foreman, and QC Inspectors have a copy of the approved WPS.
      4) Review WPQR in accordance with AWS D1.1 and D1.8 for the welds to be performed.
      5) Confirm welding equipment settings, and voltage and amperage at point of welding.
      6) Perform visual inspection of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.1. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the Owner’s Testing Agency. Acceptance criteria for visually inspected welds shall be in accordance with AWS D1.1, Section 6.
      7) Perform nondestructive tests (NDT) of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.2, except as noted below. Provide NDT equipment as required to perform specified tests.

         a) Ultrasonic testing (UT) shall conform to AWS D1.8, Section 7.10.
         b) The rate of ultrasonic testing on complete joint penetration (CJP) groove welds may be reduced to 25-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2a. However, no reduction in testing frequency shall be permitted for demand critical welds.
         c) Magnetic Particle (MP) testing shall conform to AWS D1.8, Section 7.9.
         d) The rate of magnetic particle testing on CJP groove welds may be reduced to 10-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2h.
However, no reduction in testing frequency shall be permitted for demand critical welds.

e. High-Strength Bolting Tests and Inspections:

1) Sample and test high strength bolts, nuts and washers in accordance with the requirements of the Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

2) Inspect installation of high strength bolts per ANSI/AISC 341, Appendix Q, Section Q5.3. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the Owner's Testing Agency.

f. Welded and bolted connections that fail to meet the acceptance criteria specified shall be re-inspected and/or re-tested after corrections have been made by the Contractor.

g. Confirm structural and non-structural connections do not occur in the protected zones of the SLRS, except as indicated on the Drawings.

h. The Owner's Testing Agency shall review Contractor quality control test and inspection reports.

C. Contractor's Quality Control Tests and Inspections:

1. General: Quality control tests and inspections shall be the responsibility of the Contractor. Where required herein, the Contractor shall retain a testing agency, referred to herein as the Contractor's Testing Agency, to demonstrate that quality control conforms to the requirements of the Contract Documents. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Welding Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of welding per ANSI/AISC 341, Appendix Q, Section Q5.1.

   a. Personnel performing quality control inspections of welding shall meet the minimum qualifications specified in AWS D1.8, Section 7.

   b. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the Owner's Testing Agency.

3. High-Strength Bolting Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of high-strength bolting per ANSI/AISC 341, Appendix Q, Section Q5.3.

   a. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the Owner's Testing Agency.

4. Tension Tests: The Contractor's Testing Agency shall conduct one tension test and one bend test in accordance with ASTM A 370 for each heat of structural steel not accompanied by certified mill analysis reports. Test reports shall be reviewed by the Owner's Testing Agency before placement of steel.

5. Filler Metal Toughness Tests: The Contractor's Testing Agency shall test each type of filler metal not accompanied by the manufacturer's certificate of conformance for the filler metal toughness requirements in Part 2 of this specification. Test procedures shall conform to ANSI/AISC 341, Appendix X.
PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

A. Wide Flange Shapes: ASTM A 992.
B. Plates and Bars: ASTM A 36, typical.
C. Channel and Angles: ASTM A 36.
D. Round and Rectangular Hollow Structural Sections: ASTM A 500, Grade B
E. Pipe: ASTM A 53, Grade B

2.2 FASTENER PRODUCTS AND MATERIALS

B. High-Strength Bolts: ASTM A 325, Type 1, with ASTM A 563, Grade C or DH, heavy hex nuts and ASTM F 436 washers, typical. Provide connection type N typical and X or SC where noted on the Drawings.
   1. Twist-off type tension-control bolt assemblies conforming to the requirements of ASTM F 1852 shall be permitted at pretensioned bolt locations, except at [AESS], slip critical bolted connections and where noted on the Drawings.
   2. Compressible-washer-type direct indicators conforming to the requirements of ASTM F 959, Type 325, shall be permitted at pretensioned bolt locations, except at [AESS] and where noted on the Drawings.

2.3 WELDING MATERIALS AND PRODUCTS

A. Arc-Welding Filler Metals: Filler metals shall be low hydrogen types conforming to AWS D1.1, Table 3.1 and shall be as recommended by the manufacturer for the position, thickness and other conditions of use.
   1. Electrode Wire Diameter: Wire diameter shall not exceed the maximum values specified in AWS D1.1, Table 3.7.
   2. Filler Metal Toughness:
      a. Filler metals for shop and field welded joints designated as SLRS on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at 0 degrees Fahrenheit as determined by AWS A5 classification test method or manufacturer certification.
      b. Filler metals for shop and field welded joints designated as demand critical welds on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at -20 degrees Fahrenheit as determined by the appropriate AWS classification test method or manufacturer certification and 40 ft-lb at 70 degrees Fahrenheit as determined by ANSI/AISC 341, Appendix X or other approved method.

B. Arc-welding equipment: Welding equipment shall have calibrated meters for voltage and amperage that accurately indicate these values at the point of welding for the length of cable to be used. Contractor shall demonstrate to the satisfaction of the Owner’s Testing Agency the accuracy of the meters, using external meters attached to extension cables of a length that reflects actual project conditions. If
equipment meters do not accurately reflect the electrical properties at the point of welding, the Contractor shall provide external meters.

2.4 COATING PRODUCTS AND MATERIALS

A. Structural Steel Primer Paint: Alkyd based primers shall be Tnemec, Series V10, red metal primer as manufactured by Tnemec Inc., Maclac, 42 Series, red oxide primer as manufactured by R.J. McGlenon Co. Inc., or equal. Volatile Organic Compounds (V.O.C.) shall not exceed 340 grams per liter as applied.

B. Shop Galvanizing: Items noted on the Drawings or in the specifications as galvanized shall be hot-dip galvanized in accordance with ASTM A 123.

C. Galvanizing Repair: Repair materials shall conform to ASTM A 780.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in structural steel with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings.

3.3 FABRICATION

A. General: Fabricate structural steel in accordance with AISC 303 and ANSI/AISC 360.

B. Dimensions: Contractor shall obtain dimensions from the Structural Drawings, drawings of the other disciplines, and field measurements as necessary for the fabrication of the structural steel. Complete dimensions may not be shown on the Structural Drawings.

C. Thermal Cutting: Thermal cutting shall be done by machine to the greatest extent possible. Plane thermally cut edges as necessary to comply with edge preparation requirements of AWS D1.1.

D. Bearing Surfaces: Column bases, base plates and other bearing plates shall be milled to a true plane perpendicular to the axis of the member for complete bearing at the contact face.

1. Bearing plates 2-inches or less in thickness are permitted without milling, provided a satisfactory contact bearing is obtained.
2. Top surfaces of base plates where columns are connected by CJP groove welds need not be milled.
3. Bottom surfaces of base plates to be grouted need not be milled.

E. Camber: Provide camber for beams and girders as indicated on the Drawings.

F. Machine Bolts: Install machine bolts snug tight, unless otherwise noted on the Drawings.

G. High-Strength Bolts (HSBs): Install high strength bolts in accordance with RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts” for the types of joints shown on the Drawings.
1. Holes for bolts shall be standard 1/16 inch larger than the nominal diameter of the bolt, unless otherwise noted on the Drawings.
2. Holes may be punched or drilled in material with a thickness not greater than the nominal bolt diameter plus 1/8 inch. Holes in thicker material shall be drilled or sub-punched and reamed. Thermal cutting of holes is not permitted. Burrs shall be removed from holes by grinding.
3. HSBSs shall be fully tensioned unless otherwise noted on the Drawings.

H. Welding: Welding shall conform to the requirements of ANSI/AISC 360 and AWS D1.1 using proven methods and techniques suitable for the connection configuration to be welded.

1. Use equipment that will supply the current and voltage at the point of welding shown on the approved WPS as recommended by the electrode manufacturer. Suitable meters and means of adjustment shall be provided for current and voltage.
2. Weld in accordance with the approved WPS.
3. Welders, welding foremen and the Contractor's QC inspector shall have a copy of and be capable of reading the approved WPS. Welders shall be qualified by tests per AWS D1.1 to perform the types of welds required.
4. Filler metals shall conform to AWS D1.1, Table 3.1.
5. Groove welds shall be complete joint penetration welds unless noted otherwise on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.
6. Partial penetration groove welds shall have a root face of 1/8-inch unless otherwise noted on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.

I. Fabrication Tolerances: Fabrication tolerances shall conform to AISC 303, unless otherwise noted.

3.4 FINISHES

A. Surface Preparation:

1. Remove visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from all steel surfaces in accordance with SSPC-SP1 "Solvent Cleaning."
2. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter in accordance with SSPC-SP2 "Hand Tool Cleaning" for the following steel surfaces:
   a. Steel to receive spayed-on fireproofing.
   b. Steel to be embedded or encased in concrete.
3. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter from steel surfaces to be primed in accordance with SSPC-SP3 "Power Tool Cleaning."

B. Shop Prime Painting:

1. Shop prime structural steel, except as follows:
   a. Members or portions of members to be fireproofed
   b. Members or portions of members to be embedded in concrete or mortar, except for the initial 2-inches.
   c. Faying surfaces of connections using slip critical bolts.
   d. Surfaces to be field welded, including flange surfaces to receive metal decking.
2. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions at a rate to provide a uniform dry film thickness of 3.0 mils. Use painting methods that will result in full coverage of joints, corners, edges and exposed surfaces.
   a. Apply two coats of primer to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

3.5 ERECTION
   A. General: Erect structural steel in accordance with AISC 303 and ANSI/AISC 360.
      1. Conform to the additional requirements of ANSI/AISC 341 for members and connections in the SLRS.
   B. Where erection requires fabrication on site, conform to the requirements of section 3.3 “Fabrication” of this Specification.
   C. Machine Bolts: Install machine bolts snug tight, unless noted otherwise on the Drawings.
   D. High-Strength Bolts: See section 3.3 “Fabrication” of this Specification.
   E. Welding: See section 3.3 “Fabrication” of this Specification.
   F. Structural steel shall be erected true and plumb. Temporary shoring and bracing shall be provided wherever necessary and shall be adequate for the loads to which the structure may be subjected, including wind forces, erection equipment and operation of same. Temporary shoring and bracing shall remain in place as long as required for safety and until the final framing construction is complete. Final connections shall not be made until the structure has been properly aligned.
   G. Provide temporary flooring, planking and scaffolding as necessary for the erection of the structural steel and support of erection equipment. Temporary elements shall conform to applicable Federal, State and Local regulations.
   H. Erection Tolerances: Erection tolerances shall conform to AISC 303, unless otherwise noted.

3.6 FIELD TOUCH-UP PAINTING
   A. After erection, touch-up field welded connections and areas where shop primer has been disturbed. Surface preparation and painting shall be as specified for shop prime painting.

3.7 CORRECTION OF DEFECTIVE WORK
   A. Correction of defective work shall be the responsibility of the Contractor.
   B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.
   C. Corrected work shall conform to the requirements of the Contract Documents.
   D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the
location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor’s proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the Owner’s Testing Agency.

3.8 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

END OF SECTION 05100
SECTION 05500 - METAL FABRICATIONS

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes (but is not necessarily limited to):

1. Steel framing and supports for application where framing and supports are not specified in other Sections.
2. Custom-fabricated connectors and plates not covered by Structural Drawings or Specifications.
3. Miscellaneous framing and supports including countertop support brackets.

1.3 SUBMITTALS

A. Procedures: In accordance with Section 01330, "Submittal Procedures."

B. Shop Drawings:

1. Large-scale drawings for fabrication and erection of assemblies not completely shown by manufacturer's product data.
   a. Include, as appropriate, plans, elevations, complete details, thicknesses, sizes, types, grades, classes of metal, connecting and joining methods, anchorages.
   b. Show required field measurements and interface with work of other Sections.
   c. Welds, both shop and field, shall be shown by AWS "Symbols for Welding, Brazing and Nondestructive Examination," A2.4.
   d. Indicate all required field measurements.
2. Setting drawings, templates, instructions, and directions for installation of anchorage devices.

C. Product Data: Manufacturer's specifications for manufactured products to be used in the fabrication of work, including paint products, bolts, and other exposed hardware.

D. Quality Control:

1. Certification for each welder.
2. Completed "Procedure Qualification Record" (PQR) and "Welding Procedures Specification" (WPS) forms for the welds to be performed under this Specification

1.4 QUALITY ASSURANCE

A. Exposed fabrications shall comply with recommended practices of the National Association of Architectural Metal Manufacturers (NAAMM) and Section 10 of the AISC Code of Standard Practice.

B. Welding:

3. Comply with AWS publication "Welding Zinc Coated Steel" for galvanized products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel from corrosion.
B. Store packaged materials in original unbroken package or container.

1.6 COORDINATION

A. Coordinate installation of anchorages. Furnish setting drawings, diagrams, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors, to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Field Measurements: Where metal fabrications are shown to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.
   1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.
   2. Coordinate fabrication schedule with construction progress to avoid construction delays.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate with other construction in order to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Steel:
   1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
   2. Steel Shapes, Bars, and Plates: ASTM A36/A 36M
   3. Steel Plates to Be Bent or Cold Formed: ASTM A 283, Grade C.
      a. ASTM A120, if no bending required.
      b. Pipe Fittings: Malleable iron ASTM A47, grade 32510.
   5. Steel Bars and Bar-Size Shapes: ASTM A663, Grade 65, or ASTM A36.
   6. Cold-Drawn Steel Tubing: ASTM A500, Grade B.
   7. Hot-Rolled Carbon-Steel Bars: ASTM A575, grade as selected by fabricator.

B. Aluminum: 6063-T6 extruded alloy, ASTM B221 (ASTM B221M).

2.2 OTHER MATERIALS AND COMPONENTS

A. Anchor Bolts:
1. Headed: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
3. Hot-dip galvanize or provided mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

B. Fasteners:
1. Provide zinc-coated fasteners with galvanizing complying with ASTM A153 for exterior use or where built into exterior walls.
2. Select fasteners for type, grade, and class required for installation.

C. Screws and Washers:
2. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

D. Electrodes for Welding: In accordance with AWS Code.

E. Nonshrink Grout: ASTM C1107; nonmetallic, nonstaining, nongaseous premixed grout with at least 6,800 psi compressive strength at 28 days; Sonneborn-Contech "Sonogout," Upco "Upcon," or accepted equal. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Adhesive, Stainless Steel to Other Materials: Epoxy resin type, unless otherwise recommended by metal manufacturer and fabricator.

2.3 PROTECTIVE COATINGS

A. Products:
1. Galvanizing-Repair Paint: Minimum 82 percent zinc-dust-content paint for regalvanizing welds in galvanized steel, complying with FS DOD-P-21035a; Z.R.C. Cold Galvanizing Compound by ZRC Worldwide, International Protective Coatings, or equal. Where repaired galvanizing is to be left exposed, use repair paint that will closely match appearance of hot-dip galvanizing; "Galvilet" by ZRC Worldwide, or equal.
2. Shop Primer for Ferrous Metal - Not Galvanized:
   a. Interior: Modified alkyd; Tmer series "FD88 Azeron" or equal, 1.5 to 2.5 DFT.
   b. Exterior: Inorganic, zinc-rich: "Tmer-Zinc 90-97," or equal, 2.0 to 3.5 DFT.

B. Galvanizing: Provide zinc coating for items exposed to exterior atmosphere, shown on the Drawings, or specified to be galvanized using the hot-dip process after fabrication.
1. Comply with ASTM A153 for galvanizing of iron and steel hardware.
2. Comply with ASTM A123 for galvanizing of rolled, pressed, and forged-steel shapes, plates, bars, and strips 1/8 inch thick and heavier.
4. Repair zinc coating damaged after fabrication with specified repair paint in accordance with ASTM A780, AHDGA publication, "Recommended Practice for Touch-up of Damaged Galvanized Coatings," and manufacturer's recommendations for application of repair paint.
5. Zinc-coated surfaces to be painted shall be chemically treated and finished painted as specified in Section 09900, "Paints and Coatings."

C. Shop Priming:
   1. Shop-prime work, except surfaces and edges to be field welded, unless otherwise shown.
   2. Primer paint shall be compatible with required finish coat.
   3. Surface Preparation:
      b. Concealed Items: SSPC No. 3.
      c. Exposed Items: SSPC No. 6.
   4. Apply primer within 8 hours of preparation of surface or sooner if necessary to prevent rusting.

D. Finish Painting: As specified in Section 09900, "Paints and Coatings." Finish exposed fasteners to match adjacent metal.

2.4 FABRICATED ITEMS

A. Miscellaneous Framing and Supports:
   1. Provide miscellaneous steel framing and supports as required to complete the Work.
   2. Fabricate to sizes, shapes, and profiles shown or required.
      a. Except as otherwise shown, fabricate from structural steel shapes, plates, and steel bars, of all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection.
      b. Cut, drill, and tap units to receive items anchored to the Work.
   3. Galvanize miscellaneous framing and supports wherever shown and used in an exterior location.

2.5 FABRICATION METHODS

A. Form metal fabrications to required shapes and sizes, with true lines and angles. Provide components in sizes and profiles shown.
   1. Edges shall be straight and sharp.
   2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   3. Avoid bending, twisting, or otherwise distorting individual members.

B. Castings shall be sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance.

C. Provide rebates, lugs, and brackets as required to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise shown. Use concealed fasteners, unless otherwise shown on reviewed shop drawings.

D. Joints and Connections:
   1. Shop-assemble items to greatest extent possible so as to minimize field splicing and assembly.
   2. Disassemble only as necessary for shipping and handling limitations. Clearly mark items for reassembly and coordinated installation.
   3. Use connections that maintain structural value of joined pieces.
   4. Detail connections to facilitate fabrication and erection in accordance with the AISC code.
   5. Mill joints to a tight, hairline fit. Form joints exposed to weather to exclude water penetration.
   6. Provide anchorage devices and fasteners where necessary for securing metal fabrications to inplace construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, and other connectors as required.
7. Fabricate and space anchoring devices as shown and required to provide adequate support for intended use.

E. Welding: Comply with AWS-recommended practices in shop welding and brazing.
   1. Welds shall be continuous.
   2. Weld behind finished surfaces without distorting or discoloring exposed side.
   3. Clean exposed welded joints of flux. Dress exposed and contact surfaces.

F. Finishing:
   1. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
   2. Welds, burrs, roller marks, seams, and rough surfaces shall be ground neat and smooth.
   3. Mill markings shall be completely removed.
   4. Gouges, dents, and other surface defects shall be filled and ground smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal fabrications as shown on the Drawings in accordance with reviewed submittals and referenced standards.

B. Cut, drill, and fit as required for installation.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete.

D. Set work accurately in location, alignment, and elevation; plumb, level, true, and free of rack; measured from established lines and levels.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Adjust items prior to securing in place so as to ensure proper matching of components and correct alignment.

G. Field Welding:
   1. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work.
   2. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
   3. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
   4. Protect and clean areas surrounding welds.

H. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provided threaded fasteners for use with concrete and masonry inserts, toggle bolts, lag screws, wood screws, and other connectors.

I. Provide temporary bracing or anchors in formwork for items that are to be guilt into concrete, masonry, or similar construction.

3.2 ADJUSTMENT AND TOUCH-UP
A. Inspect installed work. Correct deficiencies.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
   2. Touch-up shall not be noticeable.

C. Galvanized surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM C780.

D. Restore finishes damaged during installation and construction period so that no evidence of correction work remains.

E. Protect finishes of metal fabrications from damage during construction period as required.

END OF SECTION 05500
SECTON 06410 - CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing laboratory casework.

B. All casework, working surfaces and other items specified herein shown on the drawings shall be furnished, installed, and shall be demonstrated to properly perform in accordance with the function specified herein. Provide all necessary fillers, scribes and miscellaneous accessories and hardware to provide a complete installation.

C. Section Includes (but is Not Necessarily Limited to):

1. Wood laboratory casework (includes all casework in all locations).
2. Work Surfaces.
3. Storage Cabinets.
4. Wall Cabinets.
5. Adjustable Shelving.
6. Laboratory Drying Rack.

D. RELATED SECTIONS

1. Division 09 Section(s) for backing in walls for casework, anchorage, and resilient base.
2. Division 11 Section(s) for laboratory fume hoods.
3. Division 15 Section(s) for laboratory fixtures and fittings, plumbing, and mechanical.
4. Division 16 Section(s) for electrical.

1.2 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of casework and equipment so that spaces are sufficiently complete to allow for installation immediately following delivery.

B. Protect finished surfaces from soiling or damage during handling and installation. Cover working surfaces with cardboard. Mark large lettering “NO STANDING”.

1.3 PROJECT CONDITIONS

A. Do not deliver or install equipment until the following condition have been met:

1. Windows and doors are installed and the building is secure and weather tight.
2. Ceiling, overhead ductwork, and lighting are installed.
3. All painting is complete and floor finish is installed.
4. Casework and related materials require the interior building temperature not to exceed 80-degrees (F) to avoid undue structural fatigue and damage. Additionally, frequent and/or excessive changes in temperature and/or humidity levels during the course of the material installation, or once materials are installed, must be avoided to prevent damage to equipment.
5. Under no conditions should moisture levels exceed 50% relative humidity.
1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data for each item of laboratory furnishing, and equipment. Include component dimensions, configuration, construction details, joint details and attachments. Indicate location, size and service requirement for each utility connection. See Specification Division 1 for additional general requirements.

B. Shop Drawings: Provide 1/2"=1'-0" scale elevations of each individual and battery of casework units showing cross sections, rough-in and anchor placements, tolerances and clearances. Indicate relationship of units to fume hoods, other laboratory equipment, surrounding walls, ceilings, windows, doors and other building components. Provide 1/4"=1'-0" scale rough-in plan drawings for coordination with trades. Rough-in shall show free area.

C. Top Material Samples: Submit 3" by 3" product sample of each type of bench top.

D. Hardware Samples: Provide sample of door and drawer pulls, lock, and hinges.

E. Finish Samples: Submit 3" by 5" samples of each color of finish from manufacturer's standard color offering for casework and accessories for section by the District's representative.

F. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard.

G. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated. Proposal from brokers or multiple suppliers will not be accepted.

C. The supplier for work in this section shall use manufacturers with production facilities including all tools, equipment, and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to complete an installation of this size and type within the required time limits: Ten years or more experience in manufacture of laboratory casework and equipment of type specified. Ten installations of equal or larger size and requirements within the last five years.

D. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Preinstallation Conference: Conduct conference at Project site.
PART 2 - PRODUCTS

2.1 LABORATORY CASEWORK

A. General: It is the intent of the documents to match the existing casework. Contractor shall verify existing casework manufacturer and design.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advanced Lab Concepts.
   b. Fisher Hamilton Scientific.
   c. Kewanee.

2.2 DESIGN REQUIREMENTS

A. Construction: All cabinets to be constructed of veneer core FSC-certified plywood, plain sliced select Maple, grade A veneer finish on exposed surfaces; Plain sliced select white Maple, grade B finish veneer on semi-exposed surfaces. Particle board or medium density fiberboard (MDF) materials are not acceptable.

B. Door and drawer design: Flush Overlay.

C. Grain pattern on end panels to be vertical.

D. Grain pattern on cabinet drawers and doors; Vertical matched grain (drawers and doors), slip matched.

E. Modular, self-supporting units capable of interchangeable use.

F. Flush interiors: Set cupboard bottom flush with front end facers. Surface mounted bottoms and offsets cause by front face frames which interfere with ease of cleaning are not acceptable.

G. Joinery: 32mm doweled joinery system glued, clamped, and screwed. Dowels are to be hardwood, laterally fluted with chamfered ends and a minimum diameter of 8mm.

H. Cabinet edge banding: 3mm solid Maple on exposed and semi-exposed surfaces of cabinet box frames, and for all base, wall, tall, and open adjustable shelf cabinet box frames.

I. Adjustable shelves edge banding: Adjustable shelves insides based, tall, wall, and open adjustable shelf cabinets to be 1” Baltic Birch veneer core, FSC-certified plywood. The edge condition of the adjustable shelves shall reveal the exposed layers of the Baltic Birch veneer core plywood. The individual layers of the veneer core plywood shall not exceed 1/16” thickness. Adjustable shelves inside base, tall, and wall cabinets with doors shall have Maple veneer finish. Adjustable shelves inside open adjustable shelf cabinets (without doors) shall have Maple veneer finish on top and bottom surfaces.

J. Door and drawer edge banding: All door and drawer fronts to be constructed of 3/4” Baltic Birch veneer core FSC-certified plywood with the edge of the veneer core exposed to view. The individual layers of the veneer core shall not exceed 1/16” thickness.

K. Sinks: Refer to Drawings.

L. Casework color: Natural Maple clear finish.
2.3 DEFINITIONS OF CABINET COMPONENTS BY SURFACE VISIBILITY

A. Exposed surfaces: Surfaces visible when drawers and solid doors are closed. Front edges of cabinet body members are visible or seen through a gap of greater than 1/8" with doors and drawers closed. Portions of cabinets visible when fixed appliances are installed.

B. Semi-exposed surfaces: Surfaces visible when doors and drawers are open. Surfaces visible behind clear glass doors. Interior surfaces of open units. Bottoms of cabinets 30" or more above finished floor. Tops of cabinets less than 78" above finished floor, or are visible from an upper floor or staircase after installation.

C. Unexposed surfaces: Surfaces not normally visible after installation. Bottoms of cabinets less than 30" above finished floor. Tops of cabinets over 78" above finished floor, which are not visible from an upper floor or staircase after installation. Stretcher, blocking, and/or components concealed by drawers.

D. Hardwood: Hardwood lumber, clean and free of defects. All lumber kiln dried to uniform moisture content of six (6) percent. Exposed material: Maple. Semi-exposed material: Maple. Unexposed material: Solid hardwood of species suitable for the intended purpose.

E. Plywood: Hardwood plywood featuring a balanced construction glued with water resistant resin glue. Veneer core Baltic Birch plywood for drawer fronts, cabinet doors, and adjustable shelves.

F. Glass: Float glass – 3mm (nominal 1/8") on framed glass doors on wall and upper cased and 6mm (nominal 7/32") on tall cases. Glass to be without imperfections or marred surfaces.

G. Finish: Highly chemical resistant acrylic urethane finish with built-in UV blocker applied over stain of selected color from manufacturer’s full range of colors. Provide chemical resistant finish conforming to Woodwork Institute (WI) premium grade TR-6 finish, with no less than two topcoats.

2.4 BASE CABINETS

A. All base cabinet components shall consist of solid Maple lumber and veneer core plywood. Particle board and/or medium density fiberboard (MDF) are not acceptable.

B. Removable cabinet backs. Sink base back shall be full half height construction to allow for plumbing and sink waste connection. Sink base backs shall be 1/4" Baltic Birch veneer core plywood.

C. Provide split back on drawer cabinets.

D. Vertical dividers: Full height dividers shall be 1-1/2" thick plywood, glued and screwed in place. Provide 3mm (nominal 1/8") thick hardwood facer on exposed edge.

E. Base unit shelves are to be adjustable on 32mm centers.

F. Drawer bottoms: 1/2" Baltic Birch veneer core finished both sides.

G. Security Panels: Provide 1/4" Baltic Birch security panels between drawers at fixed island benches in Organic Chemistry and Biology Labs.
2.5 WALL AND TALL CABINETS

A. Wall, and tall cabinet ends: 1" thick veneer core plywood as specified, with 3mm (1/8" nominal) thick exposed hardwood facer on front edges. Bore interior faces, as appropriate, for security panels, rails, and four rows of shelf bracket support holes.

B. Veneer core plywood with 3mm (nominal 1/8") hardwood facer on front edge. Bottom hardwood kick rail on tall case 5-1/8" high joined to cabinet side with 8mm (nominal 5/16") dowels. Finish to match exposed surfaces.

C. Solid door shall be of 3/4" Baltic Birch veneer core plywood with edge of veneer core exposed to view. Individual layers of veneer core shall not exceed 1/16" thickness.

D. Framed glazed doors: Veneer core construction, 1" x 3" Baltic Birch veneer core plywood vertical side panels and horizontal top and bottom panels, machined to accept glass. Provide extruded vinyl retaining molding on interior, designed so glass can be replaced without tools. Edge of wall cabinet doors to have exposed layer so Baltic Birch veneer core plywood, with individual layers not greater than 1/16" thickness.

2.6 ISLAND SHELF (FIXED)

A. Location: At all island benches in Biology and Chemistry Labs.

B. Material: 1" phenolic resin, Trespa TOPLAB.

C. Construction: Provide concealed fasteners and concealed joinery.

D. Safety Rail: Provide 1/4" diameter aluminum safety rail at 2" height at front edge of island shelf. Safety rail to be attached from bottom side of shelf with flush, recessed allen-head screws.

2.7 OPEN ADJUSTABLE SHELVES

A. Construction: 1" thick veneer core with Maple veneer to match base cabinets on top and bottom surfaces. Sizes as indicated. Particle board and/or medium density fiberboard (MDF) are not acceptable.

B. Edge: Adjustable shelf edge to have exposed layers of Baltic Birch veneer core. Individual layer shall not exceed 1/16" thickness.

C. Maximum support spacing shall be 24" on center.

D. Safety Rail: Provide 1/4" diameter aluminum safety rail at 2" height at front edge of all adjustable shelves. Safety rail to be attached from bottom side of shelf with flush, recessed allen-head screws.

2.8 HARDWARE

A. Drawer and hinged door pulls shall be 8" aluminum wire pulls, all horizontally mounted, and centered on doors and drawers.

B. Hinges: Heavy duty, exposed 3-knuckle hinge attached with sheet metal screws. Provide two hinges for doors up to 36" high. Three hinges for doors over 36" high.

C. Elbow catches: Spring type with strike.
D. Bolts for tall storage cabinets shall be 3" long and have an 18" pull and an angle strike to secure inactive door on cabinets over 72" in height. Elbow catches shall be used on inactive doors up to and including 72" in height.

E. Drawer suspension: Mechanical slide shall be full extension with overtravel, 150 lb. dynamic, zinc plated. Accuride or equal.

F. Shelf supports: Single pin metal support.

G. Locks: 5-disc tumbler for master key system. Master Key System: Master key system shall have 5-disc tumbler locks with capacity of 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified: 2 for each keyed different lock; 3 for each group keyed alike locks; 2 master keys for each system. Lock types shall have heavy duty cylinder. Exposed lock nose finish to be dull nickel (stain) plated. Provide locks by National or equal. All door and drawer cabinets to be lockable.

2.9 WORK SURFACES

A. Phenolic Resin Work Surface: Provide Trespa "Top Lab" phenolic resin work surface, or approved equal, for all fixed laboratory casework tops, and moveable lab benches. 3/4" thickness unless otherwise noted.

B. Counter Backsplash: All backsplashes at laboratory countertops to be 6" in height, made of 3/4" thick phenolic resin Trespa "Top Lab".

C. Sink Backsplash with drying rack above: All backsplashes at sinks to be 12" in height made of 3/4" thick phenolic resin Trespa "Top Lab".

D. Sink Backsplash without drying rack above: Provide full height backsplash from counter top to underside of wall cabinet above, made of 3/4" thick phenolic resin Trespa "Top Lab".

E. Exterior Window Backsplash: Where noted on drawings, provide nominal 8" backsplash to match counter at exterior window condition.

F. Sinks: Refer to Drawings.

2.10 ACID CABINET

A. Acid storage cabinet manufactured by SciMatCo, Product No. SC5060, or approved equal.

B. 100% polypropylene construction, no metal parts or connectors.

C. 200 cfm exhaust. Connection by Division 15.

D. Liquid tight interior seams, welded.

E. Must meet OSHA secondary containment standards.

F. Exterior dimensions: 18-3/8" deep by 48" wide by 60" tall.

G. Interior shelves with tipped edges.
2.11 FLAMMABLE CABINETS

A. Solvent storage cabinet manufactured by Justrite, Model No. 894520, or approved equal.

B. Cabinet shall comply with California Fire Code, Articles 79 and 80. Cabinet shall be Factory Mutual and UL certified. Cabinet shall comply with CAL OSHA requirements for flammable storage cabinets.

C. Double wall construction.

D. No external exhaust.

E. Self-closing doors.

F. 45 gallon capacity.

G. Two adjustable interior shelves standard, plus one additional shelf.

H. Dual vents with flame arrestors.

I. Must conform to CAL OSHA requirements. Adjustable leveling feet on all four corners.

J. Leak proof sill in cabinet base.

K. Exterior dimensions: 18” deep by 43” wide by 65” high.

2.12 LABORATORY DRYING RACK

A. In Biology and Chemistry Prep rooms, provide 36”x36” stainless steel drying rack with drain trough and tube hose to sink below. Drying pegs to be white polypropylene.

2.13 FABRICATION

A. General:

1. Field Measurements: Verify dimensions and plumbness and trueness of wall of partition as required for proper fabrication of the Work.

2. Cut-outs: Insofar as possible, make cut-outs required to accommodate work of other Sections in shop.

3. Shop Fabrications: Shop-fabricate casework in whole units or in partial units as most practical for handling and transportation. Assemble partial units in place in such manner that each piece of casework becomes a unified whole visually and structurally. Fabricate fillers and scribe strips of same materials and finishes as cabinets with which they are associated.

4. Hardware: Make cuts for hardware neat and true. Install hardware and fit securely.

5. Adjustment: Adjust drawers, doors, and movable shelves to operate easily and smoothly without binding or excessive play.

6. Back Painting: Surfaces of casework which are not exposed to view at any time and abut walls or floor shall be thoroughly back painted with one heavy coat of finishing material of fabricator’s choice before leaving fabricator’s shop.

B. Custom Casework:


2. Grade: Custom.
4. Construction Type: Type I.
5. Door and Drawer Front Style: Flush Overlay.
6. Scribing: Flush with door faces and per Premium Grade regardless of specified casework grade.
7. Materials:
   a. Exposed Surfaces: Hardwood Plywood, align grain vertically.
   c. Edges: None.

C. Countertops:
   1. High Pressure Plastic Laminate:
      a. General: Provide throughout unless otherwise specified or shown.
      c. Grade: Custom.
      d. Core Material: Hardwood Plywood, thickness as shown.
      e. Edge Detail: As shown.
      f. Back and End or Side Splashes: Top mount square butt joint.
      g. Splash Top: Square with self-edge.
      h. Splash Height: 4-inches, unless otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

   B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

   C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

      1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

   D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c.

   E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

   F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

   G. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
H. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints

I. Fastening:
   1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
   2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
   3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

J. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

K. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

L. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

M. Accessory Installation: Install accessories and fitting in accordance with manufacturer's recommendation. Turn screws to seat flat; do no drive.

3.2 ADJUSTING

A. Repair or remove and replace defective work, as directed by owner's representative upon completion of installation.

B. Adjust door, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.3 CLEANING AND PROTECTING

A. Provide all necessary protective measure to prevent exposure of casework and equipment from exposure to other construction activity during installation.

B. Advise contractor of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION 06410
SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Building insulation.

B. Related Sections:
   1. Division 7 Section “Polyvinyl-Chloride (PVC) Roofing” for roof insulation.
   2. Division 15 Section(s) for mechanical pipe and duct insulation

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Certificates: Certifications that products proposed for use comply with specifications.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Regulatory Requirement: Certify, by manufacturer, that insulation complies with California standards for insulation materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Identification: Clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
PART 2 - PRODUCTS

2.1 NATURAL COTTON FIBER INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


B. Natural Cotton Fiber Insulation: Unfaced batts, ASTM C 739; with maximum flame-spread and smoke-developed indexes for Class A material per ASTM E 84. Free of formaldehyde.

C. Thicknesses: 3-1/2 inch (R-13) and 5-1/2 inch (R-19).

2.2 VAPOR BARRIER

A. 10 mil clear polyethylene sheet.

2.3 INSULATION FASTENERS

A. General: As specified and as recommended by insulation manufacturers; holding capacity no less than 70 pounds per device.

1. Steel Substrates: Galvanized cupped head weld pins.
2. Screwable Substrates: Other than steel; galvanized steel screws and washers.
3. Other substrates: Galvanized stick clips, washers, and adhesive.

B. Black Fabric: Guildford of Maine’s Terratex, or equal, FR701, 2100 pattern, 100% polyester, black color.

C. Tape: Laminate of aluminum foil, glass fiber reinforcing, and kraft paper with pressure-sensitive adhesive; UL listed; recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer’s written instructions applicable to products and applications indicated.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer’s standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer’s written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. At areas to receive thermal insulation, cover entire area with vapor barrier.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
   a. With faced blankets having stapling flanges, secure insulation by insetting, stapling flanges to sides of framing members.
   b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder; once finish material is installed over it.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.5 FIELD QUALITY CONTROL

A. Attachment Device Test: Prior to starting work, conduct field tests to verify that each type of attachment device will carry specified load; conduct tests with 3 devices, each carrying dead load of 70 pounds for a period of 72 hours. Failure of any one device may be cause for rejection.

END OF SECTION 07210
SECTION 07542 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Adhered PVC membrane roofing system at new penetrations in existing roof.
2. Roof insulation.

B. Related Sections:

1. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
2. Division 7 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 for roof with slopes of 2:12 of less, and 29 for roofs with slopes steeper than 2:12, when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

A. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

B. Samples for Verification: For the following products:
1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. 10 lb of aggregate ballast in gradation and color indicated.
4. Metal termination bars.
5. Six insulation fasteners of each type, length, and finish.
6. Six roof cover fasteners of each type, length, and finish.

C. Qualification Data: For qualified installer and manufacturer.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of compliance with performance requirements.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

F. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

G. Field quality-control reports.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.

   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PVC MEMBRANE ROOFING

A. PVC Sheet: ASTM D 4434, Type II, Grade 1, glass fiber reinforced, felt backed.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. Sarnafil Inc.; Sarnafil G410, feltback fiberglass reinforced fully-adhered PVC roof membrane, standard off-white color weathering surface, or approved equal with EnergyStar rating and providing and emissivity of at least 0.9.

   2. Thickness: 60 mils, nominal.

   3. Exposed Face Color: Match existing adjacent.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.


D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, thickness to match existing adjacent.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Georgia-Pacific Corporation; Dens Deck.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Dow Styrofoam Deckmate Plus, 40 psi compressive strength, extruded polystyrene foam board, flat and tapered.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, thickness to match existing adjacent.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Georgia-Pacific Corporation; Dens Deck Prime.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine surfaces, penetrations, and perimeter of area to be roofed. Give written notifications of deficiencies which would affect proper installation or performance of roof. Do not proceed until condition are satisfactory.

3.2 PREPARATION

A. General: Make surfaces clear of debris, protrusions, and foreign matter.

3.3 INSTALLATION

A. General: Install insulation, roofing membrane, and other system components per NRCA or SPRI standards.

B. Insulation and Cover Board: Adhesive Attachment; adhere insulation to roof deck with roof adhesive. Adhere layer of insulation with roofing adhesive. Adhere coverboard to insulation with roofing adhesive.

C. Roofing Membrane:
   1. General: Adhere membrane with bonding adhesive per manufacturer’s requirement for 100 percent contact.
   2. Seams: Overlap adjacent membrane sheets a minimum of 3-inches, clean overlap area, heat weld all laps, seams and splices.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer’s technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3.5 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07542
SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal flashing and counterflashing at new penetrations in existing roof.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

E. Qualification Data: For qualified fabricator.

F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Galvanized Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gauge) except as otherwise indicated.

C. Stainless Steel:
   1. General Use: AISI Type 302/304, complying with ASTM A 167, 2B annealed finish, soft except where harder temper required for forming or performance; 0.0156-inch thick (28 gauge) except as otherwise indicated.

D. Lead: ASTM B 749, type L51121, copper-bearing sheet lead, minimum 4 lb./sq. ft. (0.0625-inch thick) except not less than 6 lb./sq. ft. (0.0937-inch thick) for burning (welding) unless otherwise indicated.

E. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.032-inch thick (20 gauge) except as otherwise indicated.

F. PVC Clad Flashing: Minimum 25 gauge galvanized steel sheet with minimum 2 mil PVC membrane laminated to one side.

2.2 UNDERLAYMENT MATERIALS
A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.

C. Solder:
   1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

J. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

2. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620
SECTION 07811 - SPRAYED FIRE-RESISTIVE MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Concealed SFRM; reapplication where required.
   2. Exposed SFRM; reapplication where required.
   3. Exposed intumescent mastic fire-resistive coatings; reapplication where required.

B. Related Sections include the following:
   1. Division 5 Section "Structural Steel" for surface conditions required for structural steel receiving SFRM.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistant material.

B. Concealed: Fire-resistant materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed.

C. Exposed: Fire-resistant materials applied to surfaces that are exposed to view when the Work is completed, and that are identified as exposed on Drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of colored, exposed SFRM, two Samples, each 4 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

C. Product Certificates: For each type of SFRM, signed by product manufacturer.

D. Qualification Data: For Installer, manufacturer, professional engineer, and testing agency.

E. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:
   1. Materials have been tested for bond with substrates.
   2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed SFRM.

G. Research/Evaluation Reports: For SFRM.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Source Limitations: Obtain SFRM through one source from a single manufacturer.

C. SFRM Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistant materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

D. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.


2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with SFRM.

E. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.


F. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCEALED SFRM

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Concealed Sprayed-Fiber Fire-Resistive Material:
   a. Isolatek International Corp.; Cafco Blaze-Shield II.

B. Material Composition: Manufacturer's standard product, as follows:

1. Concealed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb/cu. ft., for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

2. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
   a. Where the referenced fire-resistance design lists a thickness of 1 inch or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch.
   b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of SFRM is the greater of 0.375 inch or 75 percent of the design thickness.
   c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..

3. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 based on laboratory testing of 0.75-inch minimum thickness of SFRM.

4. Compressive Strength: 5.21 lbf/sq. in. minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch and minimum dry density shall be as specified but not less than 15 lbf/cu. ft.


6. Deflection: No cracking, spalling, or delamination per ASTM E 759.

7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch, maximum dry density is 15 lb/cu. ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   a. Flame-Spread Index: 10 or less.
   b. Smoke-Developed Index: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.2 EXPOSED SFRM

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Exposed Sprayed-Fiber Fire-Resistive Material:
   a. Isolatek International Corp.; Calfco Blaze-Shield HP.

B. Material Composition: Manufacturer's standard product, as follows:

1. Exposed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft..
2. Bond Strength: 434 lb/sq. ft. minimum per ASTM E 736.
3. Compressive Strength: 51 lb/sq. in. minimum per ASTM E 761.
4. Dynamic Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 39 lb/cu. ft..
5. Bond Strength: 1000 lb/sq. ft. minimum per ASTM E 736.
6. Compressive Strength: 300 lb/sq. in. minimum per ASTM E 761.
8. Deflection: No cracking, spalling, or delamination per ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E 859.
12. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   a. Flame-Spread Index: 10 or less.
   b. Smoke-Developed Index: 0.
14. For exterior applications of SFRM, provide formulation listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction for surfaces exposed to exterior.

2.3 EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Fire-Resistive, Water-Based, Intumescent Mastic Coating Material:
   a. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.

2. Fire-Resistive, Non-Water-Based, Intumescent Mastic Coating Material:
   a. Albi Manufacturing, Division of StanChem Inc.; Albi Clad 800.


1. Water-Based Formulation: Approved by manufacturer and authorities having jurisdiction and investigated for Interior General and Conditioned Interior Space Purpose by UL.
2. Multicomponent system consisting of intumescent base coat and topcoat.

C. Color and Gloss: As selected by Architect from manufacturer's full range.

2.4 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.

D. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International Corp.
E. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over concealed and exposed SFRM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Verify that concrete work on steel deck has been completed.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed.

D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

C. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.

D. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL
A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach accessories where indicated or required for secure attachment of lath to substrate.

D. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.

E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.

F. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply SFRM that differs in color from that of encapsulant over which it is applied.

G. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

3.4 APPLICATION, CONCEALED SFRM

A. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed SFRM" Article.

B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating and where indicated.

C. Cure concealed SFRM according to product manufacturer's written recommendations.

D. Apply sealer to concealed SFRM where indicated.

3.5 APPLICATION, EXPOSED SFRM

A. Apply exposed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.

1. For steel beams and bracing, provide a thickness of not less than 1 inch.
2. For metal floor or roof decks, provide a thickness of not less than 1/2 inch.

B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
C. Apply exposed cementitious SFRM to produce the following finish:
   1. Spray-textured finish with no further treatment.
   2. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
   3. Skip-troweled finish with leveled surface, smoothed-out texture, and neat edges.
   4. Smooth, troweled finish with surface markings eliminated and edges squared.

D. Apply exposed sprayed-fiber fire-resistant material to produce the following finish:
   1. Spray-textured finish.
   2. Sealer where indicated.

E. Cure exposed SFRM according to product manufacturer's written recommendations.

3.6 APPLICATION, EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

A. Apply exposed intumescent mastic fire-resistant coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

B. Apply intumescent mastic fire-resistant coating as follows:
   1. Finish: Spray-textured finish with no further treatment.
   2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistant material dries, to smooth out surface irregularities and to seal in surface fibers.

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspection and prepare reports:
   1. SFRM.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

C. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
   1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
   2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.

   a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
   b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lb/sq. ft. minimum per ASTM E 736.

5. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

   D. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

   E. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.8 CLEANING, PROTECTING, AND REPAIR

   A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

   B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

   C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.

   D. Repair or replace work that has not successfully protected steel.

END OF SECTION 07811
SECTION 07840 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes (but is Not Necessarily Limited to):
   1. Through-penetration firestop systems at openings where pipe, duct, cable, conduit, other items penetrate fire-rated ceiling and wall assemblies.
   2. Fire-rated joint systems at joint between fire-rated partitions and floor/ceiling assemblies.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. General:
   1. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and passage of smoke and other gases.
   2. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E84.
   3. Materials shall be compatible with each other and with other specified items with which they may come in contact and shall not cause corrosion of penetrating items.
   4. Materials shall be free of solvents, asbestos, or PCBs, and shall be nontoxic to human beings at all stages of application and during fire conditions.
   5. Firestopping shall remain sufficiently flexible after installation to accommodate expected vibration and movement between penetrating items and rated building components or assemblies or between adjacent building components or assemblies at joint systems, without affecting adhesion or integrity of system.
   6. Materials shall not shrink noticeably after installation.
   7. Caulk, foam, mortar, and putty materials shall be autobonding to permit changes to penetrating items.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings as determined in accordance with ASTM E814 but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined in accordance with ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable areas.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.3 SUBMITTALS

A. Procedures: In accordance with Section 01330, "Submittal Procedures."

B. Shop Drawings: Manufacturer's UL-approved assembly drawings are acceptable as shop drawings if they reflect actual job conditions. For job conditions where no clearly defined UL-approved assembly exists, provide an engineering judgment from manufacturer.
   1. Engineering judgments shall follow requirements set forth by the International Firestop Council.
   2. Proposed system shall be acceptable to governing authorities.

C. Product Data: Manufacturer's specifications and installation instructions for all materials and prefabricated devices, providing descriptions sufficient for identification at the jobsite.
D. Quality Control:
   1. Manufacturer's letter of certification or certified laboratory test report stating that materials or combination of materials meet requirements specified in ASTM E814 and are so classified in UL's Building Materials Directory.
   2. UL Certificates of Compliance.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Firestopping installation shall meet requirements of UL Test UL 1479, "Fire Tests of Through-Penetration Firestops," or ASTM E814 and UBC Standard 7-1 based on ASTM E119.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened packages or containers clearly identifying manufacturer's names, brand designations, product descriptions, applicable standards, lot numbers, and test or rating labels.

B. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.6 PROJECT CONDITIONS

A. Do not install materials when temperatures exceed manufacturer's recommended limitations for installation. Maintain minimum temperatures before, during, and for 3 days after installation of materials.

B. Provide masking and drop cloths during installation to prevent firestopping materials from contaminating adjacent surfaces.

C. Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed in accordance with specified requirements.

PART 2 - PRODUCTS

2.1 FIRESTOPPING MATERIALS

A. General:
   1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used.
   2. Although several manufacturers are listed for each type of firestopping and listed manufacturers also vary for each Type, Contractor shall endeavor to develop a system for firestopping using approved systems from a single manufacturer or as few manufacturers as possible.


F. Firestop Foam: Two-component silicone elastomer; Hilti CP 620 "Fire Foam," 3M "3-6548 Silicone RTV Foam," or equal.

G. Intumescent Fire Blocks: Hilti "FS-657" or equal (no known equal).


M. High Temperature Firestop Calk: Single component; The Carborundum Company "FyrePutty, Tremco "FYRE-Shield," or equal.

2.2 FIRESAFING, ACCESSORIES, AND OTHER MATERIALS

A. Mineral Fiber Firesafing/Backing Material:
   1. Unfaced Mineral Fiber: 4 pcf, suitable for friction fit in voids. Melt point 2000 degrees F minimum, ASTM C24. Ceramic or cementitious-blend fiber is also approved. Do not use glass fiber.
   2. Noncombustible per NFPA Standard 220 when tested in accordance with ASTM E136.
   3. Thermal Conductivity: 0.25 to 0.23 k-value per ASTM C518.
   4. Surface-Burning Characteristics:
      a. Flame Spread: 15 (10 to 25 if foil faced).
      b. Fuel Contributed: 0 (5 if foil faced).
      c. Smoke Developed: 0.

B. Accessories: Provide primers, cleaners, joint fillers, packing, and other accessory materials required for installation of firestop sealants, as applicable to installation conditions indicated.

2.3 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION
A. Clean surfaces to receive firestopping. Remove dirt, grease, oil, loose materials, rust and other substances that may affect bond, installation, and fire resistance.

3.2 INSTALLATION

A. Install backing materials, forms, clips, and other items as required to hold firestopping and firesafing in place.

B. Firestopping or firesafing shall completely fill void spaces, regardless of geometric configuration to maintain integrity over entire area and form a continuous fire stop.

C. Use mineral fiber to fill gaps at fire-resistive joint systems, as a backing material for firestop sealants and calks, and elsewhere as permitted by code. Pack mineral fiber snugly into voids. Install firestop sealant to cover backing material completely. Do not use unfaced mineral fiber by itself for firestopping purposes.

D. Use foam, sealant, mortar, or ceramic fiber putty to firestop duct, conduit, and metal pipe penetrations at fire-rated construction.

E. Firestop ceiling penetrations from exposed side only. Firestop wall penetrations on both sides.

F. Fill voids behind firestopping with mineral fiber backing material.

G. Firestop space between penetrating element and sleeve or collar. Also, seal space between sleeve, collar, or penetrating element and adjacent construction.

H. Installation of Firestopping Sealants:
1. Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified.
2. Comply with ASTM C1193 for installation of elastomeric joint sealants.

I. Use firestop mortar or high-temperature calk at penetrations by high-temperature items such as steam piping, flues, and chimneys.

J. Use intumescent materials or devices where nonmetal and insulated piping penetrates fire-rated construction.

K. At sound-rated fire-rated construction, use only permanently resilient firestopping materials, and seal airtight.

L. Install protective covers or devices where applicable.

M. Exposed sealant shall be trowelled smooth.

3.3 FIELD QUALITY CONTROL

A. Firestopping shall remain accessible until inspection and approval by governing authorities.

END OF SECTION 07840
SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Acoustical joint sealants.

B. Related Sections:
   1. Division 8 Section "Glazing" for glazing sealants.
   2. Division 9 Section "Gypsum Board" for sealing perimeter joints.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Dow Corning Corporation; 795.
   b. GE Advanced Materials – Silicones; SilPruf®.
2.3 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer’s standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   b. USG Corporation; SHEETROCK Acoustical Sealant.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer’s written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.
3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING
A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07920
SECTION 08110 – STEEL DOOR FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. Section Includes:

1. Standard hollow metal door frames.

C. Related Sections:

1. Division 8 Section "Door Hardware" for door hardware for hollow metal door frames.
2. Division 9 Section “Paints and Coatings” for field painting hollow metal door frames.
3. Division 16 Sections for any electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door frame.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:
1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonventilated plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.2 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.


1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.3 FRAME ANCHORS

A. Jamb Anchors:
1. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.5 STOPS AND MOLDINGS

A. Terminated Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

1. Provide terminated stops unless otherwise indicated.

2.6 ACCESSORIES

A. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.7 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Compression Type: Not less than two anchors in each jamb.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce door frames to receive nontemplated, mortised and surface-mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap door frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents
   h. Minimum of two (2) head and three (3) jamb frame anchors for standard size doors.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer’s written instructions.

END OF SECTION 08110
SECTION 08210 - INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY
   A. In general, the intent of this Section is to match the overall appearance of the existing building.
   B. Section Includes:
      1. Solid-core doors with wood-veneer faces.
      2. Factory finishing flush wood doors.
      3. Factory fitting flush wood doors to frames and factory machining for hardware.
   C. Related Sections:
      1. Division 8 Section "Steel Door Frames" for hollow metal door frames.
      2. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS
   A. Product Data: For each type of door indicated. Include factory-finishing specifications.
   B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
      1. Indicate dimensions and locations of mortises and holes for hardware.
      2. Indicate dimensions and locations of cutouts.
      3. Indicate requirements for veneer matching.
      4. Indicate doors to be factory finished and finish requirements.
      5. Indicate fire-protection ratings for fire-rated doors.
   C. Samples: For factory-finished doors.

1.3 QUALITY ASSURANCE
   A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
   B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252, UBC Standard 7-2, or UL 10C.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde resin.
   2. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Structural-Composite-Lumber-Core Doors:
      a. Screw Withdrawal, Face: 700 lbf (3100 N).
      b. Screw Withdrawal, Edge: 400 lbf (1780 N).

D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

   1. All fire rated doors shall include, as part of the door construction, all components required per "Category A" positive pressure testing guidelines as published by ITS/Warnock Hersey. No intumescent material shall be required on door frames to meet or require ratings. Intumescent material on doors, where required, shall be concealed under veneer banding, except if required at top of bottom rail. Applied smoke gasketing to meet "S" rating shall be provided under Division 8 Section "Door Hardware" and coordinated with this Section.
   2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

E. Mineral-Core Doors:

   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
   3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: Select white maple.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Core:
   a. Non-Rated and 20-Minute Fire-Rated Doors: Mat Formed Wood Particle Board, Grade LD-2; 28-32 pcf density meeting requirements of ANSI A208.1. Provide mill option hardwood blocking for all surface applied hardware. Minimum 40 percent recycled content.
   b. 45, 60, and 90-Minute Fire-Rated Doors: Door manufacturer's standard non-combustible mineral core; non-combustible, asbestos-free mineral composition, engineered to meet labeling requirement; to contain to added urea-formaldehyde.
8. Construction: Seven plies, either bonded or nonbonded construction.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked-enamel- or powder-coated finish.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section "Glazing."

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 9 Section "Paints and Coatings". Seal all four edges, edges of cutouts, and mortises with primer.
2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
2. VOC emissions from paints must not exceed the VOC and chemical component limits of OS-11 requirements.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI catalyzed polyurethane system, Satin sheen.
3. Final color, build, and sheen to be approved by the Architect based on actual review samples.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

   a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 08210
SECTION 08311 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. This Section includes the following:

1. Access doors and frames for walls and ceilings. Provide access doors and frames as indicated and at locations where needed to gain access to concealed plumbing, mechanical, or other concealed work as required by Code.

C. Related Sections include the following:

1. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
2. Division 15 Sections for additional access door information related to mechanical and plumbing.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.
1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

4. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

C. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

D. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.2 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional Satin Finish, No. 4.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall or plaster bead flange.
5. Latch: Cam latch operated by flush key with interior release.
   a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware."

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
   2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
   3. Provide mounting holes in frames for attachment of units to metal or wood framing.
   4. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311
SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. This Section includes the following:

1. Commercial door hardware for the following:
   a. Swinging doors.
   b. Other doors to the extent indicated.
2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

C. Related Sections include the following:

1. Division 8 Section "Steel Door Frames".
2. Division 8 Section "Interior Wood Doors".
3. Division 8 Section "Access Doors and Frames" for access door hardware, except cylinders.
4. Division 16 Section "Electrical" for power supply and conduit to electric hardware devices.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Detail interface between electrified door hardware and fire alarm, access control, security building control system.

C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.

D. Product Certificates: For electrified door hardware, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches and closers.
G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

H. Warranty: Special warranty specified in this Section.

I. Other Action Submittals:

1. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Obtain approval from the District and Architect before proceeding. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

2. Installer shall have warehousing facilities in Project's vicinity.


4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.

2. Review sequence of operation for each type of electrified door hardware.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Coordinate layout and installation of recessed closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, building control system.

D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of operators and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Unconditional two (2) year installation warranty commencing on recordation date of the Notice of Completion, in addition to the following:
   a. Exit Devices: Three (3) years from date of the Notice of Completion.
   b. Manual Closers: Ten (10) years from date of the Notice of Completion.
   c. Concealed Floor Closers: Ten (10) years from date of the Notice of Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
1. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all exterior outswing doors and interior key lock doors with reverse bevels.

F. Electrified Functions for Hinges: Comply with the following:

1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

G. Fasteners: Comply with the following:

2. Wood Screws: For wood doors and frames.
3. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

2.4 LOCKS AND LATCHES, GENERAL


1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:

1. Levers: Best Access Systems, lever type as indicated in Hardware Sets.
2. Escutcheons (Roses): Solid brass, finish to match lever.
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Backset: 70 mm, unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
3. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
4. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1. Bored Locks: BHMA A156.2.

B. Bored Locks: BHMA A156.2, Grade 1 unless Grade 2 is indicated; Series 4000.
2.6 EXIT DEVICES

A. Exit Devices: All exit devices to be Von Duprin, heavy-duty touch bar exit rim device with "Safety Glow" coating. BHMA A156.3, Grade 1 unless Grade 2 is indicated.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards" and CBC Chapter 11B.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lb (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lb (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Removable Mullions: BHMA A156.3.

F. Cylinder Dogging: Keyed dogging cylinder with pull trim at exterior entrances.

G. Outside Trim: Material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latches, unless otherwise indicated.
2. At doors not required to have positive latching, 990NL Trim Pull (exterior single doors).
3. At doors required to have positive latching, 996L-NL-R

H. Through Bolts: For exit devices and trim on metal doors and non-fire-rated wood doors.

2.7 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1 unless Grade 2 is indicated.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.

D. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
a. Replace construction cores with permanent cores as indicated in keying schedule.

E. Manufacturer: Same manufacturer as for locks and latches.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. Grand Master Key System: All keying is to be keyed into District restrictive, Schlage Everest, keying system. Cylinders are operated by a change key, a master key, and a grand master key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

b. Master Keys: Five.

2.9 KEY CONTROL SYSTEM

A. Cross-Index System: Multiple-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by key control manufacturer.

2.10 ELECTRIC STRIKES

A. Standard: BHMA A156.31, Grade 1 unless Grade 2 is indicated.

2.11 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from bronze, unless otherwise indicated.

2.12 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards."

1. Comply with the following maximum opening-force requirements:
a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width when directed by authority having jurisdiction.

C. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

D. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

E. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.

F. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

G. Surface Closers: BHMA A156.4. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

H. Concealed Closers: Dorma ED400-IG in-ground concealed automatic floor closer. BHMA A156.4

I. Closer Holder Release Devices: BHMA A156.15.
   1. Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by smoke detection system or loss of power.

J. Coordinators: BHMA A156.3.

2.13 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
   1. Material: 0.050-inch- (1.3-mm-) thick bronze.

2.14 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16.
   1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Mechanical Door Holders: BHMA A156.16.
C. Combination Floor and Wall Stops and Holders: BHMA A156.8.

D. Combination Overhead Stops and Holders: BHMA A156.8.

E. Electromagnetic Door Holders: BHMA A156.15

F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame.

G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.15 DOOR GASKETING

A. Standard: BHMA A156.22

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than that for smoke control, as tested according to ASTM E 283.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.


2.16 THRESHOLDS

A. Pemko, aluminum shapes as specified. Rixson where required with pivot hinge.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards."

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

2.17 MISCELLANEOUS DOOR HARDWARE

A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
B. Monitor Strikes: Cast strike with toggle.

2.18 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard. 

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

2.19 FINISHES

A. Standard: All hardware to have USD613 finish (Oil Rubbed Bronze) unless required matching uniform building standard. Bronze or stainless steel base material on interiors unless otherwise noted. BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
   4. CBC 11B & 10: 34"-44" A.F.F.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening.
   2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

E. Floor Stops: Install within 4" of wall.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: If required, Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
   1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SETS

A. Manufacturer Abbreviations:

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<th>Abbreviation</th>
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<td>Best</td>
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murakami/Nelson
Project No. 0802C

DOOR HARDWARE
08710 - 12
**Hardware Group No. 1**

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**Hardware Group No. 3**

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**Hardware Group No. 5**

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END OF SECTION 08710
SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY
   A. In general, the intent of this Section is to match the overall appearance of the existing building.
   B. Section Includes (but Is Not Necessarily Limited to):
      1. Glass and glazing materials.
      2. Factory-glazed window and door units shall conform to the requirements of this Section.
   C. Related Sections:
      1. Division 08 Section(s) “Steel Door Frames” and “Interior Wood Doors”.

1.2 DESIGN AND PERFORMANCE REQUIREMENTS
   A. Provide watertight and airtight installation of each piece of exterior glass and sealed glass unit.
   B. Coordinate with work of other Sections for watertight installation at interface with other materials and systems.
   C. Each installation shall withstand local normal thermal movement, temperature changes, wind loading, and impact loading (for operating sash and doors) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, loss of hermetic seal, deterioration of glazing materials, and other defects.
      1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.
   D. Comply with applicable design and performance requirements of related Sections for systems in which glazing is installed.
   E. Deflection Criteria: Glass center deflection at code required design load shall not exceed 3/4 inch.

1.3 SUBMITTALS
   A. Procedures: In accordance with Section 01330, “Submittal Procedures.”
   B. Shop Drawings: As specified in related Sections for systems in which glazing is installed.
   C. Product Data: Manufacturer’s literature for all materials proposed for use substantiating that glass and glazing materials comply with specified requirements.
   D. Samples:
      1. Glass:
a. Sample, 12 inches square, of each type specified.
b. Samples of insulating glass shall be constructed from same material and by method as to be installed in Project.

2. Samples may be submitted as part of sample submittals required under other Sections.

E. Quality Control:

1. Test Reports: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

F. Closeout: Extended warranty for insulating glass.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer of Exterior Glazing: Company with documented successful experience specializing in work of this Section on jobs of similar type and complexity.

B. Regulatory Requirements:

1. Comply with CBC Chapter 24, Section 2406.
2. Where safety glass is shown or required, provide type of products shown that comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category I or II materials, as applicable.

C. Industry Standards:

1. Insulating glass shall be certified under a certification program approved by the Insulating Glass Manufacturers Alliance (IGMA).
2. Comply with GANA "Glazing Manual," except where more stringent requirements are shown.

D. Minimum Wind Load for Exterior Glass and Glazing Assemblies: In accordance with CBC Chapter 16.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's label indicating type, quality, and thickness on each piece.

B. Protect glass and glazing materials during delivery, storage, and handling so as to comply with manufacturer's directions and as required to prevent face and edge damage to glass and damage to glass and glazing materials from effects of moisture, including condensation and other causes.

1.6 WARRANTY

A. Manufacturer: Submit written warranty for sealed insulating glass unit, agreeing to replace units that fail to maintain hermetic seal of air space, deteriorate, or otherwise fail to perform as required within warranty period as a result of failure of materials or workmanship.

1. Warranty Period: Vertical Glazing: 10 years.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Fabricators: PPG Industries Inc., Pilkington LOF, or Viracon, except as otherwise specified.

2.2 MATERIALS

A. General: ASTM C1036; specified manufacturers used to set standard of design and quality for proprietary items.

B. Clear: Type I, Class 1, Quality q3, 1/2-inch thick, unless otherwise shown.

C. Heat-Strengthened and Tempered Float Glass: ASTM C1036, Type I float glass as specified above and conforming to requirements of ASTM C1048 and as specified.

   1. Tempered glass shall meet ANSI Z97.1 test requirements.
   2. Glass shall be tempered using the roller hearth method.
   3. Heat-strengthened glass shall have surface compression levels between 3500 and 7000 psi.

D. Glass of Fire-Rated Openings: TGP's Fire Glass 20, or equal, wireless fire- and safety-rated by UL or WHI.

E. Translucent: Viracon V1085 'simulated acid etch', or equal; custom pattern surface.

2.3 GLAZING MATERIALS

A. Sealants for Glazing:

   1. Interior Locations: One-part, gun grade; Tremco "Mono," Pecora "60 Plus," or equal.

   a. Color: Black, unless otherwise noted on Drawings.

B. Joint Backer: Diameter size at least 25 percent larger than joint width; type and material as recommended, in writing, by glass and sealant manufacturer.

C. Silicone Glazing Materials: Provide silicone setting blocks, jamb blocks, and sealant joint backer or spacers in lieu of neoprene, if recommended by sealant manufacturer, for compatibility with sealant. Corners, sizes, profiles, and color as specified for neoprene glazing materials.

D. Glazing Blocks and Spacers: Closed-cell neoprene complying with ASTM C509, in black color.

E. Glazing Gaskets: Standard products provided by aluminum framing and entrance manufacturer in sizes as required with preformed, premolded corners.

F. Glazing Tape: Butyl rubber type, black color; Pecora "Extru-Seal Tape G-66," Tremco "440 Tape," or equal.
2.4 FABRICATION

A. Glazing framing dimensions shall provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Provide correct glass size for each opening, within tolerances and necessary dimensions established.

B. Factory-label each pane of glass. Do not remove labels until final acceptance is obtained.

C. Tempered glass shall be horizontally tempered with roller ripples in horizontal direction.
   1. Include an inconspicuous but visible permanent identifying bug on each pane in accordance with ANSI Z97.1.
      a. Fused to glass and located in a lower corner.
      b. Include manufacturer's name or trademark, glass type, thickness, and designation of treatment.
      c. Label shall read upright at vertical glazing.
   2. Maximum warpage in accordance with Pilkington LOF or PPG standards.
   3. Provide fireman's tempered-glass marker where required by local fire department.

D. Dimensional Tolerances: Comply with referenced GANA standard.

PART 3 - EXECUTION

3.1. GLAZING

A. Comply with combined printed recommendations of glass manufacturers and manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are shown, including those of referenced glazing standards.

B. Tempered Glass: Provide at locations where shown and required in accordance with regulatory requirements.

C. Protect glass from edge damage during handling and installation.
   1. Use a rolling block in rotating glass units to prevent damage to glass corners.
   2. Use suction cups to shift glass units within openings.
   3. Do not raise or drift glass with a pry bar.
   4. When glass has flares or bevels along one horizontal edge that would occur in vicinity of setting blocks, install with flares or bevels at top of opening.
   5. Use glazing tape and shims to position glass properly.

D. Remove and dispose of glass with edge damage or other imperfections of any kind that, when installed, would weaken glass and impair performance and appearance.

E. Install setting blocks of proper size at sill, located one-quarter of glass width from each corner, unless otherwise required. Set blocks in sealant acceptable for heel bead use.
F. Provide edge blocking to comply with requirements of GANA "Glazing Manual," except where otherwise required by glass fabricator.

G. Set units in each series with uniformity of pattern, draw, bow, and similar characteristics.

3.2. PROTECTION AND CLEANING

A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

END OF SECTION 08800
SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL
A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS
A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by
construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   b. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

   1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

   1. Minimum Base-Metal Thickness: As indicated on Drawings.

D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

   1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION
3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES
A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.
   1. Space studs as follows:
      a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
      b. Multilayer Application: 16 inches o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb, unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09111
SECTION 09250 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

B. Related Sections include the following:

1. Division 7 Section “Building Insulation” for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
2. Division 09 Section “Paints and Coatings” for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS
2.1 PANELS, GENERAL

A. Recycled Content: Provide gypsum panel products encased in 100% recycled natural-finish face paper and 100% recycled liner paper on the back side.

B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

C. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
   1. Core: 5/8 inch (15.9 mm) thick.
   2. Plastic-Film Thickness: 0.010 inch (0.254 mm).

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
   1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges
or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces, unless otherwise indicated.
2. High-Impact Type: As indicated on Drawings.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES
A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 3: Where indicated on Drawings.
   4. Level 4: Where indicated on Drawings.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.
   5. Level 5. At panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250
SECTION 09402 - EPOXY MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. Section Includes:

1. Thin-set epoxy-resin terrazzo flooring and base.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: Manufacturer's color plates showing the full range of colors and patterns available for each terrazzo type indicated.

C. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and marble-chip and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:

1. Terrazzo: 12-inch square Samples.
2. Accessories: 6-inch long Samples of each exposed strip item required.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Qualification Data: For qualified Installer.

F. Material Certificates: For each type of terrazzo material or product, from manufacturer.

G. Maintenance Data: For terrazzo to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installation must be performed by an installer having not less than three years of satisfactory experience in the installation of the type of specified system, and must be approved in writing by the manufacturer of the specified systems to perform the Work.

B. Source Limitations: Obtain primary terrazzo materials from one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of
type and from source recommended by manufacturer of primary materials. Only 100% solids, zero-VOC, low odor systems are permitted.

C. Source Limitations for Marble Chips and Aggregates: Obtain each color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.

D. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

C. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

D. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

PART 2 - PRODUCTS

2.1 EPOXY-RESIN TERRAZZO

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. General Polymers Corporation; Terrazzo 1100.

B. Materials:

1. Flexible Reinforcing Membrane: Formulated by General Polymers Corporation shall consist of 3552 Epo-Flex Flexible Epoxy. Total system thickness to be 40 mils nominal. Install over clean, vacuum blasted substrate.
Flexible epoxy membrane shall be 100% solids, zero-VOC, low odor and shall not contain plasticizers or other foreign additives to achieve flexibility.

2. Primer: Manufacturer's product recommended for substrate and use indicated.

3. Terrazzo Flooring System: Formulated by General Polymers Corporation shall be Thinset Epoxy Terrazzo #1100 installed to a finished thickness of 3/8-inch with 4-inch by 1/2-inch thick precast topset wall base where shown. The system shall consist of 3579 Primer, 3520 Epoxy Terrazzo Matrix as the binder resin, 5270 Epoxy Filler, #0, #1, and #2 Marble Chips, 3520G Epoxy Terrazzo Grout, 5271 Epoxy Filler for the grout coat and XP-815 Terrazzo Sealer. Finished surface shall be dense and non-porous, with a minimum 0.5 coefficient of friction. Color to match Architect's sample.

a. Physical Properties without Marble Chips and Aggregates:

1) Hardness: 60 to 80 per ASTM D 2240, Shore D.
2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.

   a) Distilled water.
   b) Mineral water.
   c) Isopropanol.
   d) Ethanol.
   e) 0.025 percent detergent solution.
   f) 1.0 percent soap solution.
   g) 10 percent sodium hydroxide.
   h) 10 percent hydrochloric acid.
   i) 30 percent sulfuric acid.
   j) 5 percent acetic acid.

b. Physical Properties with Marble Chips and Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide," comply with the following:

1) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch per ASTM D 635.
2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.

4. Marble Chips and Aggregates: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.
d. Recycled Content: Provide products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.

5. Finishing Grout: Resin based.

2.2 MISCELLANEOUS ACCESSORIES
A. Divider Strips: 1/8-inch thick zinc angle-type divider strips.

B. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
   1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Anchoring Devices:
   1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.

D. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

G. Thresholds: Extruded, clear anodized aluminum strip, Pemko or equal, in profiles indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:
   1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
      c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
2. Verify that concrete substrates are visibly dry and free of moisture.
3. Moisture Testing:
   a. Test for moisture by anhydrous calcium chloride method according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.

C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
   1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

D. Installation of terrazzo indicates acceptance of surfaces and conditions.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. General:
   1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
   2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
   3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.
   4. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
   5. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

B. Thickness: 3/8 inch nominal.

C. Flexible Reinforcing Membrane:
   1. Prepare and prefill substrate cracks with membrane material.
   2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
   3. Reinforce membrane with fiberglass scrim.
   4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.

D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

E. Strip Materials:
   1. Divider and Control-Joint Strips:
      a. Locate divider strips in locations indicated.
      b. Install control-joint strips back to back directly above concrete-slab control joints and in locations indicated.
      c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
      d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
2. Accessory Strips: Install accessory strips as required to provide a complete installation.

F. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.

G. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.4 CLEANING AND PROTECTION

A. Cleaning:
   1. Remove grinding dust from installation and adjacent areas.
   2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.

B. Sealing:
   1. Seal surfaces according to NTMA's written recommendations.
   2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09402
SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.

2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:


4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Products: Ceiling systems are to match building standards and existing ceilings within area of work. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:


2. Acoustic Ceiling Panels: Armstrong World Industries, Inc.; “Ultimano no. 1910” fine fissured texture with Humguard Plus, no sag technology, 24" square units with square edges. Factory applied washable latex acrylic finish, mold and mildew resistant on Durabrite acoustically transparent membrane on manufacturer's standard white finish to match existing.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch-diameter wire.

2.4 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:
2. Acoustical Sealant for Concealed Joints:
   a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
   b. Pecora Corporation; BA-98.

   C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

   D. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

   A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

   A. General: Install acoustical panel ceilings to comply with ASTM C 636 and UBC Standard 25-2 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

   B. Suspend ceiling hangers from building's structural members and as follows:

      1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
      2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
      3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system
members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

7. Do not attach hangers to steel deck tabs.

8. Do not attach hangers to steel roof deck. Attach hangers to structural members.

9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Match existing patterns.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next
area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
   a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
   b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511
SECTION 09652 - RESILIENT SHEET FLOORING AND BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Resilient sheet floor covering, with backing.
   2. Linoleum sheet flooring.
   3. Resilient Wall Base

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor covering and base indicated.

D. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required and not less than 12-long sample of each different type and color of resilient base required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

F. Product Schedule: For floor coverings. Use same designations indicated on Drawings.

G. Qualification Data: For qualified Installer.

H. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.
1. Engage an installer who employs workers for this Project who are trained or certified by floor covering manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings, base, and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store sheet floor covering rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Covering: Furnish quantity not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

2. Resilient Base: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof for each color and type of resilient base installed.

PART 2 - PRODUCTS

2.1 RESILIENT SHEET FLOOR COVERING

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

B. Vinyl Sheet Floor Covering with Backing: Comply with ASTM F 1303, Type I, Grade 1. Vinyl sheet floor covering with highly compressed homogeneous vinyl wearlayer with high performance urethane top coat. Glass fiber interlayer and calendared CDF backing (Class C) with an applied acoustic comfort layer.

1. Sheet Width: 79 inches,
2. Overall Thickness: 0.134-inch.


D. Seaming Method: Heat welded.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 LINOLEUM FLOOR COVERING

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Forbo Flooring Systems, Marmoleum Decibel linoleum sheet resilient floor covering

B. Sheet Flooring: Comply with ASTM F 2034, Type III. Homogeneous sheet linoleum of natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto natural jute backing with an applied polyolefin comfort layer. Pattern and color shall extend throughout total thickness of material.

1. Roll Size: In manufacturer's standard length by not less than 78 inches wide.


D. Backing: Natural jute backing with applied polyolefin foam.


F. Thickness: 0.137-inch.

2.3 Colors and Patterns: As selected by Architect from full range of manufacturer's colors

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Seamless-Installation Accessories:
   a. Color: Match floor covering.
2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
   a. VOC Content: Not more than 510 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

D. Integral-Flash-Cove-Base Accessories:
1. Cove Strip: 1-inch radius provided or approved by manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by manufacturer.

E. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

2.5 RESILIENT BASE

A. Federal Specifications SS-W-40, Type I (rubber); Style B (cove) by Burke Flooring Products; color as selected or scheduled, smooth satin finish, 1/8-inch thick; 4-foot minimum length. Unless otherwise shown, provide bases 4-inches high.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

   b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.

   1. Move floor coverings, base, and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings or resilient base immediately before installation.

3.3 FLOOR COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out floor coverings as follows:

   1. Maintain uniformity of floor covering direction.

   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.

   3. Match edges of floor coverings for color shading at seams.

   4. Avoid cross seams.

   5. Eliminate deformations that result from hanging method used during drying (stove bar marks).

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
2. Chemically-Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

J. Integral-Flash-Cove Base: Cove floor coverings dimension indicated up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 RESILIENT BASE INSTALLATION

A. General: Where resilient base is scheduled, install around perimeter of room or space, at base of partitions, walls, columns, pilasters, casework, and other permanent fixtures. Secure base to surfaces with adjacent surfaces. Use longest lengths possible; straight pieces less than 24-inches long not permitted. Miter or cope inside corners.

B. Cove Type: Provide with premolded end stops and premolded one-piece external corners.

1. Contractor option to field cut corners in lieu of providing pre-molded units. Subject to mock-up prior to work.

C. Edges and Seams: Match edges at seams. Double cut adjoining lengths. Make tight butt joints

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer’s written instructions for cleaning and protection of floor coverings and base.

B. Perform the following operations immediately after completing floor covering and base installation:

1. Remove adhesive and other blemishes from floor covering and base surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.

C. Protect floor coverings and base from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish. Apply 3 coats.

E. Cover floor coverings until Substantial Completion.

END OF SECTION 09652
SECTION 09680 - CARPET

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Sheet carpet.
   2. Modular carpet tile.

B. Related Sections:
   1. Division 9 Section “Resilient Flooring and Base” for resilient base.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings showing the extent of carpet, seam direction of carpet, and accessories shall be submitted to the Architect for approval prior to installation. Check pattern match, if any, for matching during installation and possible waste factors in ordering required amounts. Shop drawings to indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Copy of approved shop drawings to be available on jobsite during installation.

C. Samples: For each color and texture required.
   1. Sheet Carpet: 18-inch by 18-inch square Sample.
   2. Carpet Tile: Full-size Sample.
   3. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
   4. Underlayment: 12-inch square sample of each type.

D. Product Schedule: For carpet use same designations indicated on Drawings.

E. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Manufacturer Qualifications: Manufacturer to submit copies of the following independent laboratory reports showing compliance with requirements per these methods outlined in Part 2. Submitted results shall represent average results for production goods of the specified style.
   1. ASTM E-648 Flooring Radiant Panel
   2. ASTM E-662: Smoke Density
   3. AATCC 134: Electrostatic Propensity
   4. CRI TM-102: Fluorine Analysis
5. ASTM D-3936: Delamination
6. AATCC 20: Fiber Analysis
7. Other from methods specified in Part 2

1.4 DELIVERY, STORAGE, AND HANDLING
A. Comply with CRI 104, Section 5, "Storage and Handling."

1.5 PROJECT CONDITIONS
A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

1.6 WARRANTY
A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.

1. Warranty Period:
   a. Sheet Carpet: 25 years from date of Substantial Completion.
   b. Carpet Tiles: 15 years from date of Substantial Completion.

1.7 EXTRA MATERIALS
A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Carpet, Carpet Tiles, and Underlayment: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 SHEET CARPET
A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Tandus (C&A Floorcoverings), Kasuri II Powerbond RS Vinyl Cushion GLP8320
   a. Color: To be selected.
   b. Construction: Accuweave Patterned Loop.
   c. Gauge: 1/12.
   d. Stitch Rate: 100 / inch.
   e. Tuft Density: 120 tufts / sq. inch.
   f. Pile Height Average: 0.187.
h. Fiber System: TDX BCF Nylon with Static Control & Ensure.

i. Dye Method: 65% Solution Dyed / 35% Yarn Dyed.

j. Total Weight: 91.0 oz. / sq. yd. +/- 5%.

k. Width: 6 feet.

l. Applied Soil-Resistance Treatment: Manufacturer's standard material.

m. Antimicrobial Treatment: Manufacturer's standard material.

n. Total Product Recycled Content: 43.3% (Post Consumer Mon. 10%).

2.2 CARPET TILE

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Tandus (C&A Floorcoverings), Kasuri II Flex-Aire RS Cushion Tile GLP6558.
   
a. Color: To be selected.

b. Construction: Accuweave Patterned Loop.

c. Gauge: 1/12.

d. Stitch Rate: 10.0 / inch.

e. Tuft Density: 120 tufts / sq. inch.

f. Pile Height Average: 0.187.

g. Density Factor (UM44D): 18.5 lbs / cu. ft.

h. Fiber System: TDX BCF Nylon with Static Control & Ensure.

i. Dye Method: 65% Solution Dyed / 35% Yarn Dyed.

j. Total Weight: 119.7 oz. / sq. yd. +/- 5%.

k. Tile Size: 36-inches by 36-inches.

l. Applied Soil-Resistance Treatment: Manufacturer's standard material.

m. Antimicrobial Treatment: Manufacturer's standard material.

n. Total Product Recycled Content: 44%-59% (Post Consumer Mon. 10%).

2.3 SOUND REDUCING UNDERLAYMENT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Sound Seal Impacta Acoustical Floor Underlayments, Superfloor Underlay System for Carpet and Carpet Tiles.

a. Thickness: 1/4-inch.


2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install underlayment according to manufacturer’s written recommendations.

B. Comply with CRI 104 and carpet manufacturer’s written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
2. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
3. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 11, "Attached-Cushion Installations."
4. Preapplied Adhesive Installation: Comply with CRI 104, Section 11.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
5. Hook-and-Loop Installation: Comply with CRI 104, Section 11.5, "Hook and Loop Technology."

C. Comply with carpet manufacturer’s written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Install pattern parallel to walls and borders.

END OF SECTION 09680
SECTION 09900 - PAINTS AND COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. Section Includes (but Is Not Necessarily Limited to):

1. Painting and painter's finish on exposed exterior and interior surfaces as required to complete finishing of the work.
2. The work includes the following specific items:
   a. Exposed walls, doors, ceilings as indicated on Drawings.
   b. Exposed bare and shop-primed mechanical items.
   c. Electrical Subpanels: Paint to match adjacent wall surface.
   d. Mechanical and plumbing vents on roof.

C. Items Not Included in This Section:

1. Factory-prefinished items as specified in various Sections.
2. Painting specified elsewhere and included in other Sections.

1.2 SUBMITTALS

A. Procedures: In accordance with Section 01330, "Submittal Procedures."

B. Product Data: A complete list of materials proposed for use, together with manufacturer's technical information, including paint label analysis and application instructions.

1. GS-11 compliant coatings and paint to be used on all interiors.

C. Color Samples:

1. Appropriately label and identify each sample, including location and application. Include manufacturer's name, color number, and gloss level.
2. Gypsum Board: Prepare on gypsum board with specified level of finish, 12 inches square.
3. Wood: Prepare on type and quality of wood specified, 12 inches square.
4. Other Surfaces: Prepare on hardboard, 12 inches square.
5. Each sample shall have stepped finish, clearly showing each coat and build-up of specified finish. Submit separate samples for each required gloss level.
6. Resubmit samples as requested until required gloss level, color, and texture are achieved.

D. Quality Control:

1. Statement of applicator qualifications.
2. Claims concerning unsuitability of specified products.

E. Closeout: Extra stock as specified.
1.3 QUALITY ASSURANCE

A. Unsuitability of Specified Products: Claims concerning unsuitability of any material specified will not be entertained unless such claim is made, in writing to District before beginning of application.

B. Single-Source Responsibility:

1. To the maximum extent practicable select a single manufacturer to provide all materials required by this Section using additional manufacturers to provide systems not offered by the selected principal manufacturer.
2. For each individual system:
   a. Provide primer and other undercoat paint produced by same manufacturer as finish coat.
   b. Use thinner within manufacturer’s recommended limits.

C. Applicator Qualifications:

1. Firm with not less than 5 years of successful experience in painting work similar in scope to work of this Project.
2. Maintain a crew of painters who are fully qualified to satisfy requirements of this Section.

D. Mock-Up:

1. Provide paint mock-ups of interior and exterior walls showing each color and finish
2. Mock-up other items or areas as directed by District.
3. Request review by District for color, finish, and workmanship.
4. Modify selected colors if requested by District to achieve desired effect. Allow for painting each mock-up 3 times to adjust colors if necessary.
5. Use accepted surface as the Project standard for each color scheme.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original, unopened packages and containers bearing the manufacturer’s name and label and the following information:

1. Name or title of material.
2. Manufacturer’s stock number and date of manufacture.
3. Manufacturer’s name.
4. Contents by volume for major pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials in tightly covered containers. Maintain containers in a clean condition free of foreign materials and residue.

C. Store materials at ambient temperature of between 45 degrees F minimum and 90 degrees F maximum in a well-ventilated area.

D. Keep storage area is neat and orderly. Remove oily rags and waste daily.

E. Take precautionary measures to prevent fire and health hazards.
1.5 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Comply with manufacturer's recommendations for environmental conditions under which paint and coatings can be stored and applied.
   2. Do not apply finish in areas where dust is being generated.
   3. Provide lighting level of at least 80 foot-candles, measured mid-height at substrate surface.
   4. Provide continuous ventilation to prevent accumulation of hazardous fumes.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.6 COORDINATION

A. General: Perform painting work in proper sequence with work of other trades to avoid damage to finished work.

B. Primers:
   1. Provide finish coats that are compatible with prime paints used.
   2. Review other Sections of these Specifications in which prime paints are to be provided in order to ensure compatibility of total coatings system for various substrates.
   3. Upon request, furnish information to other Sections regarding characteristics of finish materials proposed for use.
   4. Provide barrier coats over incompatible primers, or remove and reprime as required.
   5. Notify District, in writing, of any anticipated problems arising from using specified coating systems with substrates primed by other Sections.

1.7 WARRANTY

A. Color and Life of Film:
   1. At the end of 1 year, colors of surfaces shall have remained free from serious fading. Variations, if any, shall be uniform.
   2. Materials shall have their original adherence at end of 1 year. There shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at end of this period.

1.8 EXTRA MATERIALS

A. At completion of the work, deliver to District extra stock of paint of each color used in each coating material used.

B. Containers shall be full, tightly sealed, and clearly marked.

C. Provide the following quantities:
   1. Field Colors: 1 five-gallon container.
   2. Accent Colors: 1 gallon container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS
A. Manufacturers: Kelly-Moore, or equal. Products specified under "Paint Systems" in Part 3 below, unless otherwise noted, are by ICI and are listed to establish the required level or performance, quality, and appearance.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer or shall be acceptable to manufacturer of finish coating for system.

C. If more than one quality level of product type is marketed, use material of highest quality.

D. All interior and exterior paints and primers to be “No-VOC” or “Zero-VOC” where possible.

2.2 MATERIALS

A. Cementitious Filler: Nonshrink formulations of white Portland cement with fine silicate aggregate, zinc oxide pigment, and reinforcing chemical binder, as accepted.

B. Spackling Compound: Standard gypsum board compound.

C. Thinner: As recommended by each manufacturer for the respective product.

2.3 COLORS

A. District will prepare a color schedule with samples for guidance of painter and reserves right to select, allocate, and vary colors on different surfaces throughout building.

1. Colors selected by District may be from manufacturer's standard colors or be custom mixed.
2. Colors: To be selected.
   a. Interior: Maximum of 5 colors.

B. Submit samples of selected colors as specified in Part 1 above.

C. Areas or surfaces shown as black, either on the Drawings or in the Specifications shall be so painted unless specifically directed otherwise.

2.4 MIXING AND TINTING

A. Deliver paints and stains ready mixed to jobsite.

B. Accomplish job mixing and job tinting only if required for adjustment to finish applied to field test areas to achieve color acceptable to District.

1. Mix only in mixing pails placed in suitably sized nonferrous or oxide-resistant metal pans.
2. Use tinting colors recommended by manufacturer for specific type of finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence, or quality of work and that cannot be put into acceptable condition through preparatory work as included in Article 3.2, Preparation.

B. Do not proceed with surface preparation or coating application until conditions are suitable.
3.2 PREPARATION

A. General:

1. Broom-clean rooms and spaces before commencement of the work.
2. Verify that surfaces to be painted are dry, clean, smooth, and free from deleterious materials.
3. Protect hardware, nameplates, switch plates, lighting fixtures, stainless steel, aluminum, and other surfaces that are not to be painted by masking or removal or by other means to ensure a neat job.
4. Locate and install scaffolding and staging so as not to interfere with the work specified in other Sections.
5. Clean existing interior surfaces to be painted with trisodium phosphate (TSP). Sand and patch as required.

B. Wood:

1. Cleaning and Sanding:
   a. Remove handling marks and effects of exposure to moisture with a thorough final sanding over all exposed surfaces, using 150-grit or finer sandpaper.
   b. Remove paint from existing wood flagpoles before priming.
   c. Clean or vacuum before applying sealer or finish.

2. Wood to Receive Opaque Finish: Fill nail holes, cracks, open joints, and other defects with filler after priming coat has dried. Color shall match finish color.

3. Wood to Receive Transparent Finish:
   a. Remove any material that would adversely affect penetration or appearance of finish.
   b. Do not seal wood surfaces to receive transparent finish.

C. Gypsum board shall be prepared and finished for painting as specified in Section 09250.

D. Metals:

1. Remove mill scale, rust, and corrosion.
2. Clean oils, grease, and dust from surfaces.
3. Touch up chipped or abraded areas in shop coatings, using appropriate primer.

E. Ductwork: Clean visible galvanized portion of ductwork interiors to be painted with solvent, and wipe clean.

F. Concrete:

1. Fill cracks and irregularities with Portland cement grout or patching mortar in order to provide uniform surface texture.
2. Surfaces shall not be painted until they have completely cured and have a stabilized moisture content but in no case less than 60 days from completion of surface.

G. Surfaces that cannot be prepared or painted as specified shall be immediately brought to the attention of the District in writing.

1. Starting of work without such notification will be considered acceptance by the Contractor of surfaces involved.
2. Replace unsatisfactory work caused by improper or defective surfaces as directed by District.

3.3 FACTORY FINISHING AND PRIMING
A. Pertinent Work and Requirements Specified Elsewhere: Review all Sections for products that are to be factory finished or factory primed.

B. Touch-up: Touch up abrasions in prime coat immediately after products arrive on jobsite and as required prior to application of finish coats.

3.4 APPLICATION

A. Shop-fabricated and finished metal and millwork items shall be shop spray finished to the greatest extent possible.

B. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

C. Application:
   1. Apply paint with suitable brushes, rollers, or spraying equipment.
   2. Metal door frames, and other exposed metal requiring field finish painting shall be sprayed to the fullest extent conditions will permit. If brush or roller application is used, surface finish shall be subject to review by the District for complying with the appearance requirements specified.
   3. Apply coatings in accordance with manufacturer's recommendations.
   4. Rate of application shall be within limits recommended by paint manufacturer for surface involved.

D. Spray-Gun Application - Standard Coatings:
   1. Spray-apply standard paints only with airless sprayer.
   2. Apply in fine, even spray without addition of thinner using nozzle pattern suitable to surface being painted.
   3. When necessary, follow by brushing to ensure uniform coverage and to eliminate wrinkling, blistering, and air holes.
   4. If spraying becomes detrimental to equipment or objectionable to personnel, brush painting will be required.

E. Comply with recommendation of product manufacturer for drying time between succeeding coats.

F. Finish coats shall be smooth and free from brush marks, streaks, laps or pileup of paints, and skipped or missed areas.

G. Leave all parts of moldings and trim clean and true to details with no excess amount of paint in corners and depressions.

H. Make edges of paint adjoining other materials or colors clean and sharp, with no overlapping.

I. Refinish whole area where portion of finish is not acceptable.

J. Adjust natural finishes as necessary to obtain identical appearance on veneers and solid stock.

K. Equipment adjacent to walls shall be disconnected, using workmen skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

L. Top and bottom edges of all doors shall receive same paint system finish required for door faces.

M. Paint visible surfaces behind vents, registers, or grilles flat black.
1. Prepare exposed metal as specified, then prime and paint as scheduled.
2. Spray-paint wherever practicable.

N. Do not paint over fire-rating labels, fusible links, or sprinkler heads.

O. Exposed Plumbing and Mechanical Items: Items without factory finish such as conduits, pipes, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed.

3.5 CLEANING

A. Touch up and restore finish where damaged.

B. Remove spilled, splashed, or spattered paint from all surfaces.

C. Do not mar surface finish of item being cleaned.

D. Leave storage space clean and in condition required for equivalent spaces in Project.

3.6 PAINT SYSTEMS

A. General:

1. Interior paint systems are specified and identified by letter and exterior paint systems by number.
2. Only major areas are scheduled, but miscellaneous and similar items and areas within room or space shall be treated with suitable system.
3. This Specification shall serve as guide and is meant to establish procedure and quality. Confer with the District to determine exact finish desired.
4. Number of coats scheduled is minimum. Additional coats shall be applied at no additional cost as required to hide base material completely, produce uniform color, and provide required and satisfactory finish.

B. Surfaces Not to Be Painted:

1. Prefinished wall, ceiling, and floor coverings.
2. Items with factory-applied final finish unless otherwise noted.
3. Surfaces specifically scheduled or noted on the Drawings as not to be painted.

C. Acceptance of Final Colors: Final cost of paint for both exterior and interior shall not be applied until colors have been accepted by the District.

D. Gloss Levels: 60-degree meter gloss reading range:

1. Flat: Less than 5.
2. Eggshell: 5 to 20.

A. Interior Painting Systems:

System A.1
Flat Finish on Concrete and Plaster
1 coat LM9116 “Lifemaster 2000” Primer
1 coat LM9100 “Lifemaster 2000” 100% Acrylic Flat
System B.1
Flat Finish on Gypsum Board
1 coat  LM9116 “Lifemaster 2000” Primer
2 coats LM9100 “Lifemaster 2000” 100% Acrylic Flat

System B.2
Eggshell Finish on Gypsum Board
1 coat  LM9116 “Lifemaster 2000” Primer
2 coats LM9300 “Lifemaster 2000” 100% Acrylic Eggshell

System B.3
Semi-gloss Finish on Gypsum Board
1 coat  LM9116 “Lifemaster 2000” Primer
2 coats LM9200 “Lifemaster 2000” 100% Acrylic Semi-Gloss

System B.4
Semi-gloss Epoxy Finish on Gypsum Board
1 coat  3210 Wall Primer tinted to finish color
1 coat  4406 Epoxy Enamel

System C.1
Semi-gloss Finish on Wood
1 coat  “Aquacrylic Gripper” 3210 Acrylic Primer
2 coats LM9200 “Lifemaster 2000” 100% Acrylic Semi-Gloss

System E.2
1 coat  Cetol Wood Conditioner Waterborne clear primer (if recommended by manufacturer for wood to be coated)
1 coat  Cetol TS Interior Acrylic urethane in sheen to be selected by Architect

System D.1
Standard Performance Semi-gloss Finish on Shop Primed Metal
2 coats LM9200 “Lifemaster 2000” 100% Acrylic Semi-Gloss

System D.2
Premium-Performance Semi-gloss Finish on Metal
Surface Preparation and Shop Primer As specified in Division 5
1 coat Themec Series 29 “Tufcryl” Acrylic emulsion; DFT: 2.0 to 3.0 mils

END OF SECTION 09900
SECTION 10101 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. Section includes:

1. Whiteboards.
2. Resilient Tackable Surface.

C. Related Sections:

1. Division 9 Section "Non-Load-Bearing Steel Framing" for backing plates.

1.3 DEFINITIONS

A. Resilient Tackable Surface: Framed or unframed, tackable, visual display surface.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, whiteboards, and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, whiteboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions. Include information about care and maintenance of surfaces.

B. Shop Drawings: Show type, color, framing, shape, size, material, assembly, joints, seams, laps, fastening and connection for each board.

C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes.

D. Qualification Data: For qualified Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

B. Surface-Burning Characteristics: Class A fire rating as determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, profit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WHITEBOARDS

A. Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Whiteboards: Greensteel’s narrow trim prefab system, AZ Series with extruded aluminum frame, 107Chalktray, 253T display rail, and DMB7 white marker board surface on 22 gauge steel face sheet. Sizes as shown.
   2. Fasteners: Concealed type as required for solid anchorage.

2.2 RESILIENT TACKABLE SURFACE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Color: As selected from manufacturer's standard colors.
4. Trim: No trim, unless otherwise indicated.

2.3 FABRICATION

A. General: Factory fabricate and trim units. Provide concealed fastenings wherever possible.

B. Exposed Fasteners: Match adjoining surfaces.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
   2. Provide manufacturer's standard vertical-joint spline or H-trim system between abutting sections of whiteboards.
   3. Provide manufacturer's standard mullion trim at joints between whiteboards and tackboards of combination units.
   4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.
B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

   1. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.

      a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
      b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
      c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
      d. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces per manufacturer’s instructions and install in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer’s written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10101
SECTION 10200 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes (but Is Not Necessarily Limited to): Aluminum louvers and frames.

B. Related Sections and Divisions:
   1. Division 9 Section “Joint Sealants” for sealant at louver perimeter.
   2. Division 15 Section for louvers that are connected to mechanical equipment.

1.3 SUBMITTALS

A. Procedures: In accordance with Section 01330, "Submittal Procedures."

B. Shop Drawings: Indicate louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb, and sill details; blade configuration; screens; blank-out areas required; frames; and anchorage and interface with adjoining materials.

C. Product Data: Manufacturer's descriptive data of louvers, including standard drawings and free area of louvers.

D. Samples: 12-inch length of specified louver blade in specified finish.

E. Quality Control: Manufacturer's certification that louvers comply with requirements and are licensed to bear the AMCA seal, based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

F. Closeout: Extended warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code – Aluminum."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."
   3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate with installation of exterior wall finish.

1.6 WARRANTY

A. Manufacturer: Furnish coating manufacturer’s 20-year guarantee for aluminum finish against defects in materials and workmanship, including against delamination or pitting of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Louvers: Construction Specialties Inc. (C/S), Airolite Company, or equal certified by AMCA.

2.2 LOUVERS AND VENTS

A. General: Fabricate louvers and vents of types, configurations, and sizes shown. Provide complete with frame, stiffeners, flashings, angles, clips, blank-off panels, swing type access doors, and other items shown or required.

B. Metal Louver Types: C/S A4097HM extruded aluminum drainable blade type, 4-inches deep, with mullions and with blades mitered at corners.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063-T52 alloy.

B. Fasteners: Stainless steel or aluminum.

2.4 FABRICATION

A. Shop-fabricate louvers in such a manner as to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Maintain equal blade spacing.

C. Frame: Channel shape with mechanically fastened corner joints.

D. Assemble louvers by welding.

E. Install vertical stiffener assemblies between blades, spacing as recommended by manufacturer.

F. Bird Screen: 1/2-inch mesh, 0.063-inch-diameter aluminum wire intercrimp, interior mounted in a rewirable extruded-aluminum frame.

1. Finish to match louver.

2. Attach to louvers with stainless steel screws, approximately 18 inches on center.

1. Attach to louvers with stainless steel screws, approximately 18 inches on center.

2.5 FINISH

A. Finish: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin ("Kynar 500"/"Hylar 5000") and meeting or exceeding all the requirements of AAMA 2605; PPG Industries "Durarar," or equal.

1. Color: Custom, as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check openings to assure that dimensions conform to Drawings.

B. Ensure that openings are free of irregularities that would interfere with installation.

3.2 INSTALLATION

A. Install louver assembly level and plumb as indicated on Drawings.

B. Follow procedures in manufacturer's recommended installation instructions.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior. Coordinate installation with installation of head and sill flashing as specified in Section 07620.

D. Seal perimeter interior and exterior with sealant specified in Section 07920.

3.3 ADJUSTING AND CLEANING

A. After initial inspection, remove labels, protective coating, and other foreign materials from aluminum surfaces.

B. Clean metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01742.

C. Touch up field abrasions and damage to factory-painted finish. Touch-up shall be unnoticeable in completed installation.

END OF SECTION 10200
SECTION 10431 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Identification devices.

B. Related Sections include the following:
   1. Division 1 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
   2. Division 15 Section(s) for labels, tags, and nameplates for plumbing, HVAC systems and equipment.
   3. Division 16 Sections for electrical service and connections for illuminated signs, labels, tags, nameplates for electrical equipment.

1.3 DEFINITIONS


1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements and layout for each sign.

C. Samples: Full-sized, complete, example of each sign type.

D. Sign Schedule: Use same designations indicated on Drawings.

E. Qualification Data: For Installer and fabricator.

F. Maintenance Data: For signs to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.
1.5 QUALITY ASSURANCE
   A. Installer Qualifications: Fabricator of products.
   B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
   D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.6 PROJECT CONDITIONS
   A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
   B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 INTERIOR SIGNS
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   B. Regulatory Signage: As shown on Drawings.
      2. Color: Match Berkeley City College PMS standard.
      3. Typeface: White silkscreened copy; Trade Gothic Bold No. 2.
   C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by California Contracted Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
      2. Color: Match Berkeley City College PMS standard.
      3. Typeface: 1/32-inch raised white acrylic copy, horizontally centered; Trade Gothic Bold No. 2.
      5. Pictogram: 1/32-inch raised white acrylic.

2.2 ACCESSORIES
   A. Adhesive: Attach with manufacturer's recommended low-VOC construction adhesive.
2.3 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Pressemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Mount sign 60-inches above finished floor to centerline of sign, unless otherwise noted. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Attach sign with manufacturer's recommended low-VOC adhesive suited for type of substrate involved.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10431
SECTION 10520 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. In general, the intent of this Section is to match the overall appearance of the existing building.

B. This Section includes the following:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data showing compliance with contract documents.

1.3 QUALITY ASSURANCE

A. General: Provide only fire extinguishers which comply with NFPA 10.

B. Labels: Provide only fire extinguishers which are listed and labeled as one-hour rate by Underwriter Laboratories Inc. or Factory Mutual System to meet UBC Standard 43-6 in rate partitions.

1.4 PROJECT CONDITIONS

A. Do not deliver or install extinguishers until just before Substantial Completion.

B. Do not use permanent fire extinguishers for construction period fire protection.

1.5 WARRANTY

A. Manufacturer shall guarantee against defects in material and workmanship for a period of one year.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Larsens, J.L. Industries, Potter-Roemer, or equal.

2.2 FIRE EXTINGUISHERS

A. Type: Multipurpose dry chemical (ammonium phosphate). Stored pressure type.

B. Rating: 2A, 10BC, 5 lb. capacity.
2.3 FIRE EXTINGUISHER CABINETS

A. Fully Recessed Fire Extinguisher Cabinet; Marked FEC:
   2. Inside dimensions: Coordinate size with specified fire extinguisher.
   3. Style: Fully recessed mounting, with trim concealed by door.
   4. Single Flat Door:
      a. Narrow Vertical Glazing Panel: 1/2-inch wired glass.
      b. Door Material: Stainless steel, no. 4 satin finish.
   5. Hardware:
      a. Self-adjusting roller catch.
      b. Door handle; Stainless steel, no. 4 satin finish.
      c. Hinges: Concealed type; allow full 180 degree opening of door.
   7. Provide wall bracket for extinguisher, inside cabinet and at wall where marked FE.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare openings for recessed cabinets.

B. Fire-Rated Partitions: Prepare recesses in fire-rated partitions as required to maintain fire-separation integrity of partition.

3.2 INSTALLATION

A. Perform installation in accordance with the manufacturer’s instructions except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Install extinguishers in locations indicated.

C. Install cabinets at location and at heights indicated.

D. Substantial Completion: Determine date of Substantial Completion of Work. Inspect, charge, and tag fire extinguishers within 10 days before Substantial Completion date.

E. Install extinguishers in cabinets.

END OF SECTION 10520
SECTION 11130 - AUDIO / VISUAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrically operated projection screens and controls.
2. Overhead projector mounts.

B. Related Sections:

1. Division 5 Section "Metal Fabrications" for metal support framing for projection screens.
2. Division 16 Sections for electrical service and connections including device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:

1. For electrically operated projection screens and controls:

   a. Location of screen centerline relative to ends of screen case.
   b. Location of wiring connections for electrically operated units.
   c. Location of seams in viewing surfaces.
   d. Drop lengths.
   e. Details of juncture of exposed surfaces with adjacent finishes.
   f. Accessories.
   g. Wiring diagrams.

C. Maintenance Data: For projection screens to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations for Projection Screens: Obtain projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 ELECTRICALLY OPERATED PROJECTION SCREENS

A. Manufacturers: Da-Lite, Draper Screen Company, or equal. Da-Lite specified as standard.

B. Motorized Projection Screens:


   b. Marked PS1: Tensioned Cosmopolitan Electrol.

2. Surface: Flame-retardant and mildew-resistant fiberglass with glass beads.
3. Mounting: Concealed in ceiling.
4. Operation: Electrically operated by three-position (UP/Down/Stop) recessed, wall-mounted remote switch, 115 volts, 60 Hz, 3.5 amps.
5. Sizes: As shown.

2.2 OVERHEAD PROJECTOR MOUNTS

A. Manufacturer: Draper Inc., or equal.

B. Product: Draper’s Two-Piece Aero Accuset Adjustable Mount with Aero Universal Projector Bracket, ceiling escutcheon, and security lock kit. Mount shall include cable-thread capability and shall be installed and adjusted to projector height shown with pipe located in center of acoustical ceiling panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
SECTION 11451 - APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Appliances.

B. Related Sections and Divisions:
   1. Division 15 and Division 16 Sections for additional plumbing and electrical connection requirements for kitchen appliances.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples: For each exposed product and for each color and texture.
C. Product certificates.
D. Field quality-control reports.
E. Operation and maintenance data.
F. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
B. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers: All appliances to be Energy Star compliant. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. LG.
      2. Or similar approved equal.

2.2 WASHER
   A. Front Loader Washer:
      2. Capacity: 4.0 cubic feet.
      3. Color: Manufacturer's standard color.
      4. Dimensions: 27” W x 38-11/16” H x 29-3/4” D.
      5. LoDecibel™ Quiet Operation.

2.3 DRYER
   A. Gas Dryer:
      2. Capacity: 7.3 cubic feet.
      3. Dimensions: 27” W x 38-3/4” H x 29-15/16” D.
      4. LoDecibel™ Quiet Operation.
      5. Color: Manufacturer's standard color.

2.4 VIBRATION ISOLATION PAD
   A. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. Mason Industries, Inc., WMSW Pad Assemblies. Cemented steel plate sandwiched between a super waffle pad on the bottom and a friction pad on top.
         a. Size: 6-inch by 6-inch
         c. Location: At washer and dryer under each leg.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Utilities: See Divisions 15 and 16 for plumbing and electrical requirements.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.

2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After installation, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. Prepare test and inspection reports.

END OF SECTION 113100
SECTION 11602- LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chemical fume hoods.
2. Finish Requirements.
3. Water, laboratory gas, and electrical service fittings in fume hoods
4. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices included with fume hoods.

B. Related Sections:

1. Division 6 Section "Casework".
2. Division 15 Section "Plumbing (including Laboratory Fixtures and Fittings)".
3. Division 15 and 16 Sections for connecting service utilities at back of fume hoods. Piping and wiring within fume hoods are specified in this Section.
4. Division 15 Section "Testing, Adjusting, and Balancing" for field quality-control testing of fume hoods.

1.2 PERFORMANCE REQUIREMENTS

A. Comply with all applicable trade standards, ordinances, building codes and regulations and all standards and references noted herein.

B. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 at a release rate of 4.0 L/min.:

1. Average Face Velocity: 100 fpm plus or minus 10 percent with sashes fully open.
2. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
3. Maximum Sound Level: Maximum allowable decibel level of 65 dBA measured 36 inches away from, and perpendicular to, face of fume hood operating with a face velocity of 100-fpm.

C. Static-Pressure Loss: Not more than 1/2-inch wg at 100-fpm face velocity when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

D. Structural Performance: Provide fume hood components capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of cabinet drawers and doors:

1. Fume Hood Base Stands: 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood.

E. Seismic Performance: Fume hoods, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1.3 DESCRIPTION

A. Provide equipment complete with accessories as described herein and with equipment indicated, and shown on Drawings.

B. Fume hoods with accessories shall be prewired and prepiped. Prewire all electrical devices to junction box at top of hood. Refer to Division 15 for plumbing requirements and Division 16 for wiring requirements.

C. Work of this Section requires close coordination with Work of Divisions 15 and 16 as well as installation of District furnished components and Work of other trades. Sequence of all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work. Shop drawings shall be in the form of reproducibles or photocopies, not to exceed 11"x17" in size. Blueline prints are not acceptable.

1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements. Detailed anchorage and attachment drawings and calculations to be provided by licensed Structural Engineer.

2. Indicate locations and types of service fittings together with associated service supply connection required.

3. Indicate duct connections, electrical connections, and locations of access panels.

4. Include roughing-in information for mechanical, plumbing, and electrical connections.

C. Samples: For fume hood exterior finishes interior lining and work top material, in manufacturer’s standard sizes.

D. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.

E. Fume Hood Testing in Manufacturing Facility: Provide certification of fume hood compliance at the point of manufacture in accordance with ASHRAE 110 testing requirements. Provide testing certification prior to fume hood delivery of each style and size of fume hood on the project.

F. Field quality-control reports.

G. Operations/Maintenance Manuals: Submit under provisions of Division 1. Submit for District’s use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, and closest factory representative for components and service.

H. Demonstration and Instructions of Completed Installation: Test equipment prior to demonstration. Ensure equipment, including accessories, is operational. Provide demonstration of equipment operation instruction to District’s operating personnel. Demonstrate operating capability of equipment and system. Include control and safety features, and service and maintenance procedures. Engage services of
qualified instructor to instruct and train District’s operating and maintenance personnel in operation, service, and maintenance of equipment.

1.5 QUALITY ASSURANCE

A. Contractor for Work in this Section shall have a minimum eight (8) years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workers and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capability to complete an installation of this size and type within the required time limits.

B. Installer shall be thoroughly trained, experience, and familiar with manufacturer’s recommended methods.

C. Hoods and/or cabinets, when properly installed and connected to an exhaust fan of the proper capacity, shall contain and remove fumes, vapors, and particulates generated within the hood. The hood shall operate efficiently at any setting within the range of sash opening.


E. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.
   1. Permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials other trades.

B. Replacement: Any damage as a result of this contractor’s work will be replaced, repaired and restored to original condition to the approval of the District’s Representative at no additional cost or inconvenience to the District.

1.7 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.
PART 2 - PRODUCTS

2.1 General:

A. Provide laboratory equipment complete with necessary supports, anchorages, stands, gages, valves, parts and accessories required for a complete operating installation.

B. Provide each item of equipment with internal electrical services necessary for proper operation including wiring, conduit, boxes, raceways, fittings, lamps, switches, device plates, etc., sized for single point connection to building services, complying with requirements of NEC and bearing UL or Factory Mutual labeling as required.

C. Provide each item of equipment with mechanical and plumbing services necessary for proper operation including piping, fittings, ductwork, troughs, accessories and materials standard with the manufacturer, installed for easy access and connection to respective building service.

D. Provide each item of equipment fully finished by manufacturer with no additional finish or painting required after installation.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Labconco Corporation.
2. Fisher Hamilton L.L.C.
4. Mott Manufacturing Ltd.

2.3 5' ADA CHEMICAL FUME HOOD (Located in Chemistry Prep and Organic Chemistry Laboratory/Classroom)

A. Type: High Performance, Constant Volume bypass type, cabinet mounted, designed for 100 fpm face velocity through the sash opening. Prepare all openings and penetrations required at the fume hood manufacturer's facility prior to painting. Model to be Labconco Xstream or similar approved equal.

B. Fume hoods shall be prewired, with all electrical services installed by the fume hood manufacturer. Point of connection shall be above or at the top of the fume hood.


D. Work Surface: Black modified epoxy resin. Surface shall be dished three-eighths to one-half inch to contain spills. One and one half-inch diameter (unless otherwise noted) penetrations for exhaust shall be factory provided where required.

E. Service Fittings: Gas, Water, and Vacuum at left side. Compressed Air at right side. Service fittings shall not be greater than 48" above finish floor.

F. Cup Sink: 6" x 3" epoxy cup sink and hose barb at center left side.

G. Baffle Adjustment: Provide fixed baffle.
H. Sash Design: Vertical rising 7/32-inch thick laminated safety glass, frameless full view design, with formed full width flush pull. Counter balance system to utilize stainless steel cable, single weight, and be designed to permit one finger operation at any point along full width. Combination vertical/horizontal sash on all fume hoods.

I. Interior Access Panels: Service fitting access panels shall be held in place by flexible PVC gasketing. Exposed hardware is not acceptable.

J. Sash Stop: To allow manual override with automatic reset at 18 inches above hood bench top.

K. Ceiling Closure Panel: From top of hood to underside of ceiling. Panels to be mechanically fastened with removable fasteners to resist seismic forces. Finish to match superstructure exterior.

L. Trim: Provide and install matching steel trim to finish any opening around and between hoods. Finish to match superstructure exterior.

M. Exhaust Collar: Provide contoured exhaust collar, including transition piece if necessary, to receive circular exhaust duct connection by Division 15.

N. Exhaust System Controls: Controls will be provided by Division 15. All cutouts and preparation required for installation of controls shall be prepared at the fume hood manufacturer’s factory prior to painting. Coordinate requirements for preparation with Division 15.

O. Electrical Outlets: Flush mounting, 120V duplex type, two per side, with brushed stainless steel cover plates.

P. Interior Hood Lighting: Lighting within hood shall be provided by a protected fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate. Provide safety glass panel cemented and sealed to the hood roof.


R. Flammable Storage Base Cabinet: Provide 24” wide metal base cabinet suitable for storage of solvents on right side in Organic Chemistry Lab/Classroom. Cabinet shall comply with California Fire Code, Articles 79 and 80. Cabinet shall be Factory Mutual and UL certified. Cabinet shall comply with CAL OSHA requirements for flammable storage cabinets. Exterior finish and color to match fume hood.

S. Acid Storage Base Cabinet: Provide 24” wide metal base cabinet suitable for storage of acids on right side in Chemistry Prep Room. Chemical resistant seamless polypropylene lining and shelf surface. Provide acid resistant vent piping from back of acid cabinet to interior of fume hood chamber, above rear, top baffle. All connection for vent to be sealed with acid resistant sealant. Exterior finish and color to match fume hood.

T. Base Stand: ADA compliant base stand with full depth finish panels. Model to be Labconco stand number 3746701 with sink and knee panel or similar approved equal.

U. ADA compliance: Fume hood to be in full compliance with ADA standards for accessibility. Controls shall be within 48” A.F.F.

V. Finish: Epoxy powder coat, white color.

W. Interior Clear Dimension: Interior work surface shall be a minimum of 24” from inside sash panel to face of baffle.

X. Exterior Dimension: Overall depth of fume hood shall not exceed 40”.
2.4 6' STANDARD CHEMICAL FUME HOOD (Located in Organic Chemistry Laboratory/Classroom)

A. Type: Constant Volume bypass type, cabinet mounted, designed for 100 fpm face velocity through the sash opening. Prepare all openings and penetrations required at the fume hood manufacturer's facility prior to painting. Model to be Labconco Xstream or similar equal.

B. Fume hoods shall be prewired, with all electrical services installed by the fume hood manufacturer. Point of connection shall be above or at the top of the fume hood.


D. Work Surface: Black modified epoxy resin. Surface shall be dished three-eighths to one-half inch to contain spills. One and one half-inch diameter (unless otherwise noted) penetrations for exhaust shall be factory provided where required.

E. Service Fittings: Gas, Vacuum, Compressed Air, and Water at right and left sides. Service fittings shall not be greater than 48" above finish floor.

F. Cup Sink: 6" x 3" epoxy cup sinks and hose barbs at left and right rear.

G. Baffle Adjustment: Provide fixed baffle.

H. Sash Design: Vertical rising 7/32-inch thick laminated safety glass, frameless full view design, with formed full width flush pull. Counter balance system to utilize stainless steel cable, single weight, and be designed to permit one finger operation at any point along full width. Combination vertical/horizontal sash on all fume hoods.

I. Interior Access Panels: Service fitting access panels shall be held in place by flexible PVC gasketing. Exposed hardware is not acceptable.

J. Sash Stop: To allow manual override with automatic reset at 18 inches above hood bench top.

K. Ceiling Closure Panel: From top of hood to underside of ceiling. Panels to be mechanically fastened with removable fasteners to resist seismic forces. Finish to match superstructure exterior.

L. Trim: Provide and install matching steel trim to finish any opening around and between hoods. Finish to match superstructure exterior.

M. Exhaust Collar: Provide contoured exhaust collar, including transition piece if necessary, to receive circular exhaust duct connection by Division 15.

N. Exhaust System Controls: Controls will be provided by Division 15. All cutouts and preparation required for installation of controls shall be prepared at the fume hood manufacturer's factory prior to painting. Coordinate requirements for preparation with Division 15.

O. Electrical Outlets: Flush mounting, 120V duplex type, two per side, with brushed stainless steel cover plates.

P. Interior Hood Lighting: Lighting within hood shall be provided by a protected fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate. Provide safety glass panel cemented and sealed to the hood roof.

R. Flammable Storage Base Cabinet: Provide 36" wide metal base cabinet suitable for storage of solvents. Cabinet shall comply with California Fire Code, Articles 79 and 80. Cabinet be Factory Mutual and UL certified. Cabinet shall comply with CAL OSHA requirements for flammable storage cabinets. Exterior finish and color to match fume hood.

S. Acid Storage Base Cabinet: Provide 36" wide metal base cabinet suitable for storage of acids. Chemical resistant seamless polypropylene lining and shelf surface. Provide acid resistant vent piping from back of acid cabinet to interior of fume hood chamber, above rear, top baffle. All connection for vent to be sealed with acid resistant sealant. Exterior finish and color to match fume hood.

T. Finish: Epoxy powder coat, white color.

U. Interior Clear Dimension: Interior work surface shall be a minimum of 24” from inside sash panel to face of baffle.

V. Exterior Dimension: Overall depth of fume hood shall not exceed 40”.

2.5 INSTRUCTION FACEPLATE

A. Operating Instructions: Provide a 6”x6” polypropylene face plate with brushed finish and fasten it to face of hood above sash with contact cement. Plate shall contain the following instruction silk-screened with red letters (manufacturer must verify that faceplate instruction are properly spelled and punctuated):

Fume Hood Operating Procedure

1. Check flow monitor to assure proper hood operation.
2. Remove all contents from hood chamber not involved with experiment.
3. Use base cabinets for reagent storage.
4. Wipe up spills immediately.
5. Keep sash fully closed when not working inside hood.
6. Use the sash as body shelf whenever possible.
7. Limit opening sash to full open position for set up only.
8. If alarm goes off, discontinue hood operation immediately – call for help.

2.6 FUME HOOD CONTROLS

A. Fume hood controls are to be provided and installed per Division 15.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Prior to installation of the Work of this Section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.

B. Verify that all Work may be installed in complete accordance with the original design, received submittals, and the manufacturer’s recommendations.

C. Verify that adequate backing has been installed for seismic restraints and anchorage.
D. In the event of discrepancy, immediately notify the District’s Representative. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

A. General: Install fume hoods level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Coordinate location and alignment of fume hoods and cabinets for proper connection of all piping and duct work.

C. Install all equipment in accordance with the applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.

3.3 FIELD QUALITY CONTROL

A. Balance, test, and certify each fume hood in accordance with ASHRAE 110 “Flow Visualization and Face Velocity Testing Requirements”. Fume hood field test shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns. Balancing of the system is in the scope of work in Division 15.

B. Field test, with the SAMA LF10 Performance criteria, each hood after installation with hood and HVAC system balanced and operating normally in accordance with specifications and the guidelines of the Industrial Ventilation Manual. Hood cross drafts shall be limited to less than 20% of face velocity. Field Tests shall be conducted by manufacturer at manufacturer’s expense in the presence of a District Representative.

C. In the event that any hood does not meet the Field Test criteria, manufacturer shall, at their own expense, perform the following:

1. Evaluate the supply and exhaust system design as installed.
2. Evaluate air balance report.
3. Identify hood performance problems.
4. Submit a written report for District’s review, of recommended corrective measures to be undertaken.
5. Implement accepted corrective measures for hood manufacturer’s product.

D. Corrective measures shall not compromise the construction integrity of the hood. At the completion of the corrective measures, the manufacturer shall, at their own expense, if hood was determine to be primary cause of failure, retest these hoods in the presence of the District’s Representative.

E. If the first retest fails due to hood causes, the manufacturer shall, at their own expense, repeat the evaluations listed above, and make additional corrective measures to hood. If the second retest fails, the manufacturer shall remove the hood from the premises and replace with a new hood, and retest.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. After installation, carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.
B. Adjust equipment and services to operate correctly and smoothly without warp or bind. Lubricate operating parts as recommended by manufacturer.

3.5 DEMONSTRATION AND INSTRUCTION OF COMPLETED INSTALLATION

A. Test equipment prior to demonstration. Ensure equipment, including accessories, is operational.

B. Provide on-site demonstration of equipment operation instruction to District's operating personnel.

C. Demonstrate operating capability of equipment and system. Include control and safety features, and service and maintenance procedures.

D. Engage service of qualified instructor to instruct and train District’s operating and maintenance personnel in operation, service, and maintenance of equipment.

END OF SECTION 11602
PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all equipment, materials, tools, labor, engineering, drawings, etc. necessary for alteration of fire sprinkler system, with said system being made ready for operation in accordance with the requirements of the authorities having jurisdiction. The purpose of the specifications and drawings is to convey to the Contractor the scope of work required, all of which the Contractor is responsible to furnish, install, adjust, and make operable.

B. The omission of any necessary system component, as required by the authorities having jurisdiction, from the specifications and drawings shall not relieve the Contractor of the responsibility for providing such necessity, without additional cost. Any case of error, omission, discrepancy, or lack of clarity shall be promptly identified for clarifications prior to the bid due date.

C. The Contractor shall provide all devices and equipment required by these specifications and drawings. Under no circumstances shall the Contractor delete any equipment or devices without the written directive of the Engineer.

D. The drawings are the “approval set” of drawings. The drawings are intended to identify the sprinkler system installation. The drawings are further intended to provide a clear representation of the hazard to be protected, the system design concept, the proposed water supply configuration, and building construction information pertinent to system layout.

E. It is the responsibility of the installing Contractor to provide, at no additional cost to the Owner, all required piping, fittings, offsets, and elevation changes to accommodate routing around obstructions, for addressing unforeseen conditions encountered in the field, and needed to coordinate with work of other contractors.

F. In addition to the above, the Contractor shall provide for installing additional offsets and sprinklers and associated piping beyond that noted on the approval set of drawings. The Contractor shall incorporate the cost for design, approval, materials and installation for 20 additional offsets and 4 additional sprinklers and associated piping.

G. Changes to the approval set of drawings shall be submitted to the Engineer and DSA for approval. Adding or deleting sprinklers, modifying pipe sizes, and significant changes to pipe routing shall be submitted for approval. Minor deviations in the location of sprinklers and pipe routing need not be submitted for approval but shall be recorded and incorporated into the as-built drawings.

H. Changes shall be categorized as required or elective. Required changes include, but are not limited to, the provision of additional sprinklers due to obstructions or architectural changes made during the course of construction. Elective changes include, but are not limited to, modifications to the design shown on the approval set to accommodate substitutions of sprinkler types and locations; type, size, and routing of piping proposed by the Contractor for cost saving and other reasons. The cost of reviewing, processing and obtaining approvals of elective changes by Berkeley City College, Engineer and DSA shall be paid by the Contractor.
1.2 PERFORMANCE GUIDELINES

A. Work Provided Under This Section

1. Alteration of automatic wet-pipe sprinkler protection for the Berkeley City College as shown on the drawings and as dictated by field conditions.
2. The school renovation requires relocation of existing sprinklers to comply with the requirements of NFPA 13 and DSA. Sprinklers and piping shall be altered and in areas provided with new ceilings where piping shall be concealed.
3. All relocated sprinklers shall be provided with new piping and hangers, including end of branch line restraints.
4. All sprinklers shall be quick response concealed type.
5. The system is provided with a floor control valves. The existing control valve assemblies shall be used. Floor control valves are existing.
6. The backflow preventer and fire service connection are existing.
7. Work shall be as outlined in these specifications, including all labor, materials and shop drawings needed to provide an operating system, and all of the following:
   a. Pipe and fittings.
   b. Hangers and supports including earthquake protection.
   c. Coordination with all other trades.
   d. Fabrication drawings (if required by Contractor), and device manufacturer's literature.
   e. Contractor’s Material and Test Certificates and as-built drawings.
   f. Spare parts/spinklers in cabinet with special wrenches.
   g. Off-hour installation and fire watch per Berkeley City College requirements.

1.3 SYSTEM ABBREVIATIONS AND DEFINITIONS

A. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Division of the State Architect (DSA).
C. ASME: American Society of Mechanical Engineers.
F. Concealed: Where used in connection with installation of piping or conduit and accessories, shall mean "hidden from sight" as in shafts, furred spaces, in soffits or above ceilings.
G. Contractor: Automatic sprinkler contractor performing the work.
I. Exposed: Where used in connection with installation of piping or conduit and accessories, shall mean "visible" or "not concealed".
J. FM: Factory Mutual.
K. FM Approved: Materials or equipment approved by Factory Mutual and included in the most recent edition of the FM Approval Guide.
L. Furnish: Supply materials.
M. gpm: Gallons per minute.
N. Install: Install materials, mount and connect equipment or assemblies.
P. Owner: San Francisco Unified School District (SFUSD)
Q. PIV: Post indicating valve.
R. Provide: Furnish, install and connect.
S. psi: Pounds per square inch.
T. QR: Quick-response sprinkler.
U. Remove: Remove material and equipment and restore surface.
V. UL: Underwriters Laboratories, Inc.
W. UL Listed: Materials or equipment listed by Underwriters Laboratories and included in the most recent edition of the UL Fire Protection Equipment Directory.

1.4 RELATED WORK
A. Coordinate sprinkler installation with other trades. Locate sprinklers in center of new ceiling tiles, where such ceilings are provided.

1.5 DESIGN CRITERIA
A. Sprinkler system shall be in accordance with NFPA 13.
   1. Classrooms, offices, restrooms and similar areas shall be designed based on a Light Hazard classification. Sprinklers shall be concealed, pendent, quick response type spaced to a maximum of 225 square feet per sprinkler, or to the manufacturer's spacing limitations. Sprinklers shall be recessed pendent quick-response sprinklers in areas where new ceilings are provided.
   2. The building is currently fully sprinklered. This project includes relocation of existing sprinklers maintaining the existing spacing and design criteria. A fire pump provides the required densities and is located in the basement. The fire pump is rated for 750 gpm at 95 psi.
   3. No hydraulic calculations are required for this project.

1.6 APPLICABLE CODES, STANDARDS AND PUBLICATIONS
A. The design and installation shall be in conformance with all applicable local, state, and national codes and standards.
B. Reference Codes: The following codes are included as part of this specification.

DSA Backcheck AUTOMATIC SPRINKLER SYSTEM 13930-3
September 27, 2011
Aon FPE No. 1610095-000
C. Reference Standards and Publications: The following standards and publications are included as part of this specification:

1. National Fire Protection Association (NFPA):

2. Factory Mutual Systems (FM) Publication:
   a. Approval Guide.

3. Underwriters Laboratories, Inc. (UL) Publication:

1.7 REGULATORY AGENCIES

A. All material, design, installation and other work shall conform to all applicable regulatory agencies, including but not limited to:

1. Federal, state and local building codes and ordinances, and agencies including, but not limited to, the Division of the State Architect (DSA).

2. Local fire department and fire prevention bureau requirements.

B. Contractor shall include in the base bid all costs associated with complying with the applicable regulatory agencies. Failure to specifically reference on these plans and/or specifications any restrictions, materials and/or work required by the regulatory agencies shall not relieve the Contractor of the responsibility for fully complying with the regulatory agencies without additional cost to the Owner.

1.8 APPROVALS

A. Obtain acceptance of fabrication drawings and materials from the Engineer prior to submittal to DSA.

B. Obtain approval of fabrication drawings from DSA prior to fabrication and installation of materials.

C. Obtain approval of changes from DSA.

1.9 SUBMITTALS

A. Fabrication Drawings

1. Submit four (4) copies of fabrication drawings and manufacturer's data as required to obtain the approval of Engineer.

2. Contractor shall submit complete system packages. Partial system submittals will be rejected.

3. When the plans are rejected because of incomplete or incorrect information, the Contractor shall be responsible for the Engineer's extra review time and expenses beyond one resubmittal. Such extra fees shall be paid by the Contractor directly to the engineer when the resubmittal is made. The Contractor is not responsible for the Engineer's review time for the first submittal and first resubmittal, or for resubmittals required because of project changes.

B. Changes

1. Refer to Section 1.1.
2. Make no changes in installation from layout as shown on the approved set of drawings unless change is specifically approved by the Engineer. This does not include minor revisions for the purpose of coordination.

3. Any pipe fabricated and/or installed before all approvals are obtained at the Contractor's own expense and responsibility. Any changes made to the approved drawings other than as stated above are at the Contractor's own expense and responsibility.

C. Manufacturer's Data

1. Provide data from manufacturer on the following devices, including installation, maintenance, and testing procedures, dimensions, wiring diagrams, etc. Where any devices which are provided or furnished involve work by another Contractor, submit additional data copies directly to that Contractor.
   a. Sprinklers and escutcheons.
   b. Pipe, fittings, hangers and bracing.

D. As-Built Drawings

1. Maintain at the site an up-to-date marked set of as-built drawings which shall be corrected and delivered to the Owner upon completion of work.

2. Upon completion, and prior to final acceptance tests, furnish the Owner with four (4) sets of blackline prints of each as-built drawing.

E. Final Inspection and Test: Upon completion of final inspections and tests, as required by appropriate NFPA Standards and these specifications, submit documentation of all test results and copies of the Standard Contractor's Material and Test Certificates to the Engineer and Owner.

1.10 SPARE PARTS

A. Provide spare sprinkler cabinets, complete with sprinklers and special sprinkler wrenches required for each type of sprinkler installed. The number and type of spare sprinklers shall be in accordance with NFPA 13. Locate new cabinets adjacent existing cabinets in the appropriate portion of the building.

1.11 WARRANTY

A. This Contractor shall provide a one year written warranty against defects in material and workmanship furnished under this Contract. The costs of such warranty shall be part of the purchase price. The warranty commences when the system and installation are accepted by DSA and the Owner.

B. The warranty shall include all necessary material, travel, labor, and parts to replace defective components or materials at the job site. This Contractor shall commence repair of any “in warranty” defects within 8 hours of notification of such defects.

1.12 PRODUCT DELIVERY

A. Delivery of Materials: Delivery of all materials and equipment to the job site shall be scheduled to assure compliance with the predetermined construction schedules.

B. Storage of Materials, Equipment and Fixtures: Contractor shall be responsible for storage of materials on job site, including furnishing of any storage facilities or structures required beyond the available storage space provided by the Owner.
C. Handling Materials and Equipment: Contractor shall be responsible for on-site handling of materials and equipment.

1.13 QUALITY ASSURANCE

A. The Contractor shall be fully experienced and licensed in all aspects of the fire protection systems herein specified.

B. The Contractor shall provide a single person as a point of contact who is responsible for issues of scheduling, coordination, and quality control.

1.14 EMERGENCY SERVICE

A. The Contractor shall provide emergency repair service for the sprinkler/standpipe system within 4 hours of a request for such service by the Owner during the warranty period. This service shall be available on a 24-hour per day, 7-day per week basis.

PART 2 - MATERIALS

2.1 GENERAL

A. All components not referenced by NFPA 13 shall be UL listed and/or FM approved. Components shall be used in accordance with the manufacturer's recommendations and its UL listing and/or FM approval.

B. The naming of manufacturers in the specifications shall not be construed as eliminating the materials, products or services of other manufacturers and suppliers providing approved equivalent items.

C. The substitutions of materials or products other than those named in the specifications are subject to proper approval of the Owner and Engineer granted in writing.

2.2 PIPE

A. Pipe shall be new, designed for 175 psi working pressure, conforming to ASTM specifications, and have the manufacturer's name and brand along with the applicable ASTM standard marked on each length of pipe.

   1. Steel: Steel piping shall be black and galvanized.
      a. Standard Wall: Overhead pipe used shall be black steel and must comply with the specifications of the American Society for Testing and Materials, ASTM A 795 for black pipe, and hot dipped zinc coated galvanized welded and seamless steel pipe for fire protection use. Galvanized pipe shall be used where exposed to atmosphere. Dimensions for all overhead pipe must be in accordance with the American Standard for Wrought Steel and Wrought Iron Pipe ANSI B36.10-1975 for pressure up to 300 psi. Schedule 40 pipe is considered "standard wall" pipe. Schedule 30 pipe is acceptable in sizes 8-inch and larger. Standard wall pipe ends shall be welded, threaded, cut grooved or plain end.
      b. Thin Wall for sizes 2-1/2 inches or larger: Overhead pipe of the Welded and Seamless Type specified in ASTM A 53-80 used in welded systems shall have a minimum pipe wall thickness for pressures up to 300 psi as follows: Galvanized pipe shall be used where exposed to atmosphere. Schedule 10 in sizes up to 5-inch; 0.134 inches for 6-inch; and 0.188 inches for 8-inch pipe. Pipe ends shall be roll grooved or welded in accordance with NFPA 13.
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c. Pipe and preparation shall conform to the fitting manufacturer’s recommendations.

2.3 FITTINGS

A. Changes of direction shall be accomplished by the use of fittings suitable for use in sprinkler and standpipe systems and defined in NFPA 13. Fittings exposed to outside atmosphere shall be galvanized.

1. Steel Pipe
   a. Screwed fittings shall be cast iron, 125 pound class, black, and in accordance with ANSI B 16.4 or malleable iron, 150 pound class, black and in accordance with ANSI B 16.3. Bushings shall not be used unless written approval is obtained from the Engineer.
   b. Weld fittings shall be steel, standard weights, black, and in accordance with ASME B 16.9, ASME B 16.25, ASME B 16.5, ASME B 16.11 and ASTM A 234.
   c. Grooved fittings and couplings shall be produced by the same manufacturer.
   d. Grooved couplings shall be dimensionally compatible with pipe.
   e. Flanged fittings shall cast iron, short body, Class 125, black and in accordance with ASME B 16.1. Gaskets shall be full-faced of 1/8-inch minimum thickness red sheet rubber. Flanged bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B 18.2.

2.4 SPRINKLERS

A. Provide concealed, quick-response pendent sprinklers (k=5.6) for sprinklers in areas where new ceiling is provided. Provide upright quick-response sprinklers (k=5.6) for sprinklers installed exposed. Viking Model VK404, 165-degree Fahrenheit to match existing.

B. Contractor is responsible for reviewing the drawings and field conditions and providing and installing the actual number of sprinklers required under the referenced codes, standards, and these specifications. Sprinklers shall be UL listed/FM approved.

C. Temperature ratings shall be Ordinary for the sprinklers finished areas.

2.5 HANGERS AND SUPPORTS

A. Swivel rings and building attachments shall be listed/approved.

1. Trapeze/hanger component station module shall meet or exceed values listed in NFPA 13.
2. Earthquake sway bracing compartments shall meet or exceed sizes listed in NFPA 13 (if required).

PART 3 - EXECUTION

3.1 GENERAL

A. Work Schedule

1. Per Berkeley City College requirements (outside of normal business hours).
B. Fire Watch

1. Fire watch to be provided per City of Berkeley requirements, even during minor shutdowns.

C. Ceiling Access

1. Contractor shall utilize existing access points as much as possible. Where existing access does not provide clearance for maneuvering pipe or installation, new access panels shall be installed. Contractor is responsible for cutting ceilings, installing access panels and patching and painting. As an alternate, Contractor may cut openings in ceiling and patch and paint to original conditions.

2. Contractor shall furnish planks as required for gaining access for work above ceilings.

D. Product Delivery

1. Delivery of Materials: Delivery of all materials and equipment to the job site shall be scheduled to assure compliance with the predetermined construction schedules.

2. Storage of Materials, Equipment and Fixtures: Contractor shall be responsible for storage of materials on job site, including furnishing of any storage facilities or structures required.

3. Handling Materials and Equipment: Contractor shall be responsible for on-site handling of materials and equipment.

E. Clean-up

1. Maintain the premises free from accumulation of waste materials or rubbish caused by this work.

2. At the completion of the work, removed all surplus materials, tools, etc., and leave the premises clean.

F. Leak Protection

1. Damage: Protect all unfinished work to prevent damage and furnish protection of all surrounding areas where necessary.

2. Leak Damage: The Contractor shall be responsible during the installation and testing periods of the fire protection system for any damage to the work of others, to the building or its contents caused by leaks in any equipment, by unplugged or disconnected pipes or fittings, or by overflow, and shall pay for the necessary replacements or repairs to work of others damaged by such leakage.

3.2 FABRICATION

A. Pipe Ends

1. Ream and remove burrs after cutting pipe. Standard wall pipe ends shall be welded, threaded, cut grooved, or plain end.

2. Thin wall pipe ends shall be plain end, welded or roll grooved in accordance with the fitting manufacturers' recommendation.

3. Threads shall be in accordance with ASME B1.20.1 "Pipe Threads, General Purpose (inch)." Each thread on light wall pipe shall be gauged before fitting make-on.

B. Grooved Ends

1. Pipe minimum thickness, squareness and out-of-roundness shall be in accordance with the coupling manufacturers specifications.
2. Pipe surface shall be free of indentations, projections, or roll marks from the end of the pipe to the groove. 
3. Pipe of less than minimum wall thickness listed shall not be cut grooved.

C. Plain Ends
1. Pipe ends shall be cleaned and marked as recommended by fitting manufacturer.
2. Pipe O.D. shall be within the fitting manufacturers listed tolerance.

D. Welding
1. No field welding of sprinkler/standpipe piping shall be permitted.
2. Headers, risers, feed mains, cross mains and branch lines may be shop welded using acceptable welding fittings. Welding methods shall comply with all the requirements of AWS B2.1, “Specifications for Qualification of Welding Procedures and Welder for Piping and Tubing.”
3. Certified records shall be maintained upon the completion of each weld, welder shall stamp an imprint of their identification into the side of the pipe adjacent to the weld.

3.3 INSTALLATION

A. General
1. A clean set of prints or shop drawings shall be maintained at the site and marked up to show any changes.
2. Install piping as high as possible using necessary fittings and auxiliary drains to maintain maximum clear headroom.
3. Coordinate with the general Contractor to complete and test the system before Owner’s scheduled moving of combustible contents into building.
4. Flushing connections shall be installed at ends of cross mains.

B. Joining Pipe
1. Steel Pipe
   a. Apply tape or joint compound to male threads only.
   b. Threaded close nipples shall not be used.
   c. Grooved and plain end joints shall be made in accordance with the fitting manufacturer recommendations.

C. Drain and Test Piping: All sprinkler piping, drain and test piping, fire department connection piping, etc., exposed to weather shall be galvanized.

3.4 SPRINKLERS

A. General
1. Sprinklers shall be installed per NFPA and manufacturers installation instructions. Install sprinklers as required by NFPA 13 with regard to ducts, obstructions and partitions.
2. Pendent sprinklers shall be in alignment, and parallel to ceiling fixtures, walls, etc.

B. Sprinkler Guards and Water Shields: Provide guards on sprinklers within 7 feet of finished floor or wherever sprinklers may be subject to mechanical damage.
3.5 HANGERS, SUPPORTS, AND EARTHQUAKE BRACING

A. General
   1. All piping must be substantially supported from building structure and only approved types of hangers shall be used. Piping lines under ducts shall not be supported from duct work, but shall be supported from building structure with trapeze hangers where necessary or from steel angles supporting duct work in accordance with NFPA 13.
   2. All-thread rods shall not be bent.
   3. Hanger components shall be ferrous.

B. Feed and Cross Mains
   1. Install at least one hanger per length of pipe up to 8 feet in length joined by grooved couplings.
   2. Use rigid grooved couplings where more than two couplings are used per run.

C. Earthquake Protection
   1. Install flexible joints and sub bracing as provided in NFPA 13.

3.6 System Acceptance

A. Tests
   1. General system test shall be coordinated with the Owner's representatives for training and witnessed by DSA. Problems noted during testing such as air or water leaks, difficulty in operating valves, alarm failures, etc. shall be corrected before the Contractor leaves the job.
   2. All tests shall comply with the requirements of NFPA 13 and DSA.
   3. As the work involves relocating drops which cannot be isolated, test new piping at system working pressure per NFPA Section 16.2.1.6.

B. Contractor's material and test certificates shall be completed for each system/sub-system/floor and signed by the Contractor and witnessed by the Owner's representative and the local jurisdiction.

C. Spare Parts
   1. Provide spare sprinklers, typical of those installed, in a steel cabinet complete with special sprinkler wrenches for both systems. Install cabinets near sprinkler risers. The number of spare sprinklers shall comply with NFPA 13.

END OF SECTION 13930
SECTION 15010 - GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, are hereby made a part of this Section as if repeated herein.

B. These General Mechanical Provisions apply to the entire Division 15.

1.2 DESCRIPTION

A. Work Included: Furnish all labor, materials, equipment and pay all fees required to complete all plumbing work shown on the drawings and specified herein.

B. Related work included in other sections:
   1. Electrical.
   2. Painting.
   3. Access Doors.
   4. Concrete Work.
   5. Landscape Irrigation.

1.3 INCORPORATED DOCUMENTS

A. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work of this Section, including those noted below:

   1. Associated Air Balance Council (AABC).
   2. Air Diffusion Council (ADC).
   4. Air Moving and Conditioning Association (AMCA).
   6. Air Conditioning and Refrigeration Institution (ARI).
   7. Adhesive and Sealant Council (ASC).
   8. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   9. American Society of Mechanical Engineers (ASME).
  14. Institute of Electrical and Electronic Engineers (IEEE).
  17. National Electrical Manufacturers Association (NEMA).
  20. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
1.4 LEGAL REQUIREMENTS AND STANDARDS

A. General: Comply with applicable sections of state and local codes, laws ordinances, rules and regulations of authorities having jurisdiction.

B. Codes and Standards: Conform to applicable sections of codes and standards, including:

2. Occupational Safety and Health Administration (OSHA).
3. State Fire Marshal requirements.
8. Division of the State Architect Offices of Regulation (DSA).

C. Comply with the Safety Orders issued by California Occupational Safety and Health Act, COSHA, and any other safety, health or environmental regulations of the State of California, and any districts having jurisdictional authority. Where an omission or conflict appears between COSHA requirements and the Drawings and Specifications, COSAH requirements shall take precedence.

D. Minimum Requirements:

1. Comply with requirements of authorities as minimum acceptable work.
2. The drawings and specifications take precedence when they call for materials or construction of better quality or larger size than required by codes, laws, rules and regulations.

1.5 QUALITY ASSURANCE

A. Products Criteria:

1. Supply all equipment and accessories new, free from defects.
2. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this sections and with all applicable national, state, and local codes.
3. Electrical Equipment: Listed by UL and shall bear their label.
4. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
5. Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
6. When two or more units of materials or equipment of the same type or class are required. These units shall be products of one manufacturer.
7. Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
8. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
9. Asbestos products or equipment or materials containing asbestos shall not be used.
10. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Owner prior to installation. Installation of the item
will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

B. Qualifications of Installers: For the actual fabrication, installation and testing of work under this Section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer’s current recommended methods of installation.

C. Before any welding is performed, submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section 9 of the ASME Boiler and Pressure Vessel Code.

1. Before any welder performs any welding, submit a copy of the Manufacturer’s Record of Welder or Welding Operator Qualification Tests as required by Section 9 of The ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed in accordance with appropriate construction code, to each completed weld.

2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 if the Code for Pressure Piping, ANSI/ASME.

D. Requirements of Regulatory Agencies and Standards:

1. Permits: Obtain and pay for all fees, permits and inspections. Deliver all certificates of inspection to IOR.

2. Arrange and pay all costs for utilities required to complete all work of this Division. Connection to all utility company or on-site services, payment of service charges and provision for and installation of temporary utilities is included.

3. The requirements of authorities shall be minimum acceptable requirements for the work. When contract drawings or specifications call for materials or construction of better quality for larger size than required by codes, laws, rules and regulations, the drawings and specifications take precedence.

E. Drawings:

1. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. All scaled and figured dimensions are approximate and are given for estimating purposes only. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices that may be required to complete the installation. Before proceeding with any work, carefully check and verify all dimensions and sizes.

2. As far as possible the work has been indicated on the drawings in such position as to suit and adapt to the work of other trades, but the work as indicated is largely diagrammatic and shown primarily for clarity. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the work of all other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown.

3. When apparatus and equipment have been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The locations of apparatus, piping, and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

4. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the rough-in of connections.

5. Be responsible for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provision in time. Such changes shall be directly supervised by the Architect and made to his satisfaction.
6. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for submittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

1.6 DEFINITIONS

A. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms, or completed work.

B. Option or Optional: Contractor's choice of an alternate material or method.

C. Install: To physically erect, mount and connect complete with related accessories.

D. Supply: To purchase, procure, acquire and deliver complete with related accessories.

E. Furnish or Provide: To supply, install, and connect up complete and ready for safe and regular operation of particular work referred to, unless specifically noted otherwise.

F. Work: Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

G. Wiring: Raceway, conduit, fittings, wire, boxes, and related items.

H. Concealed: Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures, and not exposed to view in the completed work.

I. Reviewed, Satisfactory, Accepted, or Directed: As reviewed, satisfactory, accepted or directed, by or to Engineer.

J. Motor Controllers: Manual or magnetic starters (with or without switches), individual pushbuttons or hand (HOA) switches controlling the operation of motors.

K. Control or Actuating Devices: Automatic sensing and switching devices such as thermostats, pressure, switches and relays, etc., controlling operation of equipment.

L. Indicated, as Shown, or Noted: As indicated, shown or noted on Drawings or Specifications.

M. Similar or Equal: Of base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product.

N. Inspector of Record: IOR.

O. Engineer: Mechanical Engineer of Record.

P. Accessible: Capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.
1.7 SITE EXAMINATION

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirement of the contract. Compare site and existing conditions to the mechanical, electrical, architectural, structural, civil, and other drawings and specifications. Call any discrepancies to the attention of the Architect during bidding period. Make allowances for them in preparing the bid.

1.8 ELECTRICAL WORK

A. Quality: Work shall comply with requirements of Division 16 and applicable codes.

B. Wiring: all wiring shall be in electrical conduit or as indicated on drawings.

C. HVAC Control Wiring: Provide control wiring for starter holding coils, relays, interlock and temperature controls.

D. Provide controls, controllers, relays, transformers, switches, duct mounted products of combustion detectors, time clocks, etc., required by work of this Division.

1.9 SUBSTITUTION OF MATERIALS:

A. The design has been based on the manufacturer’s name and product listed on the drawings or named first in these specifications. Other manufacturers' names listed in these specifications may be selected and considered “as equal” for quality only; however, they must match the performance, construction, fit and features of those selected for design. The acceptance of these does not relieve the Contractor for responsibility of providing the required materials and providing a workable system.

1. In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled “SPECIFIED ITEM, NOT SUBMITTED”. Product data sheets for the corresponding proposed substitution item shall be clearly labeled “PROPOSED SUBSTITUTION”.

2. It shall be the Contractor’s responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and the submittal will not be allowed.

B. Should the contractor wish to substitute equipment or material other than those considered for the basis of design, the contractor shall submit information as called for in “Submittal of Materials and Equipment” for both the specified or scheduled item and the substitute item. These submittals will show that both the specified and the substitute material match in quality, performance, construction, fit and features of those selected for design. Any equipment or material submitted for substitution without the comparison information will not be reviewed or acceptable.

C. Liability of Substitutions:

1. Performance of substitutions must be equal to the item specified. If the substituted item fails to perform according to the specifications, replace with the originally specified item without extra compensation on request of the Architect any time within the guarantee period.

2. The contractor is responsible for the cost of any changes to other trades and additional Architectural and Consulting fees resulting from approved substitutions in mechanical equipment.

3. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these
responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

4. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

1.10 SUBMITTAL OF MATERIALS AND EQUIPMENT

A. Submittal:

1. Submittals for a product or material or area of work must be complete. PIECEMEAL SUBMITTAL WILL NOT BE ACCEPTABLE. All submittals shall be factory or manufacturer certified. Vendor's submittal data not acceptable.

2. Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.
   a. Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.
   b. Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

3. Identify submittal with Architect's project name, number and with item designation as indicated on drawings, and referenced to applicable paragraphs of the specification. Submit in brochure form.

B. Review of Submittal: These will be reviewed for general design only, and not for method of assembly, erection, construction, or detailed compliance with contract documents. All submittals shall be factory or manufacturer certified. Submittal technical data and dimensions by Vendor are not acceptable.

C. Manufacturer's Data:

1. Include data for all material and equipment that will be installed.

2. Include complete catalog information such as construction, capacities, types, fan curves, pump curves, sizes, etc. Also include dimensional data, and sufficient information to illustrate compliance with the specifications and list labeling and/or approving agencies and standards of design employed in manufacturer data.

D. Shop Drawings:

1. Prepare dimensionally accurate floor plans and Sections in tight conditions as required of all equipment rooms and all floor plans. Show all equipment, complete ductwork, piping (including plumbing and sprinkler pipes), accessories, and also clearances for operating servicing and coordination with other systems. Indicate bottom elevation for both pipes and ductwork.

2. Automatic temperature control systems, wiring diagrams, control panel boards. Include in wiring diagrams all low and line voltage wiring and equipment.

3. Drawings clearly identified with the Architect's project name and number, and a sheet title identifying its contents.

4. Show location of thermostat(s) and sensors.

1.11 SHOP, OFFICE AND STORAGE

A. Provide temporary shop, office and storage space on site only at locations approved by Architect, as required for execution of work. Remove these facilities upon completion of work.
1.12 JOB CONDITIONS

A. Where new pipes are to be connected to an existing pipe, verify location, size, elevation and all other information necessary for connection. This verification shall be done prior to installation of the new pipe. Should there be a problem, contact the IOR immediately to resolve the problem.

B. Interruption of Services:
   1. Before making any connections or doing any work which interrupts services to existing buildings, notify Owner in writing at least 72 hours in advance; and such work performed as quickly as possible and only at such times as designated by Owner.
   2. Length of time existing services is shutdown to be approved by Owner.

C. Restoration of Damage: Repair or replace, as directed by IOR, materials and parts of premises which become damaged because of installation of work of this Division. Remove replaced parts from premises. Keep accumulation of dust and debris to a minimum. Remove and dispose of debris in a legal manner. Burning and/or selling material at the site is prohibited.

D. Cleaning Equipment and Premises:
   1. Clean equipment and materials: Remove all dirt, grease, splashed paint, plaster and similar foreign materials. Restore damaged finishes to original condition.
   2. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish resulting from operations.

1.13 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of Owner or representatives of Architect.

B. Advise Architect that work is ready for review at following times:
   1. Prior to backfilling buried work.
   2. Prior to concealment of contract have been completed.
   3. When requirements of contract have been completed.
   4. Do not backfill or conceal work without Architect’s consent.

C. Maintain on job a set of specifications and drawings for use by Architect’s representative.

D. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

1.14 MATERIALS

A. In addition to material and equipment specified, also provide incidental materials required to effect complete installation. Such incidental materials and equipment shall be uniform throughout the installation. Equipment or fixtures of the same type shall be of same manufacturer.

B. Protection of Materials:
   1. Protect materials, equipment and apparatus provided under this Division from damage, water, dust, or similar impairment, both in storage and installation until Notice of Completion has been
filed. Materials, equipment or apparatus damaged because of improper storage or protection will be rejected and must be removed from the site.

2. Cap openings in pipes and ends of valves with manufactured caps and fittings. Do not use taped caps.

3. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

1.15 TESTING

A. Provide tests specified hereinafter, where applicable. Provide written verification that the tests have been successfully completed.

1.16 RECORD DRAWINGS (AS-BUILT DRAWINGS)

A. Contractor shall provide and keep up-to-date a complete and accurate "as-built" record set of blue line prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. This record shall be kept up-to-date on blue line prints as the job progresses and shall be available for inspection at all times. Submit completed drawings to Architect in compliance with Division 1.

B. Include on as-built drawings:

1. Main shut-off valves, plainly marked and identified.
2. Position of all buried or concealed mains accurately dimensioned, both horizontally and vertically.
3. Changes in location of piping, duct or equipment from construction documents. Bottom elevations of each duct and pipe.
4. Ceiling and duct access panel locations.
5. Location of temperature control devices including static pressure control probe, stats, selected zones, etc.
6. Location of all equipment.

1.17 OPERATING AND MAINTENANCE DATA

A. General: Submit to the Architect before acceptance of the installation, complete and at one time. Partial or separate data will not be accepted. Data shall consist of the following minimum submissions:

1. Piping Identification Schedule: Copy of charts as specified under valve tags and charts.
2. Simplified and consolidated control drawings.
3. Equipment: List of nameplates, including nameplate data and system served.
4. Manufacturer's Literature: 3 copies of manufacturer's instructions for operation and maintenance of all mechanical equipment, including replacement parts list.
5. Written Instructions: Typewritten instructions for operation and maintenance of these systems composed of Operating Instructions and Maintenance Schedule. 4 copies submitted to the Engineer for approval.
6. Operating Instructions: A brief description of the system indicating proper setting of switches and other equipment furnished for providing control of the system and its components by the operator. Do not include adjustments requiring the technical knowledge of the service agency personnel.
7. Maintenance Instructions: A list of each item of equipment requiring inspection or lubrication, describing the performance of such maintenance, and the month of the year when each item of equipment should be inspected, serviced, or lubricated.
8. Maintenance Schedule: A list of each item of equipment requiring maintenance, showing the exact type of bearing on every component of each item of equipment, and the frequency when each item of equipment should be inspected or serviced.

9. Verbal Instructions: Upon completion of the work, and at a time designated by the Architect, instruct the Owner's representative in the operation and maintenance of the equipment supplied by his company.

10. Binders: Four complete sets of the above data in loose ring binders with permanent covers, with permanent identification on back and index.

1.18 COMPLETION

A. Before Final Review: The work hereunder will not be reviewed for final acceptance until Operating and Maintenance Data, Manufacturer's Literature, Valve Directories, Piping Identification Code Directory and nameplates specified herein have been approved and properly posted in the building and final cleaning has been completed.

B. Demonstration of Operations: When the installation is complete and adjustments specified herein have been made, operate the systems for one week, during which time demonstrate to the Architect that systems are completed and operating in conformance with these specifications.

1.19 GUARANTEE

A. General: Conform to the GENERAL CONDITIONS of the specifications.

B. Contractor shall guarantee the entire mechanical, plumbing and piping systems unconditionally for a period of two (2) years after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

C. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of two (2) years after date of acceptance of his work.

D. Parts Warranty: Provide standard warranty of manufacturer for replacement of parts to apply after expiration of above period. Furnish replacement parts to Owner or to his service agency as directed. Furnish Owner printed manufacturer's warranties' complete with material included and expiration dates upon completion of project.

E. Warranty also applies to services including instructions, adjusting, testing, noise, balancing, etc.

PART 2 - PRODUCTS

2.1 GENERAL

A. Beyond material and equipment specified, also provide incidental materials required to effect complete installation. Such incidental materials include solders, tapes, caulking, mastic, gaskets, and similar items.

B. Materials and equipment shall be uniform throughout the installation. Equipment of the same type shall be of same manufacturer.
2.2 VALVES

A. General - Provide valves with features indicated and where not otherwise indicated, provide proper valve features as outlined in this specification. Comply with ANSI B31.1.

1. Flanged - Valve flanged complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
5. Flangeless - Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
6. Extent of valves required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Valve Tags and Lists:

1. Plumbing: Provide for all valves (Fixture stops not included).
2. HVAC: Provide for all valves other than for equipment in Section 15840, TERMINAL UNITS.
3. Valve Tags: Engraved black filled numbers and letters not less than 1/2 inch high for number designation, and not less than 1/4 inch for service designation on 19 gauge 1/2 inches round brass disc, attached with brass “S” hook or brass chain.
4. Valve Lists: Typed or printed plastic coated card(s), sized 8 1/2 x 11 inches showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.

C. Valve Types - Provide valve of same type by same manufacturer.

D. For Domestic Water Service refer to specification Section 15400 Plumbing.

E. Ball Valves

1. Comply with the following standards:
   a. Ball Valves: MSS SP - 110

F. Swing Check Valves

1. General - Construct pressure containing parts of valves as follows:
   b. Iron Body Valves: ANSI/ASTM A-126, Grade B.
2. Comply with the following standards for design, workmanship, material and testing:
   a. Bronze Valves: MSS SP - 80
   b. Cast Iron Valves: MSS SP - 71

2.3 HANGERS AND SUPPORTS

A. All required seismic bracing shall be installed as per Chapter 13 of ASCE 7-05 except as modified by Section 1614A of the 2007 CBC.

B. Installation shall be as published by SMACNA or OSHPD anchorage pre-approved restraint system. All hanger material to be electroplated zinc or hot-dipped galvanized. No plain (black) finish allowed.
C. Trapeze suspension (trapeze hangers may be used for parallel lines if pipes pitch same direction): Size channel assembly in accordance with manufacturer’s published load ratings. No deflections shall exceed 1/360 of span (refer to Superstrut load tables).

D. Support and laterally brace all ducts, pipes, and equipment per latest SMACNA Manual Standards.

E. Do not support weight of piping from mechanical equipment, i.e., coil connections.

F. Do not cut or weld to any structural steel without permission of Architect.

G. Provide Semco, Trisolator, or equal pipe isolator at all hangers for non-insulated pipes.

H. Schedule of hangers and supports:

<table>
<thead>
<tr>
<th>INDIVIDUAL PIPE HANGERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size - inches</td>
</tr>
<tr>
<td>1/4&quot; thru 2&quot;</td>
</tr>
<tr>
<td>2 1/2&quot; thru 3&quot;</td>
</tr>
<tr>
<td>4&quot; and 5&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRAPEZE HANGERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single or Double 12 Gauge Channel</td>
</tr>
<tr>
<td>Straps</td>
</tr>
<tr>
<td>Pipe Isolators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WALL SUPPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual pipe sizes up to 3&quot;</td>
</tr>
<tr>
<td>Individual pipe sizes 4&quot; thru 8&quot;</td>
</tr>
</tbody>
</table>

a. For plumbing hot and cold water 1" and smaller, see Section 15400.

2.4 ROOF, WALL AND FLOOR PENETRATIONS

A. All pipe penetration through poured concrete wall or floor shall be sealed with Metra-seal as shown on drawings. All other pipe penetration holes shall be sealed with a product that will seal against the spread of flame, smoke, gases and water, for up to a 3 hour rating. Product shall be as manufactured by 3M Brand (Fire Barrier Penetration Sealing Systems) or equal. Product must have been tested and classified by Underwriters' Laboratories and listed in the UL Building Materials Directory; "Through-Penetration Fire stop Systems (XHEZ)," and "Fill, Void or Cavity Materials (XHHW)." Submittal shall reflect product and manufacturers Spec-Data sheet reflecting approvals.

B. Provide pipe sleeves as follows:

<table>
<thead>
<tr>
<th>SLEEVE LOCATION</th>
<th>SLEEVE MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor membrane waterproof</td>
<td>Duco cast</td>
</tr>
</tbody>
</table>
SLEEVE LOCATION | SLEEVE MATERIAL
---|---
Non membrane floor and continuously exterior wall construction. | Standard weight black steel pipe with a welded water stop from outside of a sleeve, a minimum of 2" all around.

C. Length of sleeves as follows:

| SLEEVE LOCATION | SLEEVE LENGTH |
---|---
Floors | Equal to depth of floor construction including finish. Extend minimum 2" above floor level in unfinished area, and in pipe chases.

D. Escutcheons: Provide 1" wide chrome or nickel plated plates on all pipes exposed to view, passing through floors, walls, partitions, etc. Escutcheons sized to fit pipe and pipe covering and give a finished appearance. Escutcheons held in place by set screws. Provide plates on pipes extending through sleeves.

2.5 ACCESS DOORS

A. Furnished and installed under this Division.

B. Install where shown or required by regulatory agencies and for access to all concealed valves, actuators, fire dampers, volume dampers, motors, equipment, etc.

C. Access doors to be fire rated to match fire rating of wall or ceiling where door is to be installed.

D. All doors shall have key operated lock.

E. Door sizes shall be 24" x 24" minimum for ceilings and 12" x 12" minimum for walls.

F. Non-rated door: 16 gauge frames, 14 gauge steel door, flange of door shall be 3/4" wide, hinge shall be concealed, continuous piano hinge, key operated cylinder lock, finish shall be prime coat of rust inhibitive grey baked enamel.

G. Karp Model DSC-214M drywall type with key operated cylinder lock and tile with exact fit. Finish shall be prime coat of rust inhibitive grey baked enamel.

H. Karp Model KDW for gypsum drywall with key operated cylinder lock and tile with exact fit. Finish shall be prime coat of rust inhibitive grey baked enamel.

I. Fire rated doors: UL rated for 1½ hour, “B” level in walls and by Warnock Hersey for 3 hours in ceilings. 16 gauge frame, 20 gauge steel, welded pan type door, flange of door shall be 1" wide, 16 gauge steel, hinge shall be continuous, door shall be filled with 2" thick fire rated insulation, bolt type key operated latch, finish shall be prime coat of rust inhibitive grey baked enamel. Karp Model KRP-150FR.

J. Coordinate all locations with Architect and other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

2.6 SEISMIC RESTRAINTS
A. General Requirements: Seismic restraints shall be provided for all vibration isolated equipment, both supported and suspended, and all vibration isolated piping.

B. Where anchorage details are not shown on the drawings, the field installation shall be subject to the approval of the mechanical engineer and the field engineer of the Division of the State Architect.

C. All mechanical equipment shall be braced or anchorage to resist horizontal force acting in any direction using the following criteria:

1. The total design lateral seismic force shall be determined from ASCE 7 Section 13.3.1, California Building Code (CBC) 2007. Forces shall be applied in their horizontal directions, which result in the most critical loadings for design. The value of $a_p$ (component amplification factor) and $R_p$ (component of modification factor) of Section 13.3.1 shall be selected from Table 13.6-1, ASCE 7. The value of $I_p$ (seismic importance factor) and $S_{00}$ (special acceleration) shall be selected from Section 13.1.3 and Section 11.4.4, ASCE 7, respectively.

D. For Supported Equipment:

1. Pre-approved isolator restraint system by the State of California and bear approval number.
2. Submittal shall include load versus deflection curves up to 1/2" in the x, y, and z planes. Tests shall be conducted in an independent laboratory or under the signed supervision of an independent registered engineer. The snubber assemblies shall be bolted to the test machine as the snubber is normally installed. Test reports shall certify that neither the bridge bearing neoprene elements nor the snubber body has sustained any obvious deformation after release from the load.
3. Submit calculations for each seismic restraint and vibration isolation signed by structural Registered Engineer.

E. Seismic Restraint Systems for Ductwork and Piping:

1. All required seismic bracing shall be installed as per Chapter 13 of ASCE 7-05 except as modified by Section 1614A of the 2007 CBC.
2. Installation will be strictly to the Midland-Ross Corporation Superstrut Universal Seismic Support System or similar OSHPD pre-approved seismic restraint system.
3. Submittal shall reflect use of State of California pre-approved seismic restraint system and bear approval number.

2.7 IDENTIFICATIONS

A. Piping:

1. Identify all piping with Brady Perma-Code, Stenton, or approved equal, self-sticking pipe markers consisting of pipe content wording and arrow indicating directions of flow on A.S.A. color background.
2. Arrow and wording are two separate markers which shall be placed immediately adjacent to each other.
3. Markers to be 50 feet apart (maximum) on centers and shall occur where a pipe enters and leaves a concealed space.
4. Use 2" high letter size for pipe or insulation 3" or larger, and 1" size for pipe or insulation 2½" or smaller.
5. Provide at each end of each marker Brady or equal 2¼" wide self-sticking clear tape around the periphery of pipe or insulation to further secure the marker.
6. All markers shall be installed after finish painting is complete.

B. Piping Label Colors:
<table>
<thead>
<tr>
<th>SERVICE</th>
<th>BACKGROUND COLOR</th>
<th>LETTER COLORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Return</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Protection Water</td>
<td>Red</td>
<td>Black</td>
</tr>
<tr>
<td>Heating Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Return</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Sanitary Sewer Vent</td>
<td>Green</td>
<td>White</td>
</tr>
</tbody>
</table>

C. Equipment: Each piece of motor-driven equipment shall be identified by engraved plastic-laminate signs. Signs shall be a minimum of 4½" x 1¾" with minimum of ½" high white letters on a black background, mounted permanently on equipment. The names shall correspond to those given on the control panels be identified as to the area or space served by the equipment. Automatically started motors shall have warning sign: "THIS MOTOR MAY START AT ANY TIME." The equipment shall be further identified with the electrical panel and circuit.

D. Valves: All valves shall have 1-½" diameter brass disc stamped with 3/8" high letters showing type of services and valve number. Tags shall be attached to valves with brass chain.

E. Refrigerant piping shall be identified in accordance with the UMC Standard 11-2. Identification shall include: type of refrigerant, function and pressure.

2.8 DRIVE GUARDS

A. For machinery and equipment, provide guard as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, or duct, or electrical connections to equipment.

C. Access for Speed Measurement: One inch diameter hole at each shaft center.

2.9 TOOLS AND LUBRICANTS

A. Furnish and turn over to the owner special tools, 2 sets minimum, for each type or size of tool not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease guns with attachments for applicable fittings: one for each type of grease required for each motor or other equipment.

C. Tool containers: Hardwood or metal, permanently identified for intended service and mounted, or located where directed by the owner.

D. Lubricants: A minimum of one quart of oil and one pound of grease, of equipment manufacturer’s recommended grade and type in unopened containers and properly identified as to use for each different application.
PART 3 - EXECUTION

3.1 REVIEW OF CONSTRUCTION

A. Work may be reviewed any time by representative of Architect.

B. Advise Architect that work is ready for review at following times:
   1. Before concealment of work in walls and above ceilings.
   2. When requirements of Contract have been completed.

C. Do not conceal work without Architect's consent.

D. Maintain on project site a set of specifications and drawings for use by Architect's representative.

3.2 NOISE AND VIBRATION

A. Correct conditions at no cost to the Owner if noise or vibrations because of improper material or installation occurs in the building.

3.3 GENERAL INSTALLATION METHODS

A. Where pipe passes through seismic joint, install flexible connection as manufactured by Metraflex to allow vertical and horizontal movement during an earthquake.

B. Carpentry, Cutting, Patching and Core Drilling:
   1. Provide carpentry, cutting, patching, and core drilling required for installation of material and equipment specified in this Division.
   2. Do not cut, core or drill structural members without consent of Architect.
   3. All asphalt and concrete sawing shall not have any outside corners cut.

C. Waterproof Construction:
   1. Maintain waterproof integrity of penetration of materials intended to be waterproof. Caulk penetrations of foundation walls and floors watertight. Provide membrane clamps at penetrations of waterproof membranes.
   2. Provide weatherproof NEMA 3R enclosures for all equipment or devices mounted outside or otherwise exposed to the weather.

D. Sleeves, Chases, and Concrete Inserts:
   1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc., and be responsible for correct location, installation of same.
   2. Sleeves and chases are prohibited in structural members, except where approved in writing.
   3. Locating and sizing of openings for ductwork through walls, etc., under this Division.
   4. Provide sleeves for each pipe passing through walls, partitions, floors and roofs.
   5. Set all pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.
   6. Locate all chases, shafts, and openings required for the installation of the mechanical work during framing of the structure. Do any additional cutting and boring required due to improperly located or omitted openings without cost of the Owner under the supervision of the Architect.
7. Sleeves for un-insulated pipe shall be two pipe sizes larger than pipe passing through or a minimum of 1/2" clearance between inside of sleeve and outside of pipe.

8. Sleeves for insulated piping of adequate size to accommodate the full thickness of pipe covering with clearance for packing and caulking.

9. Caulk space between sleeve and pipe or pipe covering with an incombustible, permanently plastic, water-proof non-staining compound leaving a finished, smooth appearance or pack with incombustible fibrous glass to within 1/2" of both wall faces and provide plastic, water-proof caulking compound.

10. Finish and Plates: Smooth up rough edges around sleeve with plaster.

E. Mechanical Equipment:

1. Where not otherwise indicated, basis for equipment and material installation is published recommendations of respective manufacturer.

2. Equipment:
   a. Accurately set and level with supports neatly placed and properly fastened. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in, installing equipment into position inside building.
   b. All equipment shall be installed accessible on all sides with operable areas having a minimum space clearance as recommended by the manufacturer.
   c. Where the School District determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.

F. Piping and/or Ductwork Systems:

1. Work into complete integrated arrangement, with like elements to make work neat appearing finish.

2. Run concealed, except as shown otherwise.

3. Exposed pipes and ductwork to run parallel with walls or structural element. Do not install any exposed pipe or ductwork without prior approval of Architect.

4. Install with adequate passageways free from obstructions, as high as practicable to maintain adequate head room, as shown or as required. Coordinate with work of other Divisions to achieve proper head room as specified in this Division.

5. Clearance: Do not obstruct spaces required by code in front of electrical equipment, access doors, etc.

3.4 TESTING AND ADJUSTING

A. General: All defects disclosed as result of the following or other tests or operations shall be promptly repaired by and at expense of Contractor and to Architect’s satisfaction. Test shall comply with all necessary codes, rules, and regulations as noted herein before. Contractor shall supply all instruments, labor and tools required by tests. Any defective material and/or equipment shall be repaired, adjusted and replace by new, like materials and equipment, and retested before acceptance.

B. Clean and purge equipment and piping before each test.

C. Test various mechanical systems in portions as work progresses. Any system or portion previously tested to become part of any repeated test when it becomes part of distribution or collection system.

D. Maintain test pressures for periods stated, or as directed, without loss in pressure except that due to change in temperature or authorities having jurisdiction.
E. Operational Tests: Operational tests shall be made on all machinery and devices to determine proper compliance with specifications. All equipment shall function quietly and efficiently; any undue noise or vibration caused by malfunctioning of piping and equipment shall be promptly repaired and/or corrected before acceptance.

F. Timing of Tests: Two weeks before expected completion date, the Contractor shall put all systems and equipment into operation and shall continue operation of same during each working day, but not less than five 8-hour periods, until all adjusting, balancing, testing, demonstrations, instructions and cleaning of systems have been completed. Instructions and demonstrations required shall be given simultaneously with this operation.

G. Duct Leakage Tests: All ductwork with 2" W.C. or higher static pressure shall be tested for leaks, using necessary instruments. Conduct tests as recommended in SMACNA balancing manual. Ductwork handling air pressure less than 2" W.C static pressure shall be sealed wherever visible or tactile observations reveal leakage.

H. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions for two days and show specified performance. If, in the opinion of the Architect, performance of equipment or systems is not according to specifications or submitted data, alter or replace equipment at no increase in contract sum. Contractor, at his option, may order tests from an independent approved laboratory to prove compliance. All such tests shall be at no increase in contract sum.

I. At completion of work, perform and submit Certificates of Acceptance per Title 24, Part 6.

3.5 ACCEPTANCE TESTING

A. It shall be the responsibility of the mechanical contractor to submit all applicable Mechanical Acceptance forms as required for obtaining the Final Certificate of Occupancy.

B. The following is an outline of the responsible parties for observation, performance and documentation. When more than one is specified each contractor shall coordinate with other trades for time, place and procedures for implementation and documentation.

1. MECH-1-A Certificate of Acceptance: Mechanical contractor shall sign when all other required mechanical certificates of code compliance have been completed.

2. MECH-2-A Ventilation Systems – Variable and Constant Volume: Test and Balancing (T&B) agency shall document compliance with NJ3.1 and/or NJ3.2 of the ACM Manual Appendix. Failure of any item shall be noted to the mechanical contractor for remediation. When all items are in compliance, the certificate of code compliance document shall be signed and delivered to the mechanical contractor.

3. MECH-7-A Supply Fan VFD: T&B agency shall document compliance with NJ9.1 of the ACM Manual Appendix. Installing contractor of control sensor components shall perform calibration prior to T&B performing work. Failure of any item shall be noted to the installing contractor for remediation. When all items are in compliance, the certificate of code compliance document shall be signed and delivered to the mechanical contractor.

4. MECH-8-A Hydronic Systems Control: Installing contractor of control components shall confirm installation locations of control components and their calibration for proper operation for desired control. T&B agency shall document compliance with NJ10.1 - 10.5 of the ACM Manual Appendix. Failure of any portion of the requirements shall be noted to the installing contractor for remediation. Small systems with less than 20 valves shall have all valves inspected. Otherwise larger systems shall have the greater of 20 valves or 10% of the total valves visually inspected for proper operation. A failure rate of 5% or more shall require an additional 20% of the valves inspected. If the total failure rate still exceeds 5% then the remainder of the valves shall be inspected. Failure of any valve will be either fixed or replaced as needed for compliance by the installing contractor. The controls contractor shall be available to the T&B contractor during their
investigation for making the required changes of the control system as needed for proper
documentation during the documentation phase.

C. The installing controls contractor shall put all systems back into proper operation for normal conditions
after each phase of the Acceptance Requirements for Code Compliance is completed.

3.6 INSTALLATION OF PIPING AND EQUIPMENT

A. Closing-In of un-inspected Work: Do not allow or cause any of the work to be covered up or enclosed
until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to
such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make
all repairs with such materials as may be necessary to restore all work, including that of other trades, to its
original and proper condition.

B. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and
measurement exact locations and depth of existing utility and service lines to which he is going to
connect. In event depth of existing sewer main or storm drain is not sufficient to permit installation of
piping as detailed on drawings or to make connection in manner indicated; Contractor shall confer with
the Architect, Owner's representative and Engineer for Direction.

C. Conceal all piping within finished rooms, unless otherwise noted on drawings.

D. Cut pipe accurately to measurements established at the building; work into place without springing or
forcing; properly clear all windows, doors and other openings. Excessive cutting or other weakening of
the building structure to facilitate piping installation will not be permitted.

E. Make all changes in direction with fittings and changes in main sizes through eccentric reducing fittings.
Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top
of pipe.

F. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping
system.

G. Provide union and isolating valves on piping at all equipment or apparatus. Locate valves so that the
equipment can be removed without dismantling any branch lines.

H. Install drain valves at all low points of each system to enable complete drainage, and air vents at all high
points in the piping system to enable complete air venting. Install automatic air vent at all high points in
the main piping systems.

I. Support piping independently at pumps, coils, tanks, and the like so that its weight will not be supported
by the equipment.

J. Pipe all drains from pump glands, drip pans, relief valves, air vents, etc., to spill over an open sight drain,
floor drain or other acceptable discharge points, and terminate with a plain end unthreaded pipe, 2" above
the drain.

K. Securely bolt in place to building structures, all equipment, isolators, hangers, etc.

L. Pitch pipe line as required for proper drainage and elimination of air.

M. Wire for hanging or strapping pipes not permitted.

N. Support each run of piping independently from all other piping.
O. Install spring vibration isolation in mechanical rooms and penthouse for all pipes' elbows and also within 40 feet of pipe length.

P. Equipment Access:
   1. Install all piping, equipment and accessories to permit access for maintenance. Relocate piping, equipment and accessories required to provide maintenance access at no additional cost.
   2. Furnish access doors where any valves and equipment requiring access for servicing, repairs or maintenance located in walls, chases or above ceilings. Coordinate the location of access doors of access doors with and install by the applicable Contractor installing walls or ceilings.

Q. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

3.7 PIPE JOINTS

A. Welded Piping:
   1. Make welds in a thoroughly first class, workmanlike manner by welders experienced in piping work. Welders used in the work certified as having qualified within the preceding 6 months in accordance with AWS standard qualification procedures.
   2. Grind out all welds with cracks, blow holes, porosities or other defects and replace at no additional cost to the Owner. On lightweight piping, extreme care must be taken to prevent burning holes through the piping material. Piping with any such holes must be removed and replaced.

B. Screwed Piping:
   1. Cut with machine cutter, hand pipe cutter or Carborundum pipe wheel. Deburr with file or scraper or pipe reamer. Do not ream to exceed I.D. or pipe and thread to ANSI B2.1 requirements.
   2. Use Teflon tape on male thread prior to joining other services. No more than 2 full threads shall remain exposed after joining.

C. Copper Tubing:
   1. Cut square, remove burrs and clean pipe and inside of female fitting to a bright finish with steel wool, wire brush, sandpaper or emery cloths. Apply solder flux with brush to tubing. Remove internal parts of solder-end valves prior to soldering.
   2. Provide dielectric unions at points of connection of all copper tubing and any ferrous piping and equipment.
   3. Joining of Copper Pipes:
      a. Piping 1 ½" and smaller: 95-5 solder
      b. Piping larger than 1-½": Sil-Fos brazing 1000°F minimum.
      c. All solder shall be lead free.

3.8 HANGERS AND SUPPORTS:

A. Piping:
   1. Space hangers and supports for horizontal copper tubing according to the following schedule:

<table>
<thead>
<tr>
<th>TUBE SIZE - inches</th>
<th>MAXIMUM SPACING</th>
</tr>
</thead>
</table>

H&M Mechanical Group
Project No. 08023.03

GENERAL MECHANICAL PROVISIONS
15010 - 19
### TUBE SIZE - inches | MAXIMUM SPACING
--- | ---
1” and smaller | 6 feet on center
1¼” and 1½” | 7 feet on center
2” and 2½” | 8 feet on center
3” and larger | 10 feet on center

2. Space hangers and supports for horizontal iron pipes according to the following schedule:

### PIPE SIZE - inches | MAXIMUM SPACING
--- | ---
1¼” and smaller | 8 feet on center
1½” thru 3” | 10 feet on center
4” and larger | 14 feet on center
All cast iron | 5 feet on center*

- *Locate hangers within 18” of each joint per Uniform Building Code.

3. Safety Hanger Wires:
   a. For air diffusers an other mechanical units to be mounted on suspended-grid ceiling systems and weighing more than 20 pounds but less than 56 pounds per unit, safety hanger wires are specified to be furnished and installed, but not connected, as Work under Section 09510, “ACOUSTICAL CEILING SYSTEMS”, and to meet requirements as referenced in Section 09510.
   b. In advance of ceiling hanger-wire work, provide to job site layouts and/or instruction necessary for proper installation of safety wires.
   c. Connect safety wires to mechanical diffusers and equipment.
   d. For diffusers and equipment units weighing 56 pounds or more, provide approved hangers as required by UBC Section 47.1814

### 3.9 IDENTIFICATION OF VALVES
A. Provide 3 typewritten charts assembled in 3-ring binders showing the valve numbers together with their locations and use. Mount on metal frames and installed as directed the Architect.

### 3.10 VIBRATION ISOLATION
A. The entire system, including equipment, air ducts, pipes, motors, and all other parts must be noiseless and free of vibration transmission.

B. The Contractor shall not install any equipment or pipe which makes rigid contact with the “building” unless it is approved in this specification or by the Architect. “Building” includes slabs, beams, studs, walls, lath, etc.

C. The installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

D. The Contractor shall correct, at no additional cost, all installations which are deemed defective in workmanship or materials by the Architect.

### 3.11 PROTECTION, CARE, AND CLEANING
A. Provide adequate means for, and fully protect, all finished parts of the materials and equipment against physical damage from whatever cause during the progress of this work and until final completion.

B. During construction, properly cap all lines and equipment nozzles so as to prevent the entrance of sand, dirt, etc. Protect equipment against moisture, plaster, cement, paint or other work of other trades by covering it with polyethylene sheets.

C. After installation has been completed, clean all systems.

D. Piping, Ductwork and Equipment to be insulated: Clean exterior thoroughly to remove rust, plaster, cement, and dirt before insulation is applied.

E. Piping, Ductwork and Equipment to be painted: Clean exterior of piping, ductwork and equipment, exposed in completed structure, removing rust, plaster cement, and dirt by wire brushing. Remove grease, oil, and similar materials by wiping with clean rags and suitable solvents. Touch up primer coat as required.

F. Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean and polished.

G. Plumbing Fixtures: Clean and polish fixtures immediately prior to final inspection or Owner’s occupancy. Clean floor drain grates; check each fixture to insure against trap stoppage.

3.12 LUBRICATION

A. Upon completion of the work and before turning over to the Owner, clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer.

3.13 PAINTING

A. Properly prepare work under this Division to be finish painted under SECTION 09900, "PAINTING".

B. Paint duct black behind grilles and diffusers where duct is visible

3.14 COMPLETION

A. Before Final Review: The work hereunder will not be reviewed for final acceptance until Operating and Maintenance Data, Manufacturer’s Literature, Valve Directories, Piping Identification Code Directory and name plated specified herein have been approved and properly posted in the building and final cleaning has been completed.

B. Demonstration of Operations: When the installation is complete and adjustments specified herein have been made, operated the systems for a period of one week, during which time demonstrate to the Architect that systems are completed and operating in conformance with these specifications.

3.15 ALTERATION WORK

A. Existing installations are to be altered in the areas indicated. Disconnect, remove or relocate material and equipment required by removal of or changes to existing construction. Where the work of this trade or the work of other trades interrupts or interferes with existing services, all such service to be re-established
in the manner directed by the Architect. Existing installations, and similar work, have been indicated on the drawings as accurately as possible. Accuracy of such information is not guaranteed and the Contractor to determine exact requirements as work progresses. Provide all alterations, extensions, additions, and related work required providing the finished project. Existing materials removed and not required for re-installation to remain the property of the Owner and to be delivered to the Owner. Materials which the Owner does not wish to retain shall become the property of the Contractor and to be removed from the site.

B. At completion of alteration work, any existing work not required for proper operation of the completed system shall be removed.

END OF SECTION
SECTION 15051 -- MOTORS AND CONTROLLERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors.
2. Variable speed drives.
3. Motor controllers where provided as part of mechanical equipment.

1.2 RELATED WORK AND REQUIREMENTS

A. Section 15010 General Mechanical Provisions apply to all work in this Section.
B. Divisions 16.

1.3 REFERENCE STANDARDS

A. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
C. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
D. ANSI/NEMA MG 1 - Motors and Generators.
E. ANSI/NFPA 70 - National Electrical Code
G. NEMA - ICS 7.0, AC Adjustable Speed Drives.
H. Underwriters Laboratories -UL508C.

1.4 DEFINITIONS

A. VSD: Variable speed drive.

1.5 SUBMITTALS

A. Submittals shall include certification from the motor manufacturer certifying compliance with NEMA MG-1, part 31 for motors that are driven by variable speed drives.

B. Submit a site specific harmonic analysis showing total voltage harmonic distortion and total current harmonic distortion. If the analysis indicates that additional external devices or filters are required to meet...
the power quality requirements of the VSD, provide the devices or filters at no additional cost to the Owner. See Paragraph 2.3B.2.

1.6 WARRANTY

A. VSD warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors:
   1. Baldor to match all existing

B. Variable speed drives:
   1. ABB to match all existing.

2.2 MOTORS

A. General:
   1. In accordance with NEMA, IEEE, and ANSI C50 standards.
   2. Capacity:
      a. Minimum horsepower indicated.
      b. To operate driven devices under all conditions without overload.
   3. Squirrel-cage induction type, NEMA Type “B: insulation class, continuous duty.
   4. Speed:
      a. 1750 RPM, unless otherwise indicated.
      b. See schedules on drawings for other speeds.
   5. NEMA KVA locked rotor CODE LEITER: “G” or better.
   6. Service factor:
      a. Drip-proof enclosure (ODP): minimum service factor 1.15.
      b. Totally enclosed fan cooled (TEFC): minimum service factor 1.15.
   7. Type
      a. 1/3 horsepower and smaller: AC motor single-phase, 60 hertz, NEMA rated for 110 volt. With built-in overload protection.
      b. 1/2 horsepower and larger: AC motor 3 phase, 60 hertz, AC motor, NEMA rated for 460 volt or as scheduled on Drawings.
      c. Motors 50 horsepower and over: Reduced voltage start, -suitable for star-delta starting or as scheduled on Drawings.
   8. Bearings, except as noted:
      a. Ball type, unless otherwise noted.
      b. Sealed, permanently lubricated, unless otherwise noted or not available in motor size.

B. Enclosure:

1. Open drip-proof (ODP)
   a. Provide ODP motors unless otherwise indicated.
b. See schedules on drawings for other enclosures.

2. Totally 'enclosed (TEFC)
   a. Motors outside the building or otherwise exposed to the weather.
   b. Non-ventilated: under 1/2 horsepower.
   c. Fan-cooled: 1/2 horsepower and larger.

C. Belt-connected motors:
   1. Foundation slide base.
   2. Shaft as required for aligning pulleys.

D. Efficiency:
   1. Except where otherwise noted in schedules, motor efficiency for motors 1 horsepower and larger shall be Premium.
   2. Standard efficiency motors are code-minimum high efficiency motors.
   3. Where "Premium Efficiency" motors are called for, motors shall have guaranteed minimum efficiencies equivalent to or exceeding NEMA Table 12-6D levels.
   4. Fractional horsepower motors 1/20 HP and larger shall not be shaded pole motors. NEMA MG-1, Table 12-6D Nominal Efficiency for ODP and TEFC Motors.

E. Multi-speed motors:
   1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated.

F. Motors driven by variable frequency drives:
   1. Shall meet the requirements of NEMA MG-1 part 31.40.4.2.
   2. Where used for pumps or fans shall be capable of operating at 10 percent speed indefinitely.

2.3 VARIABLE SPEED DRIVES

A. All variable speed drives other than those that are factory packaged with equipment shall be supplied by one manufacturer.

B. Electrical Characteristics.
   1. Efficiency shall be not less than 97 percent at rated voltage, current, and frequency and fundamental power factor shall not be less than 98 percent at all speeds and loads.
   2. VSD shall maintain line noise (voltage harmonics) on the input electrical system at or below levels specified in IEEE 519 for a "General System." Manufacturer shall include in submittals a harmonic distortion analysis (IEEE 519, 3 percent) for this particular jobsite. Provide as a minimum line reactors, 3 percent impedance type or isolation transformers if required.

C. Features and Accessories.
   1. Plain language LCD display (code numbers not acceptable). All set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes.
   2. Displays and meters for the following: Output Voltage, output frequency, motor rpm, motor current, motor watts, speed signal input, last three faults.
   3. HOA switch or HOA keyboard function.
   4. Speed potentiometer.
   5. Input line fuses.
   6. Adjustable or multiple carrier frequencies up to 12 kHz.
7. Isolated 4-20 mA or 0-10 Vdc speed signal input.
8. Analog outputs for kW and speed.
9. Digital outputs for alarm and motor on/off status. Latter shall be based on field adjustable motor current that can indicate broken belt or coupling.
10. Auto-restart after trip due to overcurrent, under-voltage, over-voltage, or over-temperature upon correction of causative condition. Include minimum of 3 restart attempts for over-current only, with VSD shutting down and requiring manual restart after the third attempt. The attempt counter shall reset after 10 minutes of successful operation.
11. Downtime Mitigation.
   a. Unless specifically noted on plans, a separate VSD shall be provided for each motor.
   b. Bypass switch/starter. Only include where specifically required in equipment schedule. Bypass shall include:
      1) Across-the-line starter.
      2) Automatic switching upon drive failure.
      3) Contactors that electrically isolate drive and power load directly from line.
      4) Bypass shall be in a separate enclosure to allow drive to be serviced while operating in bypass mode.
      5) NEC sized thermal overload and short-circuit protection in bypass circuit.
      6) Two 3-position switches to control bypass contactor and drive input contactor labeled DRIVE-OFF-BY-BYPASS and NORMAL-OFF-TEST.
      7) Door mounted status lights indicating power on, drive, bypass, and safety.
12. Controls:
   a. Provide factory installed BACnet or Modbus network interface that allows all VSD control points to be communicated to EMCS. See Section 15900 Controls and Instrumentation.
   b. Provide a minimum of two digital outputs that can be programmed for multiple purposes and also controlled through the DDC network interface device by the DDC system.
   c. Provide built-in PID control loop, allowing connection of a pressure or flow signal to the VSD for closed loop control.
13. Enclosure:
   a. NEMA 3R enclosure for outdoor installation with thermostatically controlled filtered forced air ventilation.
   b. NEMA 1 enclosure for indoor installation.

D. Equipment Protection and Safeties.
1. VSDs short-circuit interrupting rating shall equal or exceed that fault current available at the drive.
2. VSD shall protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.
3. The VSD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
4. VSD shall protect itself against all phase-to-phase or phase-to-ground faults.
5. VSD shall be able to start into a rotating load at all speeds (forward or reverse) without nip.
6. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.
7. VSD shall ride through an input power dip of 3 cycles without trip.
8. VSD shall operate properly at a 20 percent voltage fluctuation from rated voltage.
9. VSD shall operate properly at a 10 percent frequency variation from rated frequency.
10. VSD shall employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VSD shall be designed so that overcurrent trip shall be at least 315 percent of the drive's current rating.
11. VSD shall withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between disconnect and VSD shall not be required for the safe and reliable operation of the VSD.

12. The VSD shall withstand switching of the input line power up to 20 times per hour without damage to the VSD.

13. The VSD shall be capable of operating in the following service conditions:
   a. Ambient temp: 30 to 104°F.
   b. Relative humidity: 0 to 95%, non-condensing.

E. Start-up/warranty

1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each VSD with a copy to the Owner's Representative and a copy kept on file by the manufacturer.

2. VSD manufacturer to provide one of the following:
   a. 8-hours of customer training.
   b. Interactive Computer based training on VSD installation, start-up, programming, and trouble shooting.
   c. Professionally produced video cassette on VSD installation, start-up, programming, and trouble shooting in digital format.

2.4 MOTOR CONTROLLERS

A. See DIVISION 16: ELECTRICAL.

B. Refer to individual equipment sections for factory-provided controllers:

   1. Installed on equipment by manufacturer.
   2. Supplied with equipment by manufacturer for field installation.

PART 3 - EXECUTION

3.1 INSTALLTION

A. Coordinate with work of other trades.

B. Install in accordance with manufacturer's written installation instructions.

C. Mounting and power wiring of field mounted variable speed drives and other motor controllers are specified under Division 16 Electrical.

   1. Where wall space is not available for mounting VSDs or other motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure.
   2. Where VSD has disconnect switch, locate VSD within sight of equipment served so that switch complies with NEC requirements.

D. Set overload devices to suit motors provided in accordance with NEC.

3.2 INSPECTION
A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.3 PRE-OPERATING CHECKS

A. Before operating motors and controllers:
   1. Check for proper and sufficient lubrication.
   2. Check for correct rotation.
   3. Confirm alignment and re-align if required.
   4. Check for proper adjustment of vibration isolation.

B. TESTING AND ADJUSTING
   1. Start and test motors and controllers in accordance with manufacturers written installation instructions.
   2. After starting motors:
      a. Check for high bearing temperatures.
      b. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running.
   3. Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

C. Variable speed drives.
   1. See Section 15900 for points to be mapped from the drive controller to the EMCS. Coordinate information, addresses and other information required with the Section 15900 Controls contractor.
   2. Set variable speed ramp-up rates on variable air volume systems slow enough to prevent high pressure trips and/or damage to duct systems. Coordinate with Section 15900 Controls contractor.
   3. Set minimum speed for all applications to 10% unless otherwise noted in Section 15900 Controls sequence of controls.

D. See Section 15950 Testing, Adjusting, and Balancing.

END OF SECTION
SECTION 15250 - MECHANICAL INSULATION

PART I - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for HVAC, piping systems (HVAC), and ductwork.

B. Refer to Section 15400 for insulation of Plumbing Piping.

C. Definitions:

1. Air conditioned space: Space directly supplied with heated or cooled air.
2. ASJ: All service jacket, white finish facing or jacket.
3. Concealed: Ductwork and piping above ceilings and in chases, interstitial space, and pipe spaces.
4. Conditioned Space: A room area which is heated or cooled.
5. Exhaust Duct: A duct transporting air from one or more rooms only to the out-of-doors.
6. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
7. FSK: Foll-scrim-kraft facing.
8. Hot: Ductwork handling air at design temperature above 60°F; equipment or piping handling media above 105°F.
9. Return Duct: A duct transporting air from one or more rooms toward fan if such air can be, at any time, circulated back to any rooms.
10. Run-outs: 2" maximum pipe size and 12 feet maximum branch length connection to individual equipment.
   a. Flat surface: BTU per hour per square foot.
   b. Pipe or cylinder: BTU per hour per linear foot.
12. Thermal conductivity ("k"): BTU per inch thickness, per hour, per square foot, per degree Fahrenheit temperature difference.
13. Transfer duct: A duct transporting air from one or more rooms to another room or rooms.
14. Unconditioned Space: A room or area which is neither heated nor cooled.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 07250, FIRESTOPPING

B. Section 15010, GENERAL MECHANICAL PROVISIONS.

C. Section 15400, PLUMBING

D. Section 15820, DUCTWORK AND ACCESSORIES

1.3 REFERENCES

B. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

C. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.


F. CMC – California Mechanical Code.

G. NFPA 90A - Installation of Warm Air Heating and Air Conditioning Systems.


1.4 CRITERIA

A. Comply with NFPA 90A, particularly paragraphs 2-1.3; 2-2; and 3-3.8, parts of which are quoted as follows:

1. "2-1.3.1 Duct coverings, duct linings, vapor barrier facings, tapes, and core materials in panels used in duct system shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating not higher than 50. If coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when in the final dry state."

2. "2-1.3.6 Pipe insulation and coverings shall meet the requirements of 2-2.1.2(a) when installed in ducts, plenums, or concealed spaces used as part of the air distribution system."

3. "2-2.1.2(a) All materials exposed to the air flow shall have smoke developed ratings not greater than 50 and be non-combustible or limited combustible."

4. "3-3.8.1 Where ducts pass through walls, floors, or partitions required to have a fire resistance rating and fire dampers are not required, the opening in the construction around the duct shall not exceed one inch (2.54 cm) average clearance on all sides and shall be filled solidly with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the same NFPA 255 time-temperature fire conditions required for fire barrier penetration." (Note: By NFPA 101, 6-2.3.4 and 6-3.6, this requirement applies to pipe penetrations of fire or smoke barriers also.)

B. Test methods: ASTM E84, UL 723, or NFPA 255.

C. Specified 'k' factors are at 75°F mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

D. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
E. Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory will be required to show that surface burning characteristics for materials to be used do not exceed specified ratings.

F. Lining materials installed within ducts shall have mold, humidity and erosion resistant surface that meet the requirements of CMC 605.0, ASTM C 1104 and ASTM C 1071 for surface erosion resistance.

G. General: All insulating material required for piping, mechanical equipment and ductwork etc., shall be furnished and installed under this Section of the specifications. The execution of the work shall be in strict accordance with Title 24, Energy Conservation Standards and the best practice of the trade and the intent of this specification. All insulation shall be UL listed and shall meet all code requirements.

H. Surface burning characteristics:
   1. Flame spread.............25
   2. Smoke developed........50

I. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

J. Acceptable Manufacturers:
   1. Fiberglass Insulation: Owens-Corning Fiberglas, CertainTeed, Knauf.
   3. Fiberglass Premolded Pipe Fitting Covers: Insul-Coustit/Birnma Corp., Childers, Speedline, or Zeston.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

C. Manufacturer’s products for insulation, adhesives and caulk shall be listed by the USGBC.

1.6 SUBMITTALS

A. Manufacturer’s Literature and Data:
   1. Insulation materials: Each type used. State surface burning characteristics.
   2. Insulation listings for all required Standards Listing.
   3. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
   4. Insulation accessory materials: Each type used.
   5. Manufacturer’s installation and fitting fabrication instructions for flexible unicellular insulation.
   6. Make reference to applicable specification paragraph numbers for coordination.

PART 2 - PRODUCTS
2.1 PIPE INSULATION

A. Glass Fiber: ASTM C547; rigid molded noncombustible.
   1. 'K' ('ksi') Value: 0.24 at 75°F mean temperature.
   2. Maximum Service Temperature: 1200°F.
   3. Vapor Barrier Jacket: White Draft paper reinforced with glass fiber yarn and bonded to aluminized film, secure with self-sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor barrier.
   4. Fittings and Valves: Premolded PVC fitting covers over precut insulation of same thickness as adjacent piping.

B. Inserts:
   1. Insulation inserts at pipe supports: Provide for all insulated piping. Install with metal insulation shields furnished with pipe supports, Section 15010 General Mechanical Provisions.
   2. Material: Premolded, high density mineral fiber blocks, minimum density 20 lb/ft³, of same thickness as adjacent insulation.
   3. Up through 5 inch pipe use 6 inch long insert Blocks.
   4. Optional insert material: 180 degree segment of calcium silicate, or 9 lb/ft³ minimum density of cellular glass or mineral fiber.

2.2 DUCTWORK & PLENUM INSULATION

A. Flexible Glass Fiber: ASTM C653; flexible, non-combustible blanket.
   1. 'K' ('ksi') Value: ASTM C518, 0.48 at 75°F.
   2. Density: 0.75 lb/ft³.
   3. Maximum service temperature: 250°F.
   4. Thickness: 1½" unless otherwise specified.
   5. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film vinyl, secured with pressure sensitive tape. Moisture vapor transmission: ASTM E96; 0.5 perm.
   6. Tie Wire: Annealed steel, 16 gauge.

B. Duct Liner: ASTM C553; flexible, non-combustible blanket.
   1. 'K' ('ksi') Value: ASTM C518, 0.24 at 75°F.
   2. Density: 1.5 lb/ft³ minimum.
   3. Maximum service temperature: 250°F.
   4. Thickness: 1" standard, 2" where indicated on plans.
   5. Maximum Velocity on Coated Air Side: 4,000 ft/min.
   7. Liner Fasteners: Galvanized steel anchor pins with speed washers.
   8. Adhesives and Sealants: UL listed or classified. Type 1 per Adhesive and Sealant Council Standard ASCC-A-7001 and listed by the USGBC.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS
A. Required pressure tests and connections shall be completed and the work approved by the owner or owners representative before application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping, (pipe, fittings, valves, accessories) and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor barriers shall be continuous and uninterrupted throughout systems with operating temperature 60°F and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of six inches.

D. Insulation on piping shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

E. HVAC work not to be insulated:
   1. Internally insulated ductwork and exhaust air except where otherwise designated.
   2. In hot piping: Unions and flexible connectors. Insulate piping to within approximately three inches of un-insulated items.
   3. Do not internally line exhaust ducts serving kitchen or dishwasher hoods or vapor laden ducts.

F. Apply insulation materials subject to the manufacturer's recommended temperature limits.

3.2 INSTALLATION

A. Installation: In absence of specified installation requirements follow manufacturer's published recommendations.

B. Continue insulation vapor barrier through penetrations.

C. Piping Insulation:
   1. Locate insulation and cover seams in least visible locations.
   2. Neatly finish insulation at supports, protrusions, and interruptions.
   3. Provide insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature with vapor barrier jackets. Finish with glass cloth and vapor barrier adhesive. Insulate complete system.
   4. For insulated pipes conveying fluids above ambient temperature, provide standard jackets. Bevel and seal ends of insulation at equipment, flanges, and unions.
   5. Provide insert between support shield and piping on piping 2 inches diameter or larger.
   7. Fill voids with insulating cement.
   8. Continue insulation passing through sleeves or other openings.
   9. Insulate fittings with pre-molded fiberglass fitting covers or molded Fiberglas or Owens corning No. 10 insulating cement or equal thickness to that of adjoining insulation and finished with a one-piece fireproof polyvinyl chloride fitting cover.
   10. Valves, fittings, flanges and accessory insulation:
       a. Valves, including bonnets.
       b. Flanges
c. Fittings
d. Strainers
e. Expansion joints

D. Insulation for valves, and accessories requiring Servicing or Inspection shall be removable and replaceable without damage. Enclose within two piece No. 18-gauge aluminum covers fastened with cadmium-plated nuts and bolts.

E. External Ductwork Insulation:

1. Secure with 4" strips of adhesive, 8" on center.
2. For rectangular ducts 24" and wider, secure to bottom of duct with mechanical fasteners 18" on center.
3. Wrap with 18 gauge galvanized wire, 18" on center.
4. Adhesive requirements same as for duct liner.
5. Provide insulated ductwork conveying air below ambient temperature with vapor barrier jacket. Finish with tape. Seal vapor barrier penetrations with vapor barrier adhesive.
6. Provide insulated ductwork conveying air above ambient temperature with or without standard vapor barrier jacket. Where service access is required, bevel and seal ends of insulation.
7. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
8. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.
9. For ductwork exposed in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.

F. Duct Liner:

1. Secure liner with adhesive for 100% coverage, anchor pins and speed washers. Refer to SMACNA Duct Liner Application Standards for installation.
2. Seal liner surface penetrations with adhesive.
3. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for liner thickness.
4. Surface adjacent to air flow, including at joints, shall be uniformly flat.
5. Seal butt joint edges of liner to prevent erosion. For rectangular ducts provide sheet metal end caps to cover liner edges at entering and leaving edges of lined duct section; for round ducts use low velocity duct sealant. For plenum lining, provide sheet metal caps at exposed edges, e.g., where liner terminates at access door.

3.3 PIPING INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>Code</th>
<th>System Fluid Temp (°F)</th>
<th>Nominal Pipe diameter (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run-outs</td>
<td>1&quot; &amp; Less</td>
</tr>
<tr>
<td>I</td>
<td>201 -250</td>
<td>½</td>
</tr>
<tr>
<td>I</td>
<td>105 -200</td>
<td>1½</td>
</tr>
</tbody>
</table>

A. System Codes and Insulation Types: Provide fiberglass insulation or equivalent cellular glass unless indicated otherwise. Elastomeric insulation may be used on refrigerant suction pipe.
1. Code I: Space heating water, supply and return piping.

B. Notes for Piping Insulation Schedule

1. Where systems are scheduled, insulate supply and return piping.
2. Fluid temperature means specified supply temperature.
### 3.4 DUCTWORK INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>SUPPLY</th>
<th>RETURN</th>
<th>EXHAUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Mechanical and Fan Rooms</td>
<td>DL</td>
<td>DL</td>
<td>DL</td>
</tr>
<tr>
<td>Within 10' or 10 duct diameters of fan, whichever is greater</td>
<td>DL</td>
<td>DL</td>
<td>DL</td>
</tr>
<tr>
<td>Concealed between roof and ceiling</td>
<td>WV</td>
<td>W</td>
<td>--</td>
</tr>
<tr>
<td>Out of doors unless otherwise noted</td>
<td>DL</td>
<td>DL</td>
<td>--</td>
</tr>
<tr>
<td>Concealed in shaft adjacent To unconditioned space or building exterior</td>
<td>WV</td>
<td>W</td>
<td>--</td>
</tr>
<tr>
<td>Other concealed</td>
<td>WV</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Exposed within space</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Return and exhaust stub ducts from ceiling plenum into shafts</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

### A. Notes for Duct Insulation Schedule

1. **Abbreviations**
   a. DL  Duct Liner
   b. W  Flexible Glass Fiber Duct wrap without vapor barrier
   c. WV  Flexible Glass Fiber Duct wrap with vapor barrier

2. Where lining is specified, other insulation is not required.

3. Where lining is specified in ducts or shafts constructed of architectural materials, apply plenum lining to such materials.

4. Where round ducts are specified to be lined, use one of the following methods:
   a. Line ducts as specified.
   b. Provide pre-insulated duct or approved equal.
   c. Where space permits and where permitted by Architect, provide equivalent size lined rectangular ducts (based on equal friction) in lieu of lined round ducts.

**END OF SECTION**
SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, testing, tools, equipment, services, and transportation necessary for the completion of all plumbing work as indicated on the drawings and specifications herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner. Work includes, but not limited to the following:

1. Soil, waste, and vent piping system including connections to equipment furnished in another section of work, stub, and connections to exterior stub-outs.
2. Indirect waste piping including insulation and connections to equipment furnished in another section of work.
3. Condensate drain piping system including insulation and connections to equipment furnished in another section of work.
4. Domestic hot and cold water piping systems including water heaters, mixing valves, pipe insulation, connections to equipment furnished in another section of work, and connections to exterior stub-outs.
5. Industrial cold and hot water piping systems including pipe sterilization, insulation, backflow preventers, connections to equipment in another section of work, stub-outs and rough-ins.
6. Deionized water piping systems including pipe sterilization, insulation, preventers, and connections to equipment in another section of work, stub-outs and rough-ins.
7. Laboratory air and laboratory vacuum piping systems including air compressors and vacuum connections to equipment in another section of work, stub-outs and rough-ins.
8. Natural gas piping system including connections to equipment furnished in another section of work.
9. Hangers, anchors, sleeves, metal supports, and channels as required for work under this section including sound isolators where indicated.
11. Furnishing and installation of plumbing fixtures and trim.
12. Final piping connections to all fixtures, equipment, including equipment furnished under other sections.
13. Miscellaneous steel work including floor sleeves, slots, inserts, plates, supports, hangers, etc.
14. Demolition work required for this section of work.
15. Testing, adjusting of completed work, inspections, and instructions.
16. Repair of damage done to premises as a result of this installation and removal of all debris left by those engaged in this installation.
17. Shop drawing, submittals, as-built drawings and operation and maintenance manuals.
18. Permits and connection fees.
19. Flashing and counter flashing.
20. All rigging hoisting, transportation and associated work necessary for placement of all equipment in the final location shown.
21. Concrete coring, cutting and patching as a part of this work.
22. Trenching, and compacting for work under this section.
23. Painting of exposed piping and supports in accordance with Section 09900, Painting.

1.3 RELATED WORK ELSEWHERE

A. Section 07840, Fire Stopping.
B. Section 07920, Sealants.
C. Section 08311, Access Panels.
D. Section 09900, Painting.
E. Section 15500, Fire Protection.
F. Division 16, Electrical.

1.4 REFERENCE AND STANDARDS

A. Regulatory compliance: All work performed under this Division shall comply with the latest currently adopted editions of all codes and regulations. The following references and standards are hereby made a part of this Section and work shall conform to applicable requirements herein except as otherwise specified herein or shown on the Drawings.

B. Codes and Standards: Conform to all applicable codes and standards as stated herein and as described in Division 1 of the Specifications, including the following:

1. California Building Code (CBC),
2. California Plumbing Code (CPC),
3. California Fire Code (CFC),
7. Comply with all ADA and California Title 24 requirements for disabled access.
9. City Fire Marshal requirements.
10. Comply with the latest edition of all applicable standards, including AGA, ANSI, AWWA, PDI, and OSHA.
11. Office of Statewide Health Planning and Development (OSHPD).

C. Minimum requirements: The requirements of these are the minimum that will be allowed unless such requirements are exceeded by applicable codes or regulations, in which the regulatory codes or regulation requirements shall govern.

D. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted Authorities Having Jurisdiction and from the Owner’s Representative.
1.5 WORK RESPONSIBILITIES

A. Site Conditions:

1. Examine all the drawings and the specifications, survey the existing site conditions, and include all necessary allowances in bid proposal.
2. Resolve all conflicts with code requirements, site conditions, the work of other trades, or other mechanical contractors.
3. Verify the location of all existing utilities prior to construction and protect from damage.
4. Pay all costs incurred due to damage of existing utilities or other facilities.

B. Drawings:

1. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of their work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.
2. The general indicated on the drawings shall be followed as closely as possible. Coordinate with architectural, structural, mechanical and electrical drawings and the work of other trades prior to of piping and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Owner's Representative for approval. Only when Owner Representative's approval is given, in writing, shall Contractor proceed with installation of the work.
3. Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the Owner's Representative may permit the installation to remain. However, all costs incurred to revise the contract drawings by the Engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.
4. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most stringent and most expensive alternate and after award of contract, shall secure direction from the Owner's Representative.
5. Bring discrepancies between different drawings, between drawings and actual field conditions or between drawings and specifications, promptly to the attention of the Owner's Representative for decision.
6. Install pipe with all necessary offsets and to conform to the structure. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, maintain required accessibility, keep openings and passages clear, and satisfy the requirements of the governing codes and standards of good practice. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.
7. Clearances and Openings: Contractor shall cooperate and coordinate their work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to their requirements for equipment and installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.
8. Contractor shall and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear,
panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms, unless specifically indicated.

9. The architectural drawings and specifications take precedence over the plumbing drawings for location of casework, equipment, lights, diffuser, plumbing fixtures, etc. Contractor shall refer to the drawings, specifications, and review shop drawings for all work, in order to coordinate their work with the other work of the project.

10. All scaled and figured dimensions are approximate and are given for estimate purposes only. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc.

11. Drawings are diagrammatic and size and locations of equipment are generally shown to scale. Make use of data in all Contract Documents, and informational documents, and verify this information against field conditions.

12. As far as possible, the work has been indicated on the drawings in such positions as to suit and accommodate the work of the other trades, but the work as indicated is largely diagrammatic and is shown primarily for clarity. Contractor is responsible for the correct placing of their work and the proper location and connection of their work in relation to the work of other trades.

13. Where apparatus and equipment have been indicated on the drawings, dimensions have been from typical equipment of the class indicated. Carefully check the drawings to see that the equipment will fit into the spaces provided.

14. Where equipment is furnished by another Division or others, verify dimensions and the correct locations of this equipment before proceeding with the rough-in of connections.

C. Responsibility:

1. Be responsible for any cooperative work must be altered due to lack of proper supervision or failure to make proper provision in time. Such changes shall be directly supervised by the Owner's Representative and shall be made to their satisfaction.

2. Provide complete functioning systems and include all labor, materials and associated tools and transportation required for the system to operate safely and satisfactorily.

3. Provide all work indicated on the drawings whether or not mentioned in the specifications.

4. Coordinate the installation of plumbing items with the schedules for work of other trades and other contractors to prevent delays in total work. Assume responsibility for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time.

5. Notify the Authority Having Jurisdiction when work is ready for inspection.

1.6 PERMITS, LICENSES AND INSPECTIONS

A. Obtain and pay for all permits, fees and inspections required by work under this Section.

B. Inspections: All work shall be regularly inspected by the Authority Having Jurisdiction. Certificates of approval shall be delivered to the Owner's Representative.

1.7 NOISE AND VIBRATION

A. Cooperate in reducing objectionable noise or vibration. If noise or vibration, as a result of improper installation, occurs in the building, correct these conditions at no cost to the Owner.

1.8 QUALITY ASSURANCE

A. Qualifications:

1. For the actual installation and testing of work under this section use only thoroughly trained and experienced work personnel completely familiar with the items required and the manufacturer's current methods of installation.
2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill.
3. The execution of the work shall be in strict accordance with the best practice of the trades, the intent of this specification, and all codes and ordinances.

B. Contractor's Qualifications: A firm with at least five (5) years of successful installation experience on projects with plumbing systems work similar and of comparable size and scope to that required for this project. The installer shall have performed at least five (5) similar projects in the San Francisco Bay Area. Contractor shall be prepared to submit written evidence of the installer's experience.

C. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

D. All materials and equipment installed as part of this work shall be new and the manufacturer's current model.

E. Soldering: Soldering of copper tubing shall be done in accordance with the Copper Development Association Copper Tube Handbook Instruction on Joining and Forming Copper Tube, Soldered Joints. Permits for on-site soldering shall be obtained from DSA/Fire Marshal.

F. Brazing: Brazing of copper tubing shall be done in accordance with the standards of the American Welding Society or the Copper Development Association. Copper Tube Handbook Instruction On Brazing. Permits for on-site brazing shall be obtained from DSA/Fire Marshal.

G. Welded Joints: Weld in accordance with procedures established and qualified per ANSI B31.2. Each welder and welding operator shall be qualified for the ANSI procedures as evidenced by a copy of a certified ANSI B31.2 qualification test. Contractor shall conduct the ANSI qualification test. Permits for on-site welding shall be obtained from DSA/Fire Marshal.

1.9 INSTALLATION

A. Bring to the Owner Representative's attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein due to inadequate space, etc.

B. Bring to the Owner Representative's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation.

C. Provide written notification to Owner's Representative a minimum of fourteen (14) days prior to a utility shut down.

D. Obtain inspection and approval from the Owner's Representative of any installation to be covered or enclosed prior to such closure.

E. Restoration of Damage: Repair or replace, as directed by Owner's Representative, materials and parts of premises which become damaged as result of installation of work of this Division. Remove replaced parts from premises.

1.10 PRODUCT

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades.
B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

C. Protection of Materials:

1. Protect materials, equipment and apparatus provided under this Division from damage, water, dust, or similar impairment, both in storage and installation until Notice of Completion has been filed. Materials, equipment or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.

2. Cap openings in pipes with manufactured caps or fittings. Do not use taped caps.

3. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

1.11 REVIEW OF CONSTRUCTION

A. The Owner's Representative may review work at any time.

B. Advise Owner's Representative fourteen (14) calendar days in advance that work is ready for review at following times:

1. Prior to backfilling buried work.

2. Prior to concealment of completed Contract items.

3. When requirements of Contract have been completed.

4. Prior to installation of suspended dry wall ceiling.

C. Do not or conceal work without Owner Representative's consent.

D. Maintain on job a set of specifications and drawings for use by the Owner's Representative.

E. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.12 SYSTEM ACCEPTANCE

A. Final Review: Request a final review prior to system acceptance after:

1. Completion of the installation of all systems required under the Contract Documents.

2. Submission and acceptance of operating and maintenance data.

3. Completion of pipe, valve and equipment identification.

4. Completion of cleaning.

5. Satisfactory operation of all systems for a period of one (1) week.

B. Acceptance shall be contingent upon:

1. Completion of final review and correction of all deficiencies.

2. Satisfactory completion of the acceptance tests which shall demonstrate compliance with all performance and technical requirements of the Contract Documents.

3. Submission of as-built drawings.
1.13 **DAMAGE BY LEAKS**

A. Contractor shall be responsible for damage to any part of the premises caused by leaks in the pipe or equipment installed under applicable sections for a period of twenty-four (24) months from the date of acceptance of the work by the Owner.

1.14 **SUBMITTALS**

A. Submit shop drawings and product data in accordance with Section 01600 Product Requirements and as follows:

B. Submitting Requirements:

1. Submit manufacturer's product brochures for all products. Written descriptions of products are not acceptable. Furnish, all at one time, prior to any installation, submitted data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules. Product submittals shall be bound in a three ring binder, with table of contents and tab set for each system.

2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

3. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

   a. Identify project name and location, Contractor's, Subcontractor's, supplier's or manufacturer's name, address, and telephone number.

   b. Identify manufacturer's name and model numbers.

   c. Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

   d. Include all pertinent construction, installation, performance and technical data.

   e. Have all product data sheets labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

      1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

      2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, and item numbers.

C. **Product Data:**

1. General: Manufacturer's specifications, data sheets, certified drawings, and installation instructions. Include physical and performance data such as weights, sizes, capacities, required clearances, performance curves, acoustical characteristics, finishes, color selection, and accessories. Include certified drawings on major equipment such as water heaters, pumps and tanks.

D. Submit product data and brochures for, but not limited to the following:

1. Pipe Material, Fittings and All Piping Specialties.
2. Pipe corrosion protection materials.
3. Unions, Flanges and Dielectric Isolators.
4. Pipe Supports and Seismic Bracing.
5. Escutcheons, Flashing and Sleeves.
6. Fire stopping, including UL listing system numbers and details.
7. Pipe Isolation.
8. Insulation.
9. Valves (all types), including backflow preventers.
10. Trap Primer Valves.
12. Thermometers and Pressure Gauges.
15. Pipe and equipment markers, and valve tags.
16. Flexible Connectors and Seismic Joints.
17. Hose Bibbs.
18. Plumbing Fixtures and Trim.
19. Expansion Tanks and Storage Tanks.
20. Mixing Valves.

E. Shop Drawings:

1. General: Prepare and submit plans, sections, details and diagrams to required scales for specified areas. Drawings shall be prepared using AutoCAD 2000 software. Drawings shall be coordinated, dimensioned and indicate equipment, pipe, duct, fire protection, and electrical in relation to architectural and structural features. Include minor piping, drains, etc. Indicate exact locations and elevations of valves, piping specialties, access doors, etc. Complete and detailed shop drawings of a scale equal to or larger than the design documents shall be maintained throughout the coordination and construction phase indicating all equipment trades' work clearly. All equipment including piping, etc. shall clearly indicate both top and bottom elevations as well as distances from equipment to established building lines. Coordinate with other trades and field conditions and show dimensions and details including building construction and access for servicing.

2. Use of contract documents for shop drawings is not acceptable.

3. Required Drawings: Prepare and submit drawings for all areas and all plumbing work. Scale shall be minimum 1/4"="1'-0" in mechanical rooms, toilet areas, and a minimum 1/8"="1'-0" elsewhere.

1.15 SUSTITUTIONS

A. Base manufacturer is indicated in the equipment schedules and specifications. In specification, additional acceptable manufacturers may be indicated. Other manufacturers, materials, or methods shall not be used unless approved in writing by the Owner's Representative. The burden of proof as to the equality of any proposed substitute manufacturer, material, or method shall be upon the contractor. Substitutions, shall be submitted as follows:

1. Requests for substitution review and acceptance shall be accomplished by table of comparison listing pertinent features of both specified and proposed materials, such as material of construction, replacement or maintenance access, motor type, horsepower, voltage, phase, service factor. For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for specified item shall be placed side by side with product data sheets for the corresponding proposed substitution item within the submittal. In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled ITEM, NOT SUBMITTED'. Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION'. Review of proposed substitutions will not be made until receipt of satisfactory comparison tabulation.
2. Provide calculations and other detailed data justifying how items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

3. It shall be the responsibility of the Contractor to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and re-submittal will not be allowed.

4. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

5. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all of the proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

6. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

7. The Owner or their authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Owner or that of their representative shall be final and conclusive.

8. Submittal of substitutions shall be limited to one proposal for each type or kind of item, unless otherwise permitted by the Owner's Representative. If first proposed product submittal is rejected, Contractor shall submit the first-named or scheduled product.

9. Contractor shall be responsible for all costs and coordination due to the substitution, such as impacts on electrical requirements, weights, openings in slabs and roofs, structural framing, housekeeping pad size, etc.

10. All costs incurred to revise the contract drawings by the Engineer for re-submittal to the building department or Authority Having Jurisdiction, indicating the as-installed condition, shall become the responsibility of the Contractor.

1.16 RECORD DRAWINGS

A. Record of Job Progress: Keep an accurate dimensional record of the "As-built" locations of all work as required. This record shall be kept up-to-date on prints as the job progresses and shall be available for inspection at all times. In addition, record drawings are to be used by the Owner's Representative for job review and field inspections.

B. "As-Built" documentation shall be transmitted to the Owner within ten (10) days after Owner Representative's acceptance of the completed installation. As-built documentation shall include the following (Unless noted elsewhere, furnish number of copies indicated):

1. Three copies of white bond as-built. One (1) copy of final AutoCAD drawings files shall also be provided on CD disk.

2. Four (4) sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

3. Four (4) sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions.

4. Manufacturer's literature, reports and operation and maintenance data shall be in a labeled three (3) ring binder.

C. Submit in accordance with Section 01720 Project Record Drawings and Section 01725 Electronic Documentation of Project.
1.17 OPERATION AND MAINTENANCE DATA

A. The installing contractor shall provide:

1. All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

B. Data shall include, but is not limited to the following: list of all equipment with manufacturer's name, model number, local representative, service facilities and normal channel of supply for each item. O&M manuals shall be bound in a three (3) ring binder, with table of contents and tab set for each system. "Operation and Maintenance to match "Product Submittals".

1. System Description: Description of start-up and operating procedures.
2. Controls: Diagrams and description of operating sequence of each system.
3. Equipment: Manufacturer's brochures, ratings, certified shop drawings, lubrication charts and data, parts list with parts numbers. Mark each sheet with identification number and actual installed condition.
4. Materials and Accessories: Manufacturer's brochures parts lists with part numbers and lubrication data where applicable. Mark each sheet with equipment identification number or system and location of installation; and to specifically identify which options are provided (in case where data sheet shows multiple options).
5. Certificate of factory tests and code compliance as specified.
6. Recommend preventive maintenance schedule and procedures.

PART 2 - PRODUCTS

2.1 SOIL, WASTE & VENT PIPING SYSTEMS

A. Above and Below Ground: No-hub cast iron soil pipe and fittings manufactured from gray cast iron with a tensile strength of not less than 21,000 psi, bituminous coated interior and exterior, conforming to the requirements of ASTM A888 and CISPI Standard 301. Each length of pipe shall be hydrostatically (water) tested by the manufacturer to verify compliance. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. All pipe and fittings shall be of the same manufacturer.

1. Above Ground: Pipe couplings for above ground no-hub pipe and fittings shall conform to the manufacturer's installation instructions and code requirements. No-hub couplings shall be constructed of a stainless steel shield and assembly conforming to CISPI 301 with a neoprene (elastomeric) sealing sleeve conforming to the requirements of ASTM C564. No coupling reducing fittings allowed.
2. Below Ground: No-hub couplings shall comply with 310 and all requirements of Factory Mutual 1680 Class I, 15 PSI rated pressure. No-Hub couplings shall be constructed of Type 304 stainless steel with 305 stainless steel worm drive screws. The worm drive clamps shall have a hexagon head to accept a 3/8 inch socketed torque wrench. The clamps shall be tightened to a minimum of 80 inch pounds. (Single corrugated shield, 4 band 80 inch pound torque or 2 band 125 inch pound torque minimum). The gasket material shall be neoprene rubber meeting the requirements of ASTM C-564. Submittal to include copy of compliance to the requirements of FM 1680 Class I by certified independent third party testing laboratory. No-Hub couplings shall be Husky "SD4000-Orange Shield", Ideal "Heavy-Duty-Green Shield", or Clamp-All " High Torq 125". No coupling reducing fittings allowed.
2.2 LABORATORY WASTE AND VENT PIPING SYSTEMS

A. Polypropylene Piping:

1. Piping shall be Fuseal pipe and fittings as manufactured by George Fischer (+GF+). Pipe and fittings shall conform to the requirements of ASTMF-1412, standard specification for Polyolefin pipe and fittings for corrosive waste drainage systems. Piping shall be joined by the use of electrical resistance coils energized by a variable low voltage power supply via a duplex connector.
   a. Fuseal pipe and fittings shall be installed according to the current installation instructions as published by the manufacturer.
   b. A manufacturer’s representative will perform a complete training session on the proper method installation for the piping drainage system prior to the installation of any piping.

2. At all laboratory sinks, provide +GF+ Fuseal 527242C translucent jar traps.

3. Below grade: Shall be same as specified for above grade except:
   a. No mechanical joints
   b. Pipe and fitting may be made from polypropylene resin without fire-retardant additive.

4. The entire system shall be installed and supported in strict accordance with manufacturer’s recommendations. Below grade piping shall be install in a six inch (6") sand base and six inch (6") sand cover prior to backfill.

2.3 DOMESTIC HOT AND COLD WATER PIPING SYSTEMS

A. Water Piping Above Ground:

1. Copper Tube: Type "L", hard-drawn temper, ASTM copper tubing with ANSI B16.22 wrought copper sweat type fittings. Pipe shall be NSF 61 Certified and bear the NSF Certification mark. Submit to include that pipe is NSF 61 certified.

2. Solder for Copper Piping: Lead-free, antimony-free, cadmium-free, non-toxic solder, 95.5% tin, 4% copper and 0.5% silver. Engelhard 100, or equal.

3. Mechanically formed tee fittings are not acceptable.

2.4 INDUSTRIAL HOT AND COLD WATER PIPING SYSTEMS

A. Water Piping Above Ground: Copper Tube: Type L, hard-drawn temper; ASTM B88 copper tubing with ANSI B16.22 wrought copper sweat type fittings.

1. Solder for Copper Piping: Lead-free, antimony-free, cadmium-free, non-toxic solder, 95.5% tin, 4% copper and 0.5% silver Engelhard Silvabrite 100, or equal.

2.5 DEIONIZED WATER PIPING

A. High Purity Polyvinylidene Fluoride (PVDF) pipe, fittings and valves, Super Proline, or equal. Pipe shall be SDR 11 rated to 230 psi. PVDF shall conform to ASTM D3222 and shall meet requirements for flame spread rating less than 25 and smoke development less than 50. Joints and fittings shall be butt or socket fusion.

2.6 CONDENSATE PIPING SYSTEMS

A. Pipe size 1" and smaller: ASTM B88 DWV copper pipe and fittings.
B. Pipe size 1-1/4" and larger: ASTM B306 DWV copper pipe and fittings.

C. Solder for Copper Piping: Lead-free, antimony-free, cadmium-free, non-toxic solder, 95.5% tin, 4% copper and 0.5% silver Engelhard Silvabrite 100, or equal.

2.7 LABORATORY AIR AND LAB VACUUM PIPING SYSTEMS

A. Piping 2" and smaller: Hard drawn seamless tubing, conforming to ASTM B819. Type "L". Fittings ANSI B16.22 wrought copper sweat type. Provide long radius elbows for vacuum piping system. Brazing for Piping: Copper-Phosphorous brazing filler alloy (BCuP Series) without flux. Field joining of piping shall utilize approved methods of brazing with alloys melting above 1100°F; lead type solder is not acceptable.

B. Piping larger than 2": ASTM A53 schedule 40 black steel pipe with ANSI 150 lb. ANSI B16.3 malleable iron fittings or ANSI B16.9 standard weight, butt type welded fittings. All exposed threads shall be primed with one coat of rust inhibiting paint. For pipes exposed to atmosphere, use galvanized steel pipe and fittings.

2.8 NATURAL GAS PIPING

A. Natural Gas Piping Above Ground:

1. Piping 2" and smaller: ASTM A53 schedule 40 black steel pipe with ANSI 150 lb. ANSI B16.3 malleable iron screwed fittings.

2. Piping 2-1/2" and larger: ASTM A53 schedule 40 black steel pipe with ANSI B16.9 standard weight, butt type welded fittings.

3. Exposed to weather: Galvanized steel pipe and fittings.

4. All exposed threads shall be primed with one coat of rust inhibiting paint.

2.9 PIPE SUPPORTS, ANCHORS, HANGERS, AND SEISMIC PIPE

A. Unless detailed on the drawings, all piping shall be supported with, B-Line, Grinnell, Super Strut, Tolco, or equal, pipe hangers and supports. All hangers and supports furnished for this installation shall be of one manufacturer. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide felt lined hangers for copper piping systems.

B. Special pipe supports for piping in equipment and other locations where shown on drawings shall be constructed as detailed on drawings. Unless otherwise shown on drawings, support channels, frames, brackets, and legs of special supports shall be made of B-Line, Grinnell, Super Strut, Tolco, Unistrut, or equal channels, attaching clips, pipe clamps, and other required accessories. Piping installed within partitions and connected to plumbing fixture trim shall be securely attached to adjustable stud brackets, not more than 2-feet from and on the inside of wall penetration.

C. Hanger Rods: Hanger rod size shall be no less than the standard rod sizes listed on the MSSSP-69. Rods shall be steel rods, threaded at ends only with a minimum safety factor of 5 over the imposed load, Tolco Fig. 103, or equal. All thread rods are not acceptable. Provide rod stiffeners as required.

D. Where beam clamps are used, provide beam clamp retaining strap.

E. Powder-driven and explosive type fastenets are not allowed.
F. Equipment Support Members: Install AISC steel beams to accommodate support for pipe and equipment from above when it is not practical to install concrete anchors.

G. No metallic pipes shall have metal-to-metal contact with hangers, clamps, brackets, or any other pipe support, or be otherwise in direct contact with any part of the building structure.

H. Finish of all pipe supports attachments, rods, hangers, etc., shall be galvanized or cadmium plated.

I. Steel for Equipment Support: Support steel shall be of new material conforming to ASTM A36, latest edition. Brackets, supports, etc., fabricated from ferrous metal shall be hot dipped galvanized after fabrication. Steel hangers shall have a safety factor of 4.0 or greater.

J. Miscellaneous Steel, Bolts, Nuts, Washers, Etc.: Miscellaneous steel angles, channels, brackets, rods, clamps, etc., shall be of new materials conforming to ASTM A36. All steel parts exposed to weather or where noted shall be hot dipped galvanized after fabrication.

K. All bolts and nuts, except as otherwise specified, shall to ASTM "Standard Specifications for Low Carbon Steel Externally and Internally Threaded Standard Fasteners", Designation A307. Bolts shall have heavy hexagon heads, and nuts shall be of the hexagon heavy series. All bolts, washers, nuts, anchor bolts, screws and other hardware, unless otherwise specified, shall be galvanized, and all galvanized nuts shall have a free running fit. Bolts shall be of ample size and strength for the purpose intended.

L. Concrete Anchors:

1. For New Concrete Slabs with Metal Decking: B-Line, Hilti, Red Head, or equal, steel deck inserts or wedge type expansion anchors.
2. For New Concrete Floor or Base: B-Line, Hilti, Red Head, or equal, hook bolts, wedge type expansion anchors, or Deco adjustable concrete anchors.
3. For Existing Concrete Slabs: B-Line, Hilti, Red Head, or equal, self-drilling concrete anchors. Locate anchors to clear rebar.
4. Maximum loading on inserts and rods shall not exceed 75 percent of ratings.
5. Powder actuated fastening systems will not be allowed.

M. Insulated pipes shall be supported with Pipe-Shield, Inc., Model “CS-CW” unless otherwise noted, or equal, pipe hanger shield with waterproofed calcium silicate insulation encased in a galvanized-sheet metal shield completely around the pipe. Shield shall be 26 gauge for pipes up to 1", 22 gauge for 1-1/4" and 1-1/2", 20 gauge for 2" to 8" in size, and 16 gauge for 10" and larger. Insulation shall be same thickness as pipe insulation.

N. Provide pipe supports and seismic bracing in accordance with SMACNA "Guidelines for Seismic Restraints of Mechanical Systems". Provide steel bracing as shown and specified to resist earthquake loads, as required for UBC Seismic Zone IV. As a minimum, provide seismic bracing for the following:

1. All piping greater than or equal to 2-1/2" nominal diameter.
2. All gas piping greater or equal to 1" diameter.
3. All piping (in boiler and mechanical rooms) greater than or equal to 1-1/4" nominal diameter.
4. Piping suspended by individual hangers 12" or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced. For pipes on a trapeze, the 12" exception is measured from the upper face of the horizontal structure member (or of the pipe).
5. Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and not move due to the action of quick closing of valves.
6. Cast iron no-hub pipe, where the top of the pipe is 12" or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.

2.10 ESCUTCHEONS, FLASHINGS SLEEVES

A. Provide sleeves for each pipe passing through footings, foundations, walls, partitions, floors, roofs and other locations where needed, whether shown or not.

B. Piping penetrating below grade exterior walls and floors, and floors in all food service areas including pantries, shall be sleeved and made watertight using Thunderline "Link Seal" sealer, or equal.

C. Sheet metal pipe sleeves: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge. Adjustocrete, sleevecrete, or equal.

D. Set all pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.

E. Sleeves for insulated piping shall be of adequate size to accommodate the full thickness of pipe covering with clearance for packing and caulking. Provide galvanized steel pipe sleeve, minimum 18 gauge, sized for maximum 1 inch space between insulation and sleeve. Omit specified insulation and apply same thickness of UL approved insulation through thickness of wall and extending 1" either side. Provide UL rated ceramic fiber packing. Pack space between sleeve and insulation with packing and seal ends with approved seal. Seal shall be positively fastened using metal plates, or escutcheons. Commercial pipe sleeve assemblies which are UL rated and which have been approved by the fire marshal for this purpose shall be used. Pipe Shields Inc. F1000 series or equal. Use only assemblies which have been designed for the service on which they are to be used.

F. Caulk space between sleeve and pipe or pipe covering through rated walls, partitions, and floors with fire rated, incombustible, UL listed, permanently plastic, waterproof non-staining compound leaving a finished, smooth appearance. Fire stopping shall be in accordance with specification Section 07270, Fire Stopping and Smoke Seals. Provide supporting backing to secure material in place.

G. Provide sleeves as follows:

<table>
<thead>
<tr>
<th>Sleeve Location</th>
<th>Sleeve Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Wall, Partitions</td>
<td>Galvanized sheet metal.</td>
</tr>
<tr>
<td>Membrane Waterproof Floor and Roof Construction</td>
<td>Standard weight black steel pipe with flashing clamp device welded or threaded to pipe sleeve. Flashing clamp device J.R. Smith 1720 or equal by Zurn.</td>
</tr>
<tr>
<td>Non-membrane Floor Construction</td>
<td>Standard weight black steel pipe.</td>
</tr>
<tr>
<td>Footings and Foundations</td>
<td>Schedule 40 galvanized steel pipe.</td>
</tr>
<tr>
<td>Exterior Walls</td>
<td>Standard weight galvanized steel pipe with a continuously welded water stop of ¼&quot; steel plate extending from outside of sleeve a minimum of 2&quot; all around.</td>
</tr>
</tbody>
</table>

H. Escutcheons, Finish and Plates:

1. Smooth up rough edges around sleeve with plaster.
2. Provide escutcheon plates where exposed pipes pass through walls, ceilings, or floors, in all finished rooms and conspicuous locations. Provide chrome or nickel plated plates sized to fit pipe and pipe covering and give a finished appearance. Escutcheons held in place by set screws allowing enough clearance to care for expansion and shall be sufficient size to cover the opening around the pipe. Provide plates on pipes extending through sleeves.

2.11 PIPE ISOLATION

A. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be B-Line "Vibra Clamp" and "Vibra Cushion", Super Strut, "Trisolator", or equal. Piping shall be installed and supported in a manner to provide for expansion without strain. Guides shall be properly to ensure this requirement.

B. Provide pipe isolation for all piping through walls, Mason Industries, or equal.

C. Provide sound isolation for all stud hangers, per Mason Industries, or equal.

2.12 PIPE INSULATION

A. General: Conform to NFPA Section 90A, with special regard to the fire hazard requirements of ASTM E84 and NFPA No. 255, latest revision, including vapor barriers and adhesive. All insulation shall be UL listed and shall meet all code requirements, minimum California State Energy Code Title 24. Insulation shall be Owens Corning, Johns-Manville, or equal.

B. Fire Hazard Rating: Insulation, jackets, facings, adhesives, coatings, and accessories shall be acceptable to the Fire Marshal, and shall not exceed the following fire hazard classifications: Flame-spread: Maximum 25, Fuel Contributed: Maximum 50, Smoke Developed: Maximum 50. Rating to be in accordance with UL Test Method for Fire Hazard Classification of Building Materials, No. 763.

C. Domestic and Industrial Cold Water, Hot Water, Hot Water Return: Fiberglass, Heavy Duty 25ASJ/SSL, heavy density, UL listed non-combustible fiberglass segmented pipe insulation with an integral vapor barrier jacket. The jacket shall have a pressure sealing lap adhesive. Insulation density shall be between 4 and 7 PCF. Insulate cold water piping in concealed areas and warm (heated) areas with minimum insulation. Insulate exterior cold water piping with 1" insulation. Insulation for hot water shall comply with California Title 24 requirements. Required thickness shall be a function of the pipe size as indicated below.

D. Indoor Piping -Fluid Temperature Range (105°F and Above):

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runouts (1” max) less than 12'-0”</td>
<td>0.5”</td>
</tr>
<tr>
<td>Up to and including 2”</td>
<td>1”</td>
</tr>
<tr>
<td>2-1/2” and larger</td>
<td>1.5”</td>
</tr>
</tbody>
</table>

E. Outdoor Piping -Fluid Temperature Range (105°F and Above):

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runouts (1” max) less than 12'-0”</td>
<td>0.5”</td>
</tr>
<tr>
<td>Up to and including 1”</td>
<td>1.5”</td>
</tr>
<tr>
<td>1-1/4” and larger</td>
<td>2”</td>
</tr>
</tbody>
</table>
F. Condensate Drain, Storm Drain and Overflow Drain: Fiberglass, Heavy Duty 25ASJ/SSL, heavy density, UL listed non-combustible fiberglass segmented pipe insulation with an integral vapor barrier jacket. The jacket shall have a pressure sealing lap adhesive. Insulation density shall be between 4 and 7 PCF. Insulate horizontal storm drain and overflow drain lines, elbows up to roof drain body, and roof drain bowls with a ½” thick insulation. Insulate all condensate drains with a minimum of ⅛” thick insulation.

G. Insulate fittings, valves, joints, expansion joints, and couplings with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass covers or radical mitered segments of pipe insulation. For valves, expansion joints, fittings and accessories requiring servicing or inspection, insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts. Concealed items shall be labeled. Unions and flanges, strainers, air chambers and water arrestors, need not be insulated.

H. All insulation shall be continuous through walls, sleeves, pipe supports and hangers, and other pipe penetrations.

I. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation.

J. For exterior applications and piping exposed to weather, 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 piping and all fittings with 0.016” aluminum or stainless steel jacket (meeting ASTM B209) with moisture barrier, and with two 3/16” wide 0.015” thick aluminum or 0.010” thick stainless steel bands per 3 feet section (18” on center), completely watertight. Lap all joints 2” minimum and seal per manufacturer’s recommendations. Locate seams on the bottom side of horizontal piping.

K. All insulated piping drops exposed in finished areas shall be jacketed in stainless steel jacket, secured and sealed around pipe to prevent entrance of water during cleaning process.

L. Insulated pipes shall be supported with Pipe-Shield, Inc., Series A-9000, or equal, pipe hanger shield with waterproofed calcium silicate insulation encased in a galvanized sheet metal shield completely around the pipe. Shield shall be 26 gauge for pipes up to 1-1/2”, 22 gauge for 2”, 20 gauge for 2-1/2” to 8” in size, and 16 gauge for 10” and larger. Insulation shall be same thickness as pipe insulation. Provide calcium silicate insulation with insulation protection saddles and shields at pipe hangers. Insert sections shall be installed on all insulated piping located centrally under each hanger where the insulation rests on hanger. Vapor barriers and jacketing continuous over insert.

2.13 VALVES

A. General:

1. Provide all valves of first quality of approved manufacturer, have proper clearances, and be tight at the specified test pressure. Mark on each valve the maker’s name or brand, the figure or list number, and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or provided with other means of easy identification.

2. All valves must be of the product of one manufacturer, except for special application. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.

3. Valve Design: Rising stem or outside screw and yoke stems. Non-rising stem valves may be used where space conditions prevent full extension of rising stems. Provide Class 150 valves meeting
the valve specifications where Class 125 valves are specified but are not available.
4. Sizes: Same size as upstream pipe, unless otherwise indicated.
5. Operators:
   a. Hand wheels fastened to valve stem for all valves other than quarter turn.
   b. Lever handles on quarter-turn valves, 6 inch and 8 inch and larger gear operated, except for plug valves. Provide plug valves with square heads and operating wrench. Provide gear operator for valves 8 inch or larger.
6. Extended stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
7. End Connection: Valves 2” and under shall be sweat or threaded 2-1/2” and larger shall be flanged or full lug style.
8. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.

B. Ball Valves: MSS SP-110; rated for 150 psi saturated steam pressure, 600 psi WOG pressure; full port, two or three piece bronze body construction, chrome plated solid bronze ball, blowout proof stem, reinforced “Teflon” seat and seals, separate adjustable packing gland and nut, and vinyl covered steel handle. Provide locking type handle where required.
   2. Valves 2-1/2” and Larger: Use gate valve.

C. Check Valves:
   1. Swing Check Valves: 2” and Smaller: MSS SP-80; Class 125, 200 psi WOG, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc. Provide valves capable of being refitted while the valve remains in the line.
      a. Nibco T/S-413B, Red & White #236/#237, or equal.

D. Natural Gas Provide AGA/CGA listed gas valves for natural gas piping system.
   1. Valves 2” and smaller: MSS SP-110; full port, two piece body, blowout proof stem, lever handle, screwed ends, 600 psi WOG rated, AGA/CGA/UL listed and FM approved, Red & White #5044 or equal.
   2. Valves 2-1/2” to 6”: Provide lubricated plug type, bronze body, standard port, spring balanced plug & stem, ¼ turn operation, flanged ends, and include operating wrench and locking device, UL/CGA Listed, Homestead #612, or equal.

2.14 TRAP PRIMER VALVES

A. Corrosion resistant brass containing no springs or diaphragms, activated by a 5 to 10 psi pressure drop, provide with distribution unit where serving 2 to 4 drains, ASSE 1018 certified and Listed with Precision Plumbing Products Model P-1 & P-2 with DU Series distribution unit, or equal.

B. Provide trap primers for all floor drains including piping floor drain to trap primer valve. Provide shut-off valve upstream of trap primer valve.

C. When concealed, provide access panel for maintenance or replacement. Use size appropriate for access.
2.15 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

A. Provide water hammer arrestors in water lines to equipment or fixtures having quick closing valves, flush valves, sensor operated metering faucets, mechanical metering faucets, foot pedal valves, knee operated valves, and any equipment that might produce water hammer.

B. Water hammer arrestors shall be certified by the Plumbing and Drainage Institute (PDI). Water arrestors shall have threaded stainless steel casing, partially filled with liquid and charged with gas as required for line pressure, stainless steel or neoprene bellows, J.R. Smith “Hydrotrol”, Zurn “Shocktrol”, or Wade “Shokstop”.

C. When concealed, provide access panel for maintenance or replacement. Use size appropriate for access.

D. Provide 6” brass nipple at connections to copper lines.

2.16 DRAINS

A. Conforming to ANSI A1 Drains. shall be manufactured by J.R. Smith, Wade, or Zurn.

B. Coated cast iron body, except as noted, with integral double drainage flange, weep holes and inside caulked bottom or no-hub outlet.

C. Provide cast iron P-trap at all floor drains, floor sinks and trench drains. All floor drains to have trap primers.

D. Floor Drain (FD-1): J.R. Smith Fig. 2005Y-A-U-NB, with 6” round adjustable vandal-resistant nickel bronze strainer.

E. Floor Drain (FD-2): J.R. Smith Fig. 2120Y-U-NB, with 8½” diameter nickel bronze vandal proof tractor grate top.

F. Coordinate drain, area drain, trench drains, and floor sink rim elevations to be flush with finish floor and at low point of floor.

2.17 CLEANOUTS

A. Conforming to ANSI A112.36.2. Cleanouts shall be manufactured by J.R. Smith, Wade, or Zurn.

B. Cast bronze, full size up to four inch.

C. Floor Cleanouts: J.R. Smith Fig. 4026-U-F-C, coated cast iron adjustable floor with inside caulk connection, flange with flashing clamp, internal bronze plug, scoriated round nickel bronze cover secure to rim with vandal-resistant screws.

D. Wall Cleanouts: J.R. Smith fig. 4422C-U and fig. 4532S-U, cast bronze taper thread plugs with stainless steel cover and vandal-resistant screws. Screw length as required meeting installation requirements. Wall cleanouts shall be located a minimum of 18” above finished floor.
2.18 VENT

A. Vent caps shall be by J.R. Smith, Wade, or Zurn.

B. J.R. Smith Fig. 1748, vent cap with cast iron sleeve and dome secured with recessed Allen key set screws.

C. Provide for all vents through roof.

2.19 ACCESS DOORS/PANELS

A. Furnish under this Division where shown, and required by Regulatory Agencies and for access of all concealed valves, water arrestors, unions, etc., even though access doors are not shown for Plumbing work. Doors shall be in accordance with requirements of Section 08311. Doors in this Division, Section 08311, and Division 16 shall be from same manufacturer for identical appearance and keying. Sizes: 24" x 24" inches minimum for ceilings and 12" x 12" minimum for walls. Furnish fire rated doors when located in rated construction. Deliver doors for installation under Section 08311. Mark each door to accurately establish its location.

2.20 IDENTIFICATION OF PIPING

A. All piping are to be identified as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, pressure sensitive pipe markers consisting of pipe content wording and arrow indicating directions of flow on ANSI color background. Arrow and wording are two separate markers which shall be placed immediately adjacent to each other. Provide at each end of each marker, two and one-fourth inch wide self-sticking clear tape around periphery of pipe or insulation to further secure marker. All markers shall be applied to clean surfaces free of dust, grease, oil or any other material which will prevent adhesion. Install after cleaning, painting and insulation is complete. Pipe identification shall comply with ANSI A13.1 for the "Scheme Identification of Piping Systems".

B. Location and visibility for pipe identification:

1. On all horizontal runs spaced twenty feet (20') maximum but not less than once in each room at entrance and exit of each concealed space.
2. At each branch and riser takeoff.
3. Within one foot ('1') of each valve and control device.
4. At every change in directional flow.
5. At every pipe passage through wall, floor and ceiling construction.
6. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.
7. At all wall and ceiling access
8. Near major equipment items and other points of origination and termination.
9. Attention shall be given to visibility with reference to pipe markings. pipe lines are located above or below the normal line of vision, the lettering be placed below or above the horizontal centerline of the pipe.

C. ANSI Color Coding of Piping:

<table>
<thead>
<tr>
<th>Service</th>
<th>Color of Field</th>
<th>Color of Text</th>
</tr>
</thead>
</table>

H&M Mechanical Group
Project No. 08023.03
PLUMBING
15400 - 19
<table>
<thead>
<tr>
<th>Domestic Cold Water</th>
<th>Green</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Domestic Hot Water Return</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Industrial Cold Water</td>
<td>Green</td>
<td>Black</td>
</tr>
<tr>
<td>Industrial Hot Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Industrial Hot Water Return</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Deionized Water</td>
<td>Green</td>
<td>Black</td>
</tr>
<tr>
<td>Lab Air</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Lab Vacuum</td>
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<td>Black</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Non Potable Water</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Sanitary Vent</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Condensate Drain</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Storm Drain Overflow</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Acid Waste</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Acid Vent</td>
<td>Yellow</td>
<td>Black</td>
</tr>
</tbody>
</table>

D. Size of Legend Letters:

<table>
<thead>
<tr>
<th>Outside Diameter of Pipe or Covering</th>
<th>Minimum Length of Color Field</th>
<th>Minimum Size of Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾&quot; to 1 1/4&quot;</td>
<td>8&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>1 1/2&quot; to 2&quot;</td>
<td>8&quot;</td>
<td>⅜&quot;</td>
</tr>
<tr>
<td>2 1/2&quot; to 6&quot;</td>
<td>12&quot;</td>
<td>1 ¼&quot;</td>
</tr>
<tr>
<td>8&quot; to 10&quot;</td>
<td>24&quot;</td>
<td>2 ½&quot;</td>
</tr>
<tr>
<td>Over 10&quot;</td>
<td>32&quot;</td>
<td>3 ½&quot;</td>
</tr>
</tbody>
</table>

E. All exposed water piping and valves downstream of devices shall be properly identified and labeled as "Non-Potable" water.

2.21 VALVE TAGS

A. All valves shall have brass identification tag as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, Brass valve identification tag secured with brass chain and "S" hook. Tags shall bear the service identification and numerical identification of the valve.

B. Engrave identification tags with "normally open" (green) or "normally closed" (red).
C. **Tags:**

1. Minimum two inches (2") square pattern for plumbing and two inches (2") triangle for fire protection.
2. No. 18 BS gauge brass with stamped numbers and letters filled in with black enamel paint. Engraving, ink, dye and vinyl fill are not acceptable.
3. Identifying number and system letter. Top line shall be ¾" characters and should abbreviate the service. Example: Hot Water – HW. The second line shall be characters and should list the valve number. Example: 1st floor shall begin 101, second floor begin 201.
4. Attach 6”-12” of brass jack chain around bonnet or stem of the valve in a way that it cannot accidentally come off. Attach appropriate size brass “S” hook to the chain in the most conspicuous location. Hang valve tag from the “S” hook. Valve tag should not be attached to the wheel causing interference with valve operation.
5. Provide on: All valves and controls.

D. Where shut-off valves are installed on-branch line leading to emergency safety equipment (emergency showers and eyewashes), the valves shall be locked in the open position labeled for identification.

2.22 **EQUIPMENT IDENTIFICATION**

A. Provide engraved plastic nameplates on all plumbing equipment, including but not limited to the following: Pumps (all types), water heaters, heat exchangers, and tanks. Provide nameplates on each piece of equipment and at the disconnect, and also the breaker. Nameplates shall to the following, provided the equipment accommodate the sizes outlined:

1. Black background with white lettering.
2. Sizes: Equipment 2” x 4", disconnect 1” x 2½", breaker 1” x 3”.
3. Lettering shall be ¾” (¼” minimum) or sized for the maximum per nameplate.
4. Nameplate shall be provided with both adhesive backing and screw holes to insure permanent application.
5. Material shall be 2 ply 1/16” thick with beveled edges.

B. Properly identify each piece of equipment and controls pertaining thereto by nameplates mounted on equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable. Install with corrosion resistant mechanical fasteners and adhesive and seal with clear lacquer.

C. Place warning signs on machines driven by electric motors which are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders.

D. Small devices, such as pumps, may be identified with tags.

E. Identify control panels and major control components outside panels with nameplates.

F. Identify equipment out of view behind access doors, in unfinished rooms on the face of the access door.

G. Emergency Safety Equipment: Emergency units shall be with highly visible signs in accordance with ANSI 2358.1 and shall comply with the provisions of ANSI 2535.1 through ANSI 2535.5. Signs shall utilize a white background with green lettering. Graphics and lettering shall be of the correct size and format. Signs shall be furnished by manufacturer of the safety equipment and shall be in accordance with manufacturer's instructions and ANSI standards.
2.23 VALVE AND EQUIPMENT CHARTS

A. Provide five typewritten schedules giving numbers, service and locations, and notations of open or closed, of all tagged valves. Enclose each schedule in separate transparent plastic binder. List piping systems with symbol and color coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines. Schematic flow diagrams of each piping system indicating:

1. Location and function of each tagged valve.
2. Type, size and essential features of each system.

B. Submit drafts of valve schedule for review before preparing final sets.

C. Frame five copies of reviewed schedule under glass, mount where directed.

D. Provide typewritten list of equipment in triplicate, indicating location, service for each piece of equipment, suitably framed, with glass front.

2.24 STRAINERS

A. Wye type, with Monel or stainless steel strainer cylinder and gasketed machined strainer cap, bronze body, threaded, 250 pound, C.M. Bailey No. 100-B, or equal.

2.25 FLEXIBLE CONNECTORS

A. All equipment, either rigidly mounted or mounted on vibration isolators, shall be attached to the piping system using flexible connectors designed for seismic movement. Flexible connectors shall be capable of movement in the ±X, ±Y and ±Z planes and must completely isolate the equipment from the piping.

B. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings. For potable water service, connectors shall be classified in accordance with 61-1977 standards.

C. Flexible connectors attached to fuel gas lines, shall be specifically manufactured for gas applications and certified by the American Gas Association.

D. Flexible connectors shall be flexible corrugated hose and braid, stainless steel, rated, 125 psi minimum, 150 lb flange for pipe sizes 2-1/2" and larger, and threaded ends for 2" and smaller, as manufactured by The Company, or equal. Provide flexible metal hose assembly as shown on the drawings.

2.26 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated.

1. Plumbing Fittings, trim and accessories:
   a. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves or dispensing devices of type and size indicated. Include manual shutoff valves and connecting stem pipes to permit outlet
servicing without shut-down of water supply piping systems. Stop valves shall be provided at each fixture.

b. Vacuum Breakers: provide with flush valves and water outlets equipped for hose attachment.

2. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, discoloration or other imperfections on finished units are not acceptable.

3. Where piping, fittings, trim and accessories are exposed or semi-exposed provide bright chrome plated or polished stainless steel units. Provide copper or brass where not exposed.

4. Escutcheons: Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons. Provide box style escutcheons for p-trap penetrations. Stainless Steel:

5. Stainless steel fixtures conforming to ANSI A112.19.3M. Type 302/304, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces, or as indicated.

6. Vitreous China: White vitreous china unless otherwise noted. Fixtures conforming to ANSI A1 High quality, from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C-554.


8. Traps: Lavatory and sink p-traps shall be commercial grade, chrome plated cast brass body with cleanout, with 17-gauge brass adjustable wall bend, cast brass nipple, 17-gauge tube, and cast brass slip nuts. No reducing washers allowed. Trap shall be provided with forged brass with brass box style escutcheon. Traps to have a 2" water seal and rough-in complete. Trap adapter extensions are not allowed. P-trap shall be Commercial, or Commercial.

9. Trap shall be by CSA or other recognized testing authority and bare manufacturers name. Lavatory and sink water supply shall be commercial grade and include chrome plated all brass stops with all brass (no plastic stems allowed). Kits shall have chrome plated flexible copper risers and deep forged brass with setscrew flange, and have EPDM washers. Met shall be IPS with chrome plated nipple. Supply riser lengths to conform to fixture manufacturers recommended rough-in dimensions. Outlets shall be compression. Stops shall be certified to 200 psi line pressure. Supply kit shall be certified by CSA or other recognized testing authority, bare manufacturers name and complies with the SDWA (Safe Water Act) "No Lead" restrictions of ANSI NSF 61 Sec.9. Supply kits shall be Brasscraft Commercial, McGuire, or Zurn Commercial.

10. Lavatory grid drains to have chrome plated cast brass strainer (with overflow for lavatories with overflow drains) with brass lock nut. Drain tailpiece shall be seamless brass tube and a 6" long. Provide offset type for ADA accessible fixtures. Grid drain shall be Commercial, and be certified by CSA or other recognized testing authority. Drain body shall bear manufacturers name so as to be visible after installation.

11. Product submittals for p-traps and lavatory grid drains shall include documentation that product is CSA listed or other recognized testing authority. Product for fixture faucets and water supplies shall include documentation that product is ANSI 61 Sec.9 compliant. Include documentation indicating that water stops are certified to 200 psi line pressure.

12. Water Connections: Shall have rigid metal to metal connections. Slip joints utilizing non-metallic washers are not permitted. All fixtures shall have stops or valves. Corrugated tubing or braided hose supply risers are not acceptable. All stops shall be lock-shield type, unless otherwise noted.

13. Provide Schedule 40 red brass nipples at copper lines serving fixtures. Galvanized nipples are not allowed.

14. Carriers: Fixture supports for all off-floor plumbing fixtures conforming to ANSI A1 Provide floor mounted commercial grade cast-iron supports for fixtures of either graphitic gray iron, ductile iron, malleable iron, or steel as indicated. Carriers for water closets shall be rated to support loads of up to 500 lbs. Submittals indicate that water closet carriers can meet this requirement. Provide cast iron nipples and couplings for water closets and urinals. ABS is not acceptable. Carriers shall be manufactured by J.R. Wade, or Zurn.

15. Backing: For fixtures other than those specified to be furnished with carriers, 1-1/4" x 6" wide steel flat plate welded to steel studs or secured to brick or concrete, drilled and tapped to match
hanger. Also install backing where bottom of fixture meets wall. Bolt fixtures to backing through holes in fixture casting.

16. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

17. Faucets: Provide with renewable cartridges. Aerators are not permitted on any faucet. All faucets shall be fitted with approved flow control devices to limit flow to the following maximum rates, unless otherwise noted:
   a. Public Lavatories (Non-Metered): 0.5 GPM.
   b. Private Lavatories (Non-Metered): 2.2 GPM
   c. Lavatories (Metered): 0.25 gallons per use.
   d. Sinks (Non-Metered): 2.2 GPM
   e. Sinks (Metered): 0.25 gallons per use.

18. All water closets shall utilize a maximum of 1.60 gallons per flush, and all urinals shall utilize a of 1.60 gallons per flush.

19. All lavatory and sink trim on wheelchair accessible fixtures shall be covered with a white antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for drain tailpiece, drain offsets, all p-trap components and hot and cold water supplies including supply risers. Insulation kits shall be "Lav Guard", or Zurn.

2.27 THERMOSTATIC VALVES

A. Shower valves: Valves shall be a thermostatic and/or pressure balancing type meeting the performance requirements of ASSE 1016 -Type T/P and/or Type P, compensating for 50% fluctuations in supply line pressure, and compensate for increases in hot water supply temperature. Valves shall be capable of supplying mixed water temperature to within 5°F of hot water supply temperature. Valve shall have an all cast bronze housing and include a temperature limit stop factory set at 110°F and factory installed check stops. Valves shall be Powers "HydroGuard T/P" Series, or equal. Field test and verify temperature setting and make adjustments as necessary to maintain specified outlet temperature.

B. Master mixing valves: Valves for tempered water control shall be a thermostatic type, capable of maintaining water temperature to a set point of plus or minus 5°F within the range of 40°F to 160°F. Valve must compensate for temperature fluctuations due to inlet temperature, or pressure changes. It shall have bronze body construction with non-corrosive parts. Valve construction shall employ poppets which are independently seated, balanced, and self-aligning. Valve must have an expandable restrictor and a quick acting actuator in order to guarantee precise control when tested in accordance with ASSE 1017 and CSA B125. Dial thermometer, union inlets with strainers and check stops shall be provided. Mixing valves shall have flow capacities at pressure drop across valve as scheduled on the drawings. Valves shall be Powers "HydroGuard Single Valve Hi-Lo", or equal. Field test and verify temperature setting and make adjustments as necessary to maintain specified outlet temperature.

C. Point of use mixing valves: Valves for under the counter (single fixture use) shall be a thermostatic type made of solid brass and all internal parts shall be stainless steel or other corrosion material. Valve shall be CSA B125 and meet the requirements of ASSE 1016. The capacity of the valve must be at least 3.65 gpm @45 psig differentials, and must control down to 0.5 gpm. Control temperature must be adjustable between 90 and 110°F, with a nut to prevent unauthorized or accidental adjustment. The valve shall contain integral checks to prevent cross flow. Valves shall be a Powers Model 480, or equal.

1. Where single temperature tepid water is provided at a lavatory or sink faucet, set mixing valve at 105°F maximum, unless otherwise indicated. Field test and verify temperature setting and make field adjustments as necessary to maintain specified outlet temperature.
2. Where hot and cold water is provided at a lavatory or sink faucet, set mixing valve at maximum, unless otherwise indicated. Field test and verify temperature setting and make adjustments as necessary to specified outlet temperature.

D. Safety Equipment: Valves for supplying tepid water to emergency safety equipment shall be a thermostatic type. It shall have bronze body construction with non-corrosive parts and have a powerful filled temperature element, with dual internal cold water by-pass to ensure flow in the event of valve failure or loss of hot water supply. The valve shall provide precise temperature control over a wide range of flow conditions in accordance with ASSE 1017 and shall be ANSI 1998 compliant. By-Pass shall respond to changes in temperature and pressure. Dial thermometer, union inlets with strainers and check stops shall be provided. Valves are to be factory set at 85°F. Field test and verify temperature setting and make field adjustment as necessary to maintain specified outlet temperature. Provide steel cabinet where specified. Valves shall be a Powers “Hydroguard” XP Series, or equal.

PART 3 - EXECUTION

3.1 DRAWINGS AND SITE

A. Drawings:

1. All scaled and figured dimensions are approximate and are given for estimate purposes only. Before proceeding with any work, carefully check and verify all dimensions, sizes, lengths, etc.
2. So far as possible the work has been on the drawings in such positions as to suit and accommodate the work of the other trades, but the work as indicated is largely diagrammatic and is shown primarily for clarity. Contractor is responsible for the correct placing of their work and the proper location and connection of work in relation to the work of other trades.
3. Where apparatus and equipment have been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the drawings to see that the equipment will fit into the spaces provided.
4. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
5. Contact Owner’s Representative before any digging and investigate and all existing conditions. Secure permit from Owner’s Representative prior to initiation of underground excavation.

3.2 GENERAL PIPING INSTALLATION

A. Carry all exposed and concealed horizontal lines of pipe on specified hangers properly spaced and set to allow the pipe to adjust for expansion and contraction. Use trapeze hangers for supporting groups of pipes. Piping in parallel shall be evenly spaced and supported.

B. Conceal all piping in furred walls and partitions and pipe spaces except where specifically noted otherwise. Check all piping runs beforehand with all other trades. Run piping to maintain proper clearance for maintenance and to clear opening in exposed area. Run piping in strict coordination with mechanical piping, ducts, and equipment, plumbing work, all electrical conduit and equipment, structural, and architectural conditions. Where work of other trades prevents installation of the piping as shown on the Drawings, reroute piping at no extra cost. Verify all inverts in pitched lines before starting work.

C. Install all exposed piping parallel to or at right angles with building walls and tight to walls or ceilings wherever possible, except where otherwise shown on the Drawings.

D. No valve and no piece of equipment or trim shall support the weight of any pipe.
E. Support all pipe from the building structure so that there is no apparent deflection in pipe runs. Fit piping with steel sway braces and anchors to prevent vibration and/or horizontal displacement under load when required. Do not support pipe from or brace to ducts, other pipes, conduit, or any materials shown on the Drawings. Piping or equipment be immobile and shall not be supported or hung by wire, rope, plumber’s tape or blocking of any kind.

F. Install all piping free from traps and air pockets and true to line and grade.

G. Wherever changes in sizes of piping occur, make such changes with reducing fittings, as the use of face bushings will not, in general, be permitted. Install eccentric reducing fittings where necessary to provide free drainage of lines.

H. Furnish and install insulating unions or insulating flanges as hereinbefore specified at all connections of ferrous and non-ferrous piping.

I. Fire stop all pipes penetrating fire rated construction in accordance with specification section 07270, Fire Stopping and Smoke Seals.

J. No cutting, or drilling of structural members shall be done without prior written approval of structural engineer.

K. Rough-In Work: Proceed as rapidly as the building construction will permit. All piping shall be completed, tested and approved before being enclosed.

L. Thoroughly clean piping before installation. Cap all pipe openings to exclude dirt until fixtures are installed and final connections are made.

M. Provide a drip at any point in the gas lines where condensate may collect. All drips shall be readily accessible to permit cleaning or emptying.

N. Show no tool marks or threads on exposed plated, polished or enameled connections to fixtures.

O. Provide each connection to faucet or fixture with an air chamber, eighteen inches (18") long, placed in a vertical position and one (1) pipe size larger than the pipe served.

P. Pitch: Horizontal sanitary and storm drain piping shall be installed at a uniform grade of not less than one-fourth inch (¼") per foot, unless otherwise indicated or directed.

Q. Contraction and Expansion: Install all work in such a manner that its contraction and expansion will not do any damage to the pipes, the connected equipment, or the building. Install offsets, swing joints, expansion joints, seismic joints, anchors, etc., as required to prevent excessive strains in the pipe work. All supports shall be installed to permit the materials to contract and expand freely without putting any strain or stress on any part of the system. Provide anchors as necessary.

R. Equipment and Fixtures Furnished under other Sections: For rough-ins and connections to fixtures and equipment furnished under other sections, ascertain exact sizes, services and locations, before starting work. Verify accuracy of work shown on drawings before starting work. Contractor is responsible for providing proper installation. Provide proper protection on all hot and cold water service.

S. All piping shall be installed within designated finished and open ceiling heights as noted on the architectural drawings.

T. Coordinate the installation of access panels with the equipment valve being served. Valves and equipment located in ceiling spaces shall be accessible and located no more than 2'-0" above the access panel and
within arm reach. Distances greater than 2'-0" only allowed when it is not possible to meet the 2'-0" requirement. Approval from the Owner's representative shall be obtained for such installations.

U. Provide membrane clamping device for all piping drains and hose bibbs passing through any waterproof membrane.

V. Powder actuated fastening systems will not be allowed. Embeds, beam clamps, or drilled fasteners will be required, unless otherwise noted. Earthquake bracing shall be required for all piping.

W. All piping into stem walls and footings shall be double half lap wrapped with one-eighth inch (5/64") thick "Armaflex" insulation. The Contractor shall also provide blocked out areas in stem wall and footing as required for the installation of the piping. All piping shall avoid the lower eight inches (8") of the footing and the Contractor shall coordinate and provide dropped footings as required for the installation of the underground piping.

X. All piping on roof shall be anchored to 4" x 4" redwood blocking with pipe straps. Blocking shall be set in mastic at 6'-0" on center.

Y. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

3.3 INSTALLATION OF LABATORY WASTE AND VENT PIPING SYSTEMS

A. All material shall be installed in accordance with the manufacturer's instructions and in compliance with the International Plumbing Code and all applicable local codes.

B. Each length of pipe in a horizontal run shall be supported by a hanger. If the line consists in part of fittings, supports shall be placed no farther than five feet (5') apart. P-Traps must be supported individually. Supports shall be placed directly beneath horizontal fittings that connect to the stack. Vertical lines of pipe shall be supported at intervals not to exceed ten feet (10'). Hangers shall not clasp the pipe so tightly as to prevent normal lateral movement due to expansion. Test in accordance with all applicable code requirements. Prior to testing, Bell & Spigot and Mechanical Joint piping shall be filled with water and allowed to sit for twenty-four (24) hours.

1. Above Grade Piping: Piping and fittings located in air plenums shall be smoke-proof and non-combustible, in compliance with the flame and smoke spread ratings of ASTM E84.

2. Below Grade Piping: A trench shall be excavated so as to provide adequate room to make joints, align, and grade the pipe. The trench bottom shall be properly compacted and rock-free and shall support the pipe throughout its entire length. Fill material shall be applied in layers not exceeding 6 inches loose depth and each layer shall be thoroughly compacted. The first 6 inches of fill material shall be rock-free.

3.4 PIPE JOINTS

A. Joints: Ream pipe ends to remove burrs, inspect each length of pipe carefully and remove all obstructions prior to fabrication.

B. Screwed Piping: Cut with machine cutter, hand pipe cutter or carborundum pipe wheel with file or scraper or pipe reamer. Do not ream to exceed I.D. of pipe and thread to ANSI B2.1 requirements. Use Teflon tape on male thread prior to joining other services. No more than two full threads shall remain exposed after joining. Teflon tape shall not be used on steam trap piping.
C. Copper Tubing: Cut square; remove burrs and clean pipe and inside of fitting to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing. Remove internal parts of solder-end valves prior to soldering. Provide dielectric unions at points of connection of all copper tubing and any ferrous piping and equipment.

D. Threaded Joints: Use threaded joints for natural gas pipes of size 2 inches and smaller. Where possible use pipe with factory-cut threads, otherwise cut pipe ends square, remove all fins and burrs, and cut taper pipe threads per ANSI B2.1. Threads shall be smooth, clean, full-cut. Apply thread tape to male threads only. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than two threads remain exposed. Use unions for connections to valves for which a means of disconnection is not otherwise provided.

E. Welded Joints: Use welded joints for natural gas piping of sizes larger than two inches and all fuel oil piping. Weld by the shielded metal-arc process using covered electrodes and in accordance with procedures established and qualified per ANSI B31.2. Each welder and welding operator shall be qualified for the ANSI procedures as evidenced by a copy of a certified ANSI B31.2 qualification test report. Contractor shall conduct the ANSI qualification test.

3.5 PIPE SUPPORTS

A. Maximum hanger spacing and rod sizes for horizontal runs of piping shall be as given below:

<table>
<thead>
<tr>
<th>Pipe Size Inches</th>
<th>Rod Size Inches</th>
<th>Steel Pipe</th>
<th>Copper Tubing</th>
<th>Cast Iron Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and smaller</td>
<td>3/8</td>
<td>6</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>1¼</td>
<td>3/8</td>
<td>10</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3/8</td>
<td>10</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2½ -- 3</td>
<td>½</td>
<td>10</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>4 -- 6</td>
<td>¼</td>
<td>10</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Over 10&quot;</td>
<td>7/8</td>
<td>10</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

B. Every branch of piping over three feet (3') long shall have a separate hanger. Support at each horizontal branch connection. Provide at least one (1) hanger per branch.

C. Support all suspended piping with clevis or trapeze hangers and rods.

D. Hangers and supports shall be adequate to maintain alignment and prevent sagging and shall be placed within eighteen-inches (18") of a joint. Support shall be provided at each horizontal branch connection. Hangers shall not be placed on joints. Make adequate provision to prevent shear or twisting of the pipe or joint.

E. Support for cast iron no-hub pipes shall be adjacent to joint, not to exceed eighteen inches Provide hangers on the piping at each side of and within eighteen inches (18") of a no-hub pipe coupling so that the coupling will not bear any weight. Provide supports at every other joint, unless over four feet (4') then support on each side of the coupling within eighteen inches (18") of the joint. Hangers shall not be placed on the coupling. Provide hangers adequate to maintain alignment and prevent sagging of the pipe. Make adequate provision to prevent shear or twisting of the pipe or joint.
3.6 CLEANOUTS

A. Size: Cleanouts of same nominal size as pipe they serve, except where they occur in piping four inches (4") and larger, in which case they shall be four inches (4") in size.

B. Accessibility: Make all cleanouts accessible. Use graphite on all cleanouts with all threads being thoroughly greased after acceptable pressure test.

C. Cleanouts Locations:
   1. Where indicated on drawings and as noted. Exact locations as directed by the Representative.
   2. At all horizontal offsets.
   3. At ends of or storm drain lines more than five feet (5') in length.
   4. At one-hundred feet (100') maximum intervals on all or drain horizontal runs within the building lines.
   5. At base of all soil/waste stacks and storm drain lines.
   6. For cleanouts in finished portions of building, locations subject to Owner Representative's approval before installation.
   7. Do not locate floor and wall in patient rooms, electrical rooms and elevator machine rooms.

3.7 ROOF OPENINGS

A. Flash each pipe extending through roof with properly sized lead flashing assembly. Make watertight. Install vent caps on all vents through roof.

3.8 PLUMBING FIXTURE ROUGH-INS

<table>
<thead>
<tr>
<th>Fixture</th>
<th>Waste</th>
<th>Vent</th>
<th>Cold Water</th>
<th>Hot Water</th>
<th>Tepid Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinks</td>
<td>2&quot;</td>
<td>1 ½&quot;</td>
<td>½&quot;</td>
<td>½&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>Showers</td>
<td>2&quot;</td>
<td>1 ½&quot;</td>
<td>½&quot;</td>
<td>½&quot;</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: branch lines shall not be longer than 5'-0".

3.9 PLUMBING FIXTURES INSTALLATION

A. Installation: Set Fixtures level and in proper alignment with respect to walls and floors, and sets of fixtures equally spaced. Install supplies in proper alignment with fixtures and with each other. Install flush valves in alignment with the fixture without vertical or horizontal offsets.

B. Seals: Seal all wall and floor mounted fixtures watertight where fixture is in contact with wall or floors. Fill all cracks and open spaces between fixtures and wall or floor with non-elastomeric sealer. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

C. Caulking: Caulk all deck mounted trim at the time of assembly, including fixture and casework mounted. Caulk all self-rimming sinks installed in casework.

D. Trim: Make up trim with care and with the proper tools in order that no tool marks show after installation.
E. Bolt carrier base supports to floor in accordance with manufacturer's installation instruction and recommendations.

F. Metered Faucets: Test and adjust all metered faucets for proper flow, duration of cycle. Metered faucets shall not exceed 0.25 gallons of water use per usage.

G. Extra Stock: Furnish special and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten (10) units.

H. Installation of emergency safety equipment (emergency showers and eyewashes): Install emergency safety equipment in conformance with ANSI 2358.1-1998. Locate identification signs in accordance with this standard. Where shut-off valves are installed in the branch line leading to emergency safety equipment, the valves shall be indicating type (OS&Y or ball valve with lever handle), labeled for identification, and locked in the open position.

3.10 TESTING AND ADJUSTING

A. Provide all equipment required for testing, including fittings for additional operating. Plumbing Inspector shall be present at time of testing.

B. After the inspection has been approved or portions thereof, certify in writing the time, date, name and title of the person reviewing the test. This shall also include the description of what portion of the system has been approved.

C. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job site.

D. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner's Representative before final payment is made.

E. Defective work or material shall be replaced or repaired, as necessary, and the inspection and test repeated. Repairs shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

F. Protection: Isolate all equipment subject to damage from test pressure. Make no test against a service valve or meter.

G. No part of any work shall be concealed or covered until after it is inspected, tested and approved by the Inspector. All piping for plumbing shall be completely installed and tested as required by the Plumbing Code. The test pressures indicated are a minimum only. All tests shall be as required by the governing authority as well.

H. Sanitary Waste and Vent; Waste and Vent; and Drain Piping Systems: No-hub joints shall be tightened using a calibrated torque wrench. The water test shall be applied to the system either in its entirety or in sections. The piping shall be tightly plugged and submitted to a ten foot (10') head (4.3 psi) of water located at the highest point. Provide a separate standpipe above the highest point being tested or extend the system to obtain the required ten foot (10') head of water. The water shall be kept for at least thirty (30) minutes before the inspection starts. System shall hold water four (4) hours. Coordinate test tees with wall construction. Test tees shall not interfere with construction. Testing with compressed air or gas is not recommended.

I. Domestic Water; Industrial Water; and Deionized Water Systems: Test the system with water at a hydrostatic pressure of not less than one hundred twenty-five (125) psi. Provide a pressure gauge located at the highest point of the system being tested, with a shutoff valve and bleeder valve so arranged to
check gauge operation. When the piping system operates at higher pressure than seventy-five (75) psi, the hydrostatic test pressure shall be fifty (50) psi above the operating pressure. The test shall be applied not less than 1 hour prior to inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately as specified for the entire system. There shall be no drop at the end of four hours.

J. Natural gas piping: For gas pressures up to and 14 inches water column, the piping shall be subjected to an air pressure test of not less than ten (10) psi gauge pressure and shall be held for a length of time satisfactory to the Administrative Authority, but in no case less than four (4) hours. For gas pressures in excess of inches (14") water column and welded metal pipe, the test pressure shall be not less than sixty (60) psi gauge pressure and shall be continued for a length of time satisfactory to the Administrative Authority, but in no case less than four. For underground gas pipe, the test pressure shall be not less sixty (60) psi gauge pressure and shall be continued for a length of time satisfactory to the Administrative Authority, but in no case for less than four hours. Tests shall be made using air, CO2, or nitrogen pressure only and shall be made in the presence of the Plumbing Inspector. Test gauges used in conducting tests shall comply with the Plumbing Code.

K. Apply tests for a minimum period of four (4) hours or tests are complete.

L. Work may be tested in sections, if necessary, for convenience. In this case, test of last section shall include connections between previously tested sections and section under test.

M. Furnish all labor and all other utilities required to make tests. Make compliance tests in the presence of the Owner's Representative.

N. Should any piece of equipment, apparatus, materials, or work fail in any of these tests, immediately remove and replace by perfect material, and retest the portion of the work replaced.

3.11 PIPE DISINFECTION AND CLEANING

A. Supervision and Testing: Supervision and Testing: Perform disinfection under Plumbing Inspector's supervision. Disinfection shall be subject to written approval upon receipt of satisfactory laboratory test results.

B. Contractor's Responsibility: Furnish labor, equipment, materials and transportation to disinfect domestic hot and cold water systems and fire lines directly connected thereto, in conformity with procedures and standards described herein.

C. Disinfecting Agent: Use an aqueous solution of sodium of calcium hypochlorite having at least 5.25% available chlorine. The use of powered hypochlorite is prohibited unless specifically approved by Health Department.

D. Preliminary Preparations:

1. Service Cock: Provide within three feet (3') of the entrance of the supply main to the building, a three-fourths inch (3/4") service cock, or valve, for the purpose of introducing the disinfecting agent into the lines.
2. Flushing: After final pressure tests and before draining for disinfection, open each fixture or outlet until the water flow is clear.

E. Disinfection Procedure:

1. Drain entire domestic water system including fire line.
2. Post suitable warning signs at each outlet: "Warning Do Not Use Water System Being Chlorinated".
3. Inject disinfection solution into the system through the service cock by means of a pump, or other pressure device, at a slow continuous rate, simultaneous with a reduced flow the water main, until the orthotolidine test for residual chlorine at each outlet shows a concentration of at least 50 ppm.

F. Close all outlets and valves, including the service valve at the main and the injection cock. Retain the chlorinated water in the system for twenty-four (24) hours.

G. After the twenty-four (24) hour holding period, the residual chlorine concentration shall be not less than fifty (50) ppm as shown by the test.

H. Drain and flush entire domestic water system until orthotolidine tests show a residual chlorine concentration of not more than 0.5 ppm at any outlet.

I. Health Department will take samples of water for the determination of bacteriological quality.

J. Standards Necessary for Approval:

1. The water system shall have been uniformly chlorinated under the supervision of Plumbing Inspector.
2. The results of water sample analysis shall be negative for the Aerogenes organisms, with a coliform MPN of less than 2.2 and a total plate count of less than 100 bacteria per milliliter.
3. If the test for the bacteriological quality of the water in the system does not meet the standards, repeat the disinfection procedure until the specified standards are met.

K. Final Approval: Health Department will give written approval for acceptance and use of the water system after the above procedures have been successfully completed and the standards met.

L. For temporary hook-ups, use the following disinfection procedure: This procedure is also to be used on repair of and ductile iron water mains. All fittings and piping are to be disinfected.

1. Hoses to be used only for potable water use.
2. Hoses to be used must be stored in a clean, dry area.
3. Disinfectant mixture = one-half (½) cup HTH to three (3) gallons water.
4. Fill hose with disinfectant mixture and hold for one (1) hour.
5. Flush hose after one hour with clean, potable water.
6. Connect hose, avoiding any contaminant, mud, water, or touching the inside of connections.
7. When through, disconnect and store properly.

M. Upon completion of the work, all records and certifications approving pipe disinfections shall be submitted to the Owner's Representative before final payment is made.

3.12 PROTECTION, CARE AND CLEANING

A. Provide adequate means for, and fully protect, all finished parts of the materials and equipment against physical damage from whatever cause during the progress of this work and until final completion.

B. During construction, properly cap all lines and equipment nozzles so as to prevent of sand, dirt, etc. Protect equipment against moisture, plaster, cement, paint or other work of other trades by covering it with polyethylene sheets.

C. Thoroughly clean exterior and interior of piping, equipment, and materials before systems are put into operation. All systems of any nature shall be thoroughly cleaned and flushed of all pipe contaminates.
such as cuttings, filings, lubricant, rust, scale, grease, solder, flux, welding residue, debris, etc. Any piece of equipment or part of any system which malfunctions or is damaged due to failure or neglect on the of this Division to observe this paragraph shall be repaired or replaced to the satisfaction of the Owner's by and at the total expense of this Contract.

D. After installation has been completed, clean all systems.

1. Piping, and Equipment, Non-insulated or to be insulated: Clean exterior thoroughly to remove most, plaster, cement, and dirt before insulation is applied.
2. Piping and Equipment to Be Painted: Clean exterior of piping, and equipment, exposed in completed structure, removing rust, plaster, cement and dirt by wire brushing. Remove grease, oil, and similar materials by wiping with clean rags and suitable non-toxic solvents. Touch up primer coat as required.
3. Motors, Pumps and Other Items with Factory Finish: Remove grease and oil, and leave surfaces clean and polished.
4. Plumbing Fixtures: Clean and polish fixtures immediately prior to final inspection of Owner Representative's occupancy. Clean floor drain grates, faucet aerators and outlets, check each fixture to insure against trap stoppage.
5. Chrome or Nickel Plated Work: Thoroughly polish.
6. Factory Finished Items: Remove grease and oil and leave surfaces clean and polished.

E. All code stamps and nameplates shall be protected from damage and must be clean and legible before final inspection.

F. All piping shall be flushed out or blown out after pressure testing is complete and before being put into use. All strainer screens shall be removed and cleaned.

G. After start-up and testing, strainer screens shall again be removed and cleaned.

3.13 PAINTING AND IDENTIFICATION

A. After completion of hydrostatic tests, all system piping exposed to view in or on the building shall be painted in accordance with Section 09900-Painting.

B. Provide pipe, valve, and equipment identification, and signage in accordance with referenced standards, codes and specifications.

3.14 ACCESSIBILITY

A. The installation of valves, thermometers, gages, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement shall be conveniently and accessibly located with reference to the finished building.

3.15 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause any to be covered up or enclosed until inspected, tested and approved.
3.16  EMERGENCY REPAIRS

A. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantee bond or relieving the Contractor of their responsibility during the bonding period.

3.17  CLEANINGUP AND REMOVAL OF SCRAP

A. For work under all Mechanical Sections, trash and scrap shall be cleaned up and removed from the site as the work progresses.

3.18  PRELIMINARY OPERATIONS

A. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

3.19  GUARANTEE

A. At completion, furnish the Owner's Representative a written guarantee, in triplicate, that work has been performed in accordance with Drawings and Specifications and to replace or repair, to the satisfaction of the Owner's Representative any portion of the work that fails within the guarantee period after final acceptance provided such failure is due to Also agree to replace or repair, with like any part of the building or equipment installed by other trades but damaged by them in installing their work.

B. During the guarantee period, make four (4) inspections of the work at six (6)-month intervals after final acceptance to check the performance of systems and correct any guaranteed items. Inspections to be made in the presence of the Owner's Representative.

C. Guarantee in writing all plumbing work for a period of twenty-four (24) months following date of certificate of final acceptance.

D. All apparatus shall be built and installed so as to deliver its full rated capacity at the efficiency for which it was designed.

E. All plumbing and electrical apparatus shall operate at full capacity without objectionable noise or vibration.

F. The plumbing systems shall provide the performance required at standard operating conditions.

G. Where a manufacturer's exceeds one (1) year, the longer guarantee/warranty shall govern.

3.20  TRAINING

A. Submit a written test schedule to the Owner's Representative for approval a minimum of three (3) weeks prior to proposed training dates.

B. Provide three (3) sessions of two (2) hours each of instruction to the Owner with regard to proper use and operation of the system. Submit a written course outline and a sample of all manuals to be used two (2) weeks prior to the scheduling of the training. Training shall include both classroom and "hands-on"
sessions and shall occur after final inspection and testing. Location and timing of the training session is to be arranged with the Owner's Representative.

C. Two weeks prior to scheduled training dates, furnish the Owner's Representative with six (6) bound copies of complete instructions, including catalog cuts, diagrams, drawings, and other descriptive data covering the proper testing, and maintenance of each type of system installed, and the necessary information for ordering replacement parts. In addition, post one (1) copy of complete instructions at the control panel location.

D. Session shall include detailed training and instructions covering the necessary and recommended testing, operating, and maintenance procedures for each type of system. Session shall include training and instructions covering the emergency operation procedures for type of system.

E. Session shall include training and instructions covering the emergency operation procedures for each type of system.

END OF SECTION
SECTION 15704 - WATER TREATMENT (HVAC)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Cleaning and treatment of circulating HVAC water systems.
   1. Cleaning compounds.
   2. Chemical treatment for closed loop heat transfer systems.

1.2 RELATED WORK

A. Section 15010, GENERAL MECHANICAL PROVISIONS.
B. Section 15705, PIPING SYSTEMS (HVAC).

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE in Section, GENERAL MECHANICAL PROVISIONS.
B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than four service calls and written status reports. Minimum service during construction/start-up shall be 8 hours.

1.4 SUBMITTALS

A. Manufacturer's Literature and Data.
   1. Cleaning compounds and recommended procedures.
   2. Chemical treatment for closed systems.
B. Water analysis verification
C. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4, May 1969.
D. Maintenance and operating instructions in accordance with Section 15010, GENERAL MECHANICAL PROVISIONS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. National Fire Protection Association (NFPA):

C. U.S. Department of Labor:

PART 2 - PRODUCTS

2.1 CLEANING COMPOUNDS
   A. Alkaline phosphate or nonphosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.
   B. Refer to Section, PIPING SYSTEMS (HVAC), PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS (SPACE HEATING HOT WATER).
   A. Inhibitor: Use inhibitor that is currently used by the owner. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.
   B. pH Control(Heating System only): Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.0.
   C. Performance: Protect various wetted, coupled, materials of construction including ferrous, and red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0.5; brass, 0.2; copper, 0.15. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of, respectively, not less than 250 and 125 degrees Fahrenheit. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.
   B. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.
   C. Perform tests and report results in accordance with Section 15010, GENERAL MECHANICAL PROVISIONS.
D. Instruct owner's personnel in system maintenance and operation in accordance with Section 15010, GENERAL MECHANICAL PROVISIONS.

END OF SECTION
SECTION 15705 - PIPING SYSTEMS (HVAC)

PART 1 - GENERAL

1.1 DESCRIPTION
   A. Water piping to connect HVAC equipment, including the following.
      1. Heating hot water piping.

1.2 RELATED WORK
   A. Section 15010, GENERAL MECHANICAL PROVISIONS.
   B. Section 15250, MECHANICAL INSULATION.
   C. Section 15704, WATER TREATMENT (HVAC).

1.3 QUALITY ASSURANCE
   A. Section 15010, GENERAL MECHANICAL PROVISIONS, which includes welding qualifications.

1.4 SUBMITTALS
   A. Manufacturer's Literature and Data:
      1. Pipe and equipment supports.
      2. Pipe and tubing, with specification, class or type, and schedule.
      3. Pipe fittings, including miscellaneous adapters and special fittings.
      4. Flanges, gaskets and bolting.
      5. Valves of all types.
      7. Flexible connectors for water service.
      8. All specified hydronic system components.
     10. Gages.
     11. Thermometers and test wells.
   B. Coordination Drawings: Refer to Section 15010, GENERAL MECHANICAL PROVISIONS.
   C. As-Built Piping Diagrams: Provide drawing as follows for boilers, pumps, and other central plant equipment.
      1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
      2. One set of reproducible drawings.

1.5 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specification (Fed. Spec.)

C. American National Standards Institute (ANSI).
   B1.20.1-83.......... Pipe Threads, General Purpose.
   B16.5-88............ Pipe Flanges and Flanged Fittings.
   B16.24-79.......... Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.
   B31.1-89............ Power Piping.
   B40.1-85............ Gauges-Pressure Indicating Dial Type - Elastic Element.

D. American Society of Mechanical Engineers (ASME).

E. American Society for Testing and Materials (ASTM):
   B62-86.............. Composition Bronze or Ounce Metal Castings.
   B88-89.............. Seamless Copper Water Tube.

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
   SP-80-87............ Bronze Gate, Globe, Angle and Check Valves.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES.

A. Provide in accordance with Section 15010, GENERAL MECHANICAL PROVISIONS.

2.2 PIPING

A. Heating Hot Water Piping:
   1. 2" and under: ANSI H23.1 Type M, L, or K copper.
   2. Hard temper unless indicated otherwise.
   4. Cast-bronze solder-joint fittings, ANSI B16.8 only in sizes available in wrought copper.
   6. Cast bronze, flanged unions, ANSI B16.24, 150 pounds per square inch class, 2-1/2 inches and larger.

2.3 FITTINGS FOR COPPER PIPE

A. Unions: Nibco No. 633.

B. Dielectric Unions:

C. 2" and smaller:
   1. 250 pounds per square inch in water on gag (WOG).
2. High temperature gaskets for heating.
3. EPCO Model FX.

D. 2-1/2” and larger:

2.4 VALVES

A. Provide in accordance with Section 15010, GENERAL MECHANICAL PROVISIONS and as follows.

B. Ball Valves:

1. Comply with the following standards:

2. For HVAC Hot Water Service:
   a. Soldered Ends 3” and Smaller: 600# W.O.G., forged brass two piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Red-White 5049F, Nibco S-585-70, Stockham S216-BR-RS, Apollo 70-Series.

C. Circuit Balancing Valve:

1. Calibrated bronze with bronze disc balance valve with provisions for connecting portable differential pressure meter as shown on plans. Meter connections to have built-in check valves. An integral pointer shall register degree of valve opening. Each balance valve to be constructed with internal seals to prevent leakage around rotating element.

2. Each balance valve shall be constructed for 300 psig working pressure at a maximum temperature of 250 degrees F. and supplied with preformed polyurethane insulation. Unit to be Armstrong ITT Bell & Gosset Circuit setter Balance Valve or approved equal.

3. All valves to be provided calibrated name plate detailing its flow range through a range of differential pressure readings.

4. Provide one (1) differential pressure gauge to facilitate system balancing which shall become the Owner’s property.

5. Provide circuit setters for pipe sizes 2” and below. Provide flange circuit sensors for pipes 2 1/2” and below. Provide flange circuit sensors for pipes 2 1/2” and above.

D. Pipe Flexible Hose Connectors: Provide Flexonics or equal, Series 300, bronze braided hose with screwed ends through 2” size and Series 400, Type 321 stainless steel braided hose with flanged ends for pipes 2 1/2” and above. Each connector shall be rated for a minimum of 150 PSI working PSI working pressure at 250 degrees Fahrenheit and shall be of sufficient length to allow ¾” offset motion.

E. Control Valves: Furnished under Section 15900 and installed under this Section.

F. Shut-off and balancing valves: All valves marked “Balancing Valves” shall be eccentric plug valve through 4” and butterfly type for valves 5” and above.

1. 2” and under, 175 lb. DeZurik #499, screwed steel: bpdu eccentric plug with 250 degrees Fahrenheit rubber seal ring, oil impregnated bronze bushings, high temperature o-ring stem seal.

2. 2 1/2” through 4”, 175 lb. DeZurik #118, flanged, steel body eccentric valve with 250 degrees Fahrenheit rubber cover plug, stainless steel bearings, operating lever and adjustable open position stop. Provide worm gear operator and wheel for 4” valve size.

3. 5” and above, 150 lb. DeZurik Fig. #660, Centerline, Keystone Fig. 122, ductile iron body butterfly valves with 250 degree Fahrenheit double rubber seat, bronze bearings, #416 stainless steel shaft seals. Valves have an infinite position lever.
4. Valves for equipment isolation shall have lug type bodies and shall provide bubble-tight at full rated pressure. Valves shall be installed with lat side of disc on higher static pressure side of valve.

2.5 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Spherical Connector: Single-sphere or twin-sphere, precision molded of multiple layers of nylon cord and neoprene rated 175 psi working pressure at 220 degrees F.

1. 2-1/2 inches and larger: Provide steel or ductile iron independent (floating) flanges.
2. 2-inches and smaller: Threaded union end connections.

B. Mechanical Pipe Couplings (where shown): Fittings specified in this section.

2.6 HYDRONIC SYSTEM COMPONENTS

A. Pressure Gauges: Weiss Series LF25S liquid filled. Pressure range to shall be determined by the anticipated pressure to be near the middle of the total range.

B. Cocks: All bronze, square head, screwed, 125 lb. WOG. Powell Figure 2202, Walworth 1718F.

C. Strainers:
   1. 2" and smaller: Full pipeline size, 250 lbs. cast iron, with screwed ends and a removable plug type screen retainer. Strainer screen shall be stainless steel or monel screen with 20 mesh openings. Sarco Type AT, Bailer 100A.
   2. 2-1/2" and larger: Full pipeline size, 125 lbs. cast iron, with flanged ends and a bolted screen retainer. Strainer screen shall be stainless steel with 0.045 perforated screen opening.

D. Pete's Plug: Install Pete's Plug with extended neck as indicated and as required.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the Owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. All piping to be new, positively marked for field identification, and installed to allow for free expansion, including tight angle loops, cold springing or other satisfactory method. Lines and risers to be perfectly straight, plumb, true, properly graded and free from depression or pockets. Open ends of all piping to be kept closed during construction.

C. Welding is required on all piping located in building overhangs, underground piping, all piping 2 1/2" and over, and permitted on all or part, of other piping in lieu of screwed joints.

D. Where copper, brass or bronze piping systems are connected to steel or iron piping systems, this connection shall be made with dielectric isolators.
E. Provide steel slip sleeves for all pipes passing through beams and walls of concrete brick, tile or masonry and 22 gauge galvanized iron sleeves for pipes passing through other parts of construction. Provide steel slips for all sleeves penetrating upper floors. Set sleeves 2" above floors of equipment rooms, and caulk so no water leakage can occur between sleeves and floors. Furnish each sleeve having inside diameter 1" larger than outside diameter of covered piping. Openings around pipes penetrating required fire restive rated floor wall and roof assemblies shall be filled solidly with material of fire-resistive rating equal to the required rating of assembly penetrated.

F. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

G. Support piping securely. Refer to PART 3, Section 15010, GENERAL MECHANICAL PROVISIONS.

H. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one-inch minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than one inch in 40 feet. Provide eccentric reducers to keep bottom of sloped piping flat.

I. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

J. Offset equipment connections to allow valve off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

K. Tee water piping run-outs or branches into the side of mains or other branches. Avoid bull-head tees, which is two return lines entering opposite ends of a tee and exiting out the common side.

L. Connect piping to equipment as shown on the drawings.

3.2 PIPE JOINTS

A. Screwed: Threads shall conform to ANSI B2.1; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

B. Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Apply a light coat of cup grease or graphite paste to pipe ends and outside of gaskets to facilitate assembly.

3.3 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.

B. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.
C. Refrigerant gas piping shall be leak tested and comply with appropriate codes. Nitrogen test at 1.5 times design pressure for 1 hour with no loss in pressure unless otherwise noted. Expansion valves and compressor crankcase are not to be part of the pressure test. After pressure testing and lad tested twice blow out with dry nitrogen and charge system with refrigerant, put into operation and test equipment performance.

3.4 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 15704, WATER TREATMENT (HVAC).

1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.

2. Cleaning: Using products specified in Section 15704, WATER TREATMENT, (HVAC), circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 6-feet per second. Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.5 WATER TREATMENT

A. Close and fill system as soon as possible after final flushing to minimize corrosion.

B. Charge systems with chemicals specified in Section 15704, WATER TREATMENT (HVAC).

C. Utilize this activity, by arrangement with the Owner's Representative.

END OF SECTION
SECTION 15820 - DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

   A. This Section includes the following:

   1. Ductwork.
   2. Volume dampers.
   3. Fume hood exhaust valves.
   4. Damper regulators.
   5. Combination fire and smoke dampers.
   6. Duct smoke detectors.
   7. Turning vanes.
   8. Duct silencers.
   9. Duct-mounting access doors.
   10. Flexible connectors.
   11. Flexible ducts.
   12. Duct accessory hardware.

1.3 SUBMITTALS

   A. Product data for the following:

   1. Volume dampers.
   2. Fume hood exhaust valves.
   3. Damper regulators.
   4. Combination fire and smoke dampers.
   5. Duct smoke detectors.
   6. Turning Vanes.
   7. Duct silencers.
   8. Duct-mounting access doors.
   10. Flexible ducts.
   11. Duct Sealants.

   B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Special fittings.
   3. Motorized-control damper installations.
   4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including
sleeves and duct-mounting access doors.


1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to the product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated on drawings and as herein specified.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A653 and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A480.

D. Aluminum Sheets: ASTM B209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.


F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.

2. American Warming and Ventilating.

3. Flexmaster U.S.A., Inc.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classes of 3-inch w.g. or higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch thick extruded aluminum.
8. Tie Bars and Brackets: Aluminum or galvanized steel.

D. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FUME HOOD EXHAUST VALVES

A. Air Valve
1. Construction:
   a. 16 gage aluminum with baked phenolic coating, or stainless steel, body with continuous welded seam.
   b. Composite Teflon shaft bearings.
   c. Spring grade stainless steel spring and polyester or PPS assembly.
2. Operating Characteristics:
   a. Pressure independent from a maximum of 0.6" w.c. up to a minimum of 2.0" w.c.
   b. Volume control accurate to ±5% of airflow setpoint.
   c. No additional straight runs of duct required; valve will be mounted directly on fume hood.
   d. Response time to changes in duct pressure shall be less than 1 second.

B. Controls:
1. Pressure independent without feedback controls.
2. Design based on pneumatic actuator; electric actuator that meets performance requirement also acceptable.
3. Controls for two position volume control based on output from hood monitor.
4. 24 V DC power supply

2.5 DAMPER REGULATORS

A. Manufacturers:
   1. Ventfabrics.
   2. Ventlock.
   3. Young.

B. At accessible dampers, provide locking quadrant operators.
   1. Un-insulated ducts: Young No. 403.
   2. Insulated ducts: Young No. 403B

C. At inaccessible dampers, provide with remote operators.
   1. Flush to Ceiling: Young 270-301-EZ mounting bracket for Bowden Cable Controls. Use with Young 5020CC round or 830ACC rectangular dampers OR 270-301-EZ-B kit for dampers furnished separately.
   2. Alternatively provide Young 270-275 for controller mounted in diffuser/register.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Air Balance, Inc.
   2. CESCO Products.
   4. Nailor Industries Inc.
   5. Penn Ventilation Company, Inc.
   6. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 1650F or 2120F according to manufacturer's UL-approved written instructions.

D. Frame and Blades: 0.064-inch thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch thick, galvanized sheet steel; length to suit wall or floor application.

F. Smoke Detector: See Duct Smoke Detector Article 2.7.

2.7 DUCT MOUNTED SMOKE DETECTORS
A. Duct type smoke detectors: Furnished under Division 16 with appropriate length sampling tubes and installed under this Division. Unit shall be wired under Division 16 for power and alarm system. Control wiring furnished and installed under Division 15.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA’s "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Available Manufacturers:
   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. METALAIRE, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT SILENCERS

A. Manufacturers:

   1. Industrial Noise Control, Inc.
   2. McGill AirFlow Corporation
   3. Ruskin Company
   4. Vibro-Acoustics

B. General Description: Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer. Silencers shall be Vibro-Acoustics (basis of design). Alternate manufacturers must request and obtain written approval by the Engineer to bid the project at least 10 days prior to the bid due-date. As a condition of pre-approval, alternate manufacturers must submit to the Engineer a minimum of twenty (20) different HVAC silencer test reports. Each report shall be for a silencer tested in full accordance with the ASTM E-477-99 silencer test standard in an aero-acoustic test facility that is NVLAP accredited for the ASTM E-477-99 standard. Each test shall have been conducted within the last 12-month period. A copy of the laboratory’s NVLAP accreditation certificate must be included with the submitted reports. Any changes to the specifications must be submitted and approved in writing by the Engineer at least 10 days prior to the bid due-date. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.

C. Combustion Ratings: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84, NFPA 255 and UL 723.

D. Round Elbow Units: All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48” shall have at least two half splitters and one full splitter.
1. Outer Casings:
   a. 16 Gage stainless.

E. Elbow Units: All elbow silencers shall be constructed with a 10 gauge galvanized steel outer casing (unless noted differently on the silencer schedule) and 22 gauge galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48” shall have at least two half splitters and one full splitter.

F. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in “Section B Materials”, are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge. Casings shall be lock-formed and sealed to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
2. Lock form and seal or continuously weld joints
3. Suspended Units: Field-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
4. Reinforcement: Cross or trapeze angles for rigid suspension.

G. Source Quality Control:

1. Acoustic Performance: Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule. Silencer generated noise shall not be greater than that listed in the silencer schedule. Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements. All silencer ratings shall be determined in a duct-to-reverberant room test facility that provides for airflow in both directions through the test silencer in accordance with the ASTM E-477-99 test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

2. Aerodynamic Performance: Silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E-477-99 test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

3. Submittals: The manufacturer shall supply certified test data for each scheduled silencer. The data shall include dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project's air distribution system requirement. All ratings shall be conducted in the same facility and shall utilize the same silencer. Test facilities and test reports shall be open to inspection upon request from the Engineer. Silencer performance must have been substantiated by laboratory testing according to ASTM E-477-99 and so certified when submitted for approval. The aero-acoustic laboratory must be NVLAP accredited for the ASTM E-477-99 test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted.

2.10 DUCT MOUNTED ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation
fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-
by-1-inch butt or piano hinge and cam latches.

1. Available Manufacturers:
   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Flexmaster U.S.A., Inc.
   e. Greenheck.
   g. Nailor Industries Inc.
   h. Ventfibre, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Provide number of hinges and locks as follows:
   a. Less than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches [with outside and
      inside handles].
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill
   and 1-inch thickness. Include cam latches.

1. Available Manufacturers:
   a. Ductmate Industries, Inc.
   b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch thick, fibrous-glass or polystyrene-foam board.

2.11 FLEXIBLE CONNECTORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfibre, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with
   UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips
   of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Select
   metal compatible with ducts.


1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200°F.
E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq.yd.
2. Tensile Strength: 530 lb/inch in the warp and 440 lb/inch in the filling.
3. Service Temperature: Minus 50 to plus 250°F.
4. Connectors in paragraph below are suitable for system temperatures from minus 25 to plus 500°F (minus 32 to plus 260°C).


1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lb/inch in the warp and 340 lb/inch in the filling.

G. Service Temperature: Minus 67 to plus 500°F.

2.12 FLEXIBLE DUCTS

A. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.

B. Noninsulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch w.g. positive and 1.0-inch w.g. negative.
3. Temperature Range: Minus 10 to plus 160°F.

C. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10-inch w.g. positive and 1.0-inch w.g. negative.
3. Temperature Range: Minus 10 to plus 160°F.

D. Flexible Duct Clamps: Nylon strap in sizes 3 through 18 inches to suit duct size.

2.13 ROOF AND WALL JACKS (CAPS) AND FLASHING


B. Sloped roof: as manufactured by Aldes, Low Pressure Roof Cap with integral backdraft damper; galvanized steel G-90.

C. Flat roof: as manufactured by Aldes, Spun Aluminum Roof Cap with screen, no damper.

D. Metal roof flashing: Master Flash EDPM Rubber pipe and duct flashing boot.

2.14 DUCT ACCESSORY HARDWARE
A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pilot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.15 DUCT SEALANTS

A. Shall conform to and be listed by U.S. Green Building Council.

B. Manufacturers:

1. Duct-Seal 321, Hardcast Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that the mechanical system may be installed in complete accordance with all pertinent codes and regulations and the approved shop drawings.

C. Verify all dimensions at the site making all field measurements and shop drawings necessary for fabrication and erection of sheet metal work. Dimensions shown are net free areas. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Check plans showing work of other trades and consult with Architect in the event of any interference.

3.2 DESCREPENCIES

A. In the event of discrepancy, immediately notify Architect.

B. Do not proceed with the installation in areas of discrepancies until all such discrepancies have been fully resolved.

3.3 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install back draft dampers on outside air intakes, exhaust fans, or exhaust ducts nearest to outside and where indicated.
D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and fire/smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.

J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
6. Install the following sizes for duct-mounting, pressure relief access doors:
   a. One-Hand or Inspection Access: 5 inches in diameter.
   c. Head and Hand Access: 13 inches in diameter.
   d. Head and Shoulders Access: 19 inches in diameter.

K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

L. Install duct test holes where indicated and required for testing and balancing purposes.

3.4 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Section 15990 "Testing, Adjusting, and Balancing."

3.5 DUCTWORK AND ACCESSORIES

A. Fabricate and support in accordance with 2001 California Mechanical Code, SMACNA HVAC Duct Construction Standards Metal and Flexible, and ASHRAE handbooks, except as indicated. Gages for
galvanized steel ducts for low pressure systems up to 2” w.g. shall be as follows:

<table>
<thead>
<tr>
<th>RECTANGULAR DUCT</th>
<th>ROUND DUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 12</td>
<td>26</td>
</tr>
<tr>
<td>12 &lt; L ≤ 30</td>
<td>24</td>
</tr>
<tr>
<td>30 &lt; L ≤ 54</td>
<td>22</td>
</tr>
<tr>
<td>54 &lt; L ≤ 84</td>
<td>20</td>
</tr>
<tr>
<td>84 &lt; L</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Exposed spiral ductwork shall be one (1) gauge heavier

B. Verify all dimensions at the site making all field measurements and shop drawings necessary for fabrication and erection of sheet metal work. Dimensions shown are net free areas. Lined ducts shall be fabricated so that new dimensions to inside of lining shall equal the sizes shown on drawings.

C. Make allowances for beams, pipes or other obstructions in building construction and for work of other trades. Check plans showing work of other trades and consult with Architect in the event of any interference.

D. Fittings: Manufactured fittings for all exposed ductwork. Use slip fit couplings for all pipe joints. All fittings are to be continuously welded. Where the zinc coating has been burned during fabrication, the fittings are to be painted by the manufacturer.

E. Low Pressure Ductwork: Sheet metal gauges, transverse joint type and spacing, reinforcing type and spacing, In accordance with latest ASHRAE and SMACNA Schedules for low pressure ductwork. Figures below are from the SMACNA Manual.

F. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

G. Elbows shall be standard radius or square with vanes as shown on Fig 2-2, 3, 4, 5, 6, & 7. Single vanes with 3/4” trailing edge are preferred. Adjust the vanes so that the raking edges are parallel with the downstream duct when entering and leaving duct sizes are not equal.

H. Offsets & taper - Fig 2-9 & 10, branch connections - Fig 2-7 & 8 or as indicated on the plans.

I. Round tees and laterals - Fig 3-4 & 5 except straight tees not acceptable.

J. Junctions between ducts: Branch take-off with 45° or 90° tapered spin-in. No branch duct to intersect main duct on bottom.

K. Seal all longitudinal and transverse duct and plenum joints and field formed seams airtight (Seal Class B) with medium water based, low VOC, pressure duct sealant.

L. Joints between ducts: Make with beaded sleeve joints. Apply duct sealer to male end. Mechanically fasten with sheet metal screws or pop rivets. Over joint and screw or rivet heads, apply coating of duct sealer. Cover entire joint with duct tape.
M. Supports for ducts and plenums shall be band iron supports according to Section IV.

N. All ductwork shall be concealed behind finished wall, ceilings or floors unless specifically noted “exposed” on the drawings. Ductwork shown to be exposed shall be installed to provide maximum headroom and/or floor space.

O. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

P. Access Panels and Doors in Ductwork: Provide in ductwork as indicated and wherever necessary or required for proper access to all instruments, controls, fire and automatic dampers and equipment and for convenient inspection and maintenance. Size as approved by Architect.

Q. Install ductwork of sizes, runs and connections as shown on drawings.

R. Fabricate ductwork in workman-like manner with airtight joints; presenting smooth surfaces on inside, neatly finished on outside; construct with curves, bends; turning vanes to aid in easy flow of air. Make internal ends of slip joints in directions of air flow.

S. Install ductwork to provide maximum headroom.

T. Adjust ducts to suit local conditions. Alter duct sizes on basis of equal friction where required to facilitate installation.

U. Provide ductwork connected to air-handling equipment or air inlet and outlet devices, with all necessary transformation pieces, flexible fabric connections as required. Secure fabric connectors tightly to fans, casings and ducts. Allow at least 1” slack in connections. Do not paint fabric connectors. Provide galvanized steel weather shield over exterior top and sides of exposed flexible connections.

V. Diagonally or transversely cross break all panels on metal rectangular ducts over 18” in either direction.

W. Avoid penetration of ducts. Provide airtight rubber grommets at unavoidable penetrations of hanger rods.

X. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, etc.

Y. Provide pitot tube openings where required for testing of systems: Complete with metal cap with spring device or screw to ensure against air leakage.

Z. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

3.6 FUME HOOD EXHAUST

A. Entire length stainless steel continuous welded liquid tight.

B. Slope duct 1-inch per foot down toward equipment. Only if above slope is impossible due to structural or architectural space imitations, slope in direction of air flow to low-point drain. Provide 1-inch drain from all low points to nearest air gap waste. Drain to have S trap for water seal.

C. Do not cross break bottom panel of duct.

3.7 ALUMINUM DUCTWORK

H&M Mechanical Group
Project No. 08023 03

DUCTWORK AND ACCESSORIES
15820- 12
A. One gauge heavier than galvanized steel.

3.8 DUCT HANGERS AND SUPPORTS

A. General: Attachment to structure, as specified in Section 15010, "GENERAL MECHANICAL PROVISIONS".

B. Install hangers for ducts as specified in the SMACNA Manual.

C. Upper Hanger Attachments:

1. Attachment to Existing Cast-In-Place Concrete:
   a. Secure hangers to overhead construction with wedge anchor.
   b. Secure hanger attachment required to be supported from wall to floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

D. Duct Riser Supports:

1. Unless otherwise specified or shown, support vertical ducts by means of two steel angles, riveted to duct and resting on floor slab or adjacent structural steel members and specified vibration isolators at every floor through which the duct passes. Size supports as follows (all dimensions in inches):

<table>
<thead>
<tr>
<th>Max. Side Dimensions (Inches)</th>
<th>Support Angle</th>
<th>Secure to Duct Width</th>
<th>Minimum Bearing Each End</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>1 x 1 x 1/8</td>
<td>Screws</td>
<td>2</td>
</tr>
<tr>
<td>48</td>
<td>1-1/2 x 1-1/2 x 1/8</td>
<td>Bolts</td>
<td>3</td>
</tr>
<tr>
<td>60</td>
<td>2 x 2 x 1/8</td>
<td>Bolts</td>
<td>3</td>
</tr>
<tr>
<td>Over 60</td>
<td>2-1/2 x 2-1/4 x 3/16</td>
<td>Bolts</td>
<td>4</td>
</tr>
</tbody>
</table>

3.9 FLEXIBLE DUCT

A. Do not use flexible duct for duct connection through walls or gypsum board.

B. Use insulated flex duct on run-outs to air outlets. Maximum flexible duct length duct length of 7-feet. Bends greater than 90-degrees not permitted.

C. Flex duct on exhaust same as above but without insulation.

D. Connect flexible ducts with liquid adhesive plus tape, draw band, or adhesive plus sheet metal screens.

3.10 DUCT CLEANING

A. Oil film on sheet metal shall be removed prior to shipment to site. Ducts shall be inspected on site to confirm that no oil is present; remove oil if so detected. If ducts contain dust and dirt, clean the ducts immediately, prior to substantial completion and prior to using the ducts to circulate air.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust during construction. To obtain sufficient air, clean half the system at a time. Protect equipment that may be harmed by excessive dirt with temporary filters or bypass during cleaning.

C. Clean duct systems with high power vacuum machines. Protect equipment that may be harmed by
excessive dirt with filters or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION
SECTION 15840 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this section: materials, equipment, fabrication, installation and test in conformity with applicable codes and authorities having jurisdiction for the following:

1. All terminal heating and cooling units including:
   a. Variable Air Volume boxes.
   b. Fan powered boxes.

1.2 RELATED WORK AND REQUIREMENTS

A. 1510 General Mechanical Provisions.

1.3 REFERENCE STANDARDS


1.4 QUALITY ASSURANCE

A. Terminal units rated and certified in accordance with ARI Standard 880-98 Certification Program.

B. Heating Coils rated in accordance with ARI Standard 410.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturers model numbers used as example or item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

   1. Envirotech.
   2. Krueger.
   3. MetalAire.
   4. Titus.
   5. Trane.
   7. Or equal.

2.2 GENERAL
A. Casings:
   1. Minimum 22-gage, galvanized steel.
   2. Leakage rating: 7 cubic feet per minute maximum at 1.5 times water column.
   3. Acoustic Lining:
      a. Material: fiberglass with high density facing.
      b. Minimum thickness: ½ inch.
      c. Minimum 1.5 pound per cubic foot density
      d. Maximum thermal conductivity: 0.28 Btu in/(h·ft²·°F) measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F.
      e. Meet erosion test method described in UL publication No. 181.
      f. Meet smoke developed and flame spread rating requirements of NFPA 90A.
      g. Meet ASTM C114#4 and ASTM C665 for biological growth and insulation.
   4. Gasketed access door:
      a. For actuators inspection, repair and replacement if mounted internally.
      b. Upstream of reheat coil for inspection and cleaning.
   5. Discharge duct connection.

B. Controls unit mounted by manufacturer.
   1. Multi-point, cross-flow or flow-ring, center averaging sensor.
      a. Amplify velocity pressure signals with a minimum amplification factor as indicate in the table below. Provide documentation with submittal that substantiates the requirements.

<table>
<thead>
<tr>
<th>Duct Diameter (in.)</th>
<th>Amplification Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>8</td>
<td>2.3</td>
</tr>
<tr>
<td>10</td>
<td>2.3</td>
</tr>
<tr>
<td>12</td>
<td>2.7</td>
</tr>
<tr>
<td>14</td>
<td>2.0</td>
</tr>
<tr>
<td>16</td>
<td>2.1</td>
</tr>
</tbody>
</table>
   b. Provide accurate flow sensing regardless of inlet duct configuration.
   c. Brass balancing taps and unit mounted airflow vs. flow sensor pressure signal charts for field airflow measurements.
   d. For Direct Digital Controls, see Section 15900 Controls and Instrumentation.

C. Radiated and discharge sound power:
   1. Equal or less in each octave band than terminal selections scheduled on plans at noted capacities assuming 1.0 inch inlet static pressure, with a tolerance of +2 dB in any band.
   2. Providing additional plenums or attenuators to meet sound power ratings is not acceptable (due to added space and pressure drop).

D. Total Pressure drop:
   1. Equal or less than terminal selections scheduled on plans at noted capacities, with a tolerance of 0.02 inches of water.
   2. This limitation is in total, not static pressure. Where total pressure is not listed on certified performance documents, provide a table of manual adjustments or static pressure with velocity pressure calculated from inlet and outlet velocities.
E. Dampers:
   1. Heavy gage steel.
   2. Shaft rotating in self-lubricating bearings. Nylon bearings are not acceptable.
   3. Close-off leakage rating: 5 cubic feet per minute maximum leakage at 1.50 inches water column.

F. Hot water heating coils:
   1. Removable type.
   2. Tubes:
      a. 1-row unless otherwise scheduled on drawings.
      b. Copper, 0.15 minimum tube wall thickness.
      c. Connections: external, same end, solder type connection, minimum ½ inch outside diameter.
   3. Fins:
      a. Aluminum, with full fin collars.
      b. As scheduled on drawings or as required to provide heating capacity listed.
      c. Maximum: 12 fins per inch.
   4. Factory leak-tested at 300 pounds per square inch.
   5. Access panel for coil inspection and cleaning. See paragraph A.4.B.b above.

2.3 VARIABLE AIR VOLUME TERMINAL UNITS

A. Basis of design: See Schedules.

B. Options and features: as scheduled.

2.4 FAN POWERED VAV TERMINAL UNITS

A. As specified above, amended as follows:

1. Fan and Motor:
   a. Units ETL or UL listed and labeled.
   b. Forward curved, direct drive fans.
   c. Motor and controller:
      1) Voltage as scheduled.
      2) Electrically commutated motor (ECM).
      3) Permanently lubricated.
      4) Mounted in vibration isolators.
      5) Integral thermal overload protection.
      6) Integral speed adjustment for balancing.
      7) Controller to accept 0-10 Vdc signal from DDC controller.
      8) Equal to GE ECM.
   d. Anti-backward wheel rotation device.
   e. Housing: minimum 22-gage steel.

B. Accessories:

1. Filter:
   a. Type 1: 1 inch filter is acceptable.
   b. Filter media required only for units with heating coil.

2. 24V control transformer.
3. Options as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Locate hot water control valve and isolation valves for VAV box reheat coils located above hard ceiling at a location where they are accessible via ceiling access doors.

C. Install terminal units in accordance with manufacturer’s written installation instructions.

D. Support each unit at four corners with minimum, 1”x18 gage sheet metal straps or 3/8 inch all-thread rod. Secure lower end of strap to the side of unit casing with minimum two #10 sheet metal screws, or bolt through casing with washers to prevent leakage. Bend end of strap and secure to bottom of casing with one #10 sheet metal screws.

E. For units with cross sectional area 5 square feet or larger, provide additional seismic bracing at each corner. Bracing shall be a 45 degrees horizontal angle to the box’s axis and at 45 degrees vertical angle from the horizontal. Bracing shall #18 gage hanger strap or 3/32 inch aircraft cable.

F. Supply duct connections: See Section 15820 Ductwork and Accessories.
   1. Provide sheet metal connections at inlet. Flexible duct connection is not acceptable.

G. Piping connections: see Section 15750 Piping Systems.

H. Coordinate access with respective trades.

I. See Section 15900 Controls and Instrumentation.

3.2 TESTING AND ADJUSTING

A. Before starting terminal heating and cooling units: Cover fan-inlet on fan-powered boxes with plastic sheeting to protect from construction dust. Do not remove until start-up.

B. Start and test fans in accordance with manufacturer’s written installation instructions.

C. Start up and adjust fans to ensure proper operation.

D. After starting terminal heating and cooling units: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

E. See Section 15980, Testing, Adjusting, and Balancing.

F. The installing controls contractor shall put all systems back into proper operation for normal conditions after each phase of the Acceptance Requirements for Code Compliance is completed.
SECTION 15900 – HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED


B. The systems to be controlled under work of this Section are limited to the HVAC.

C. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

D. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

E. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

1.2 RELATED WORK AND REQUIREMENTS

A. Section 15010 General Mechanical Provisions apply to all work in this Section.

B. Coordination with other Divisions.

1. This Section is provided to assist the 15900 EMCS Contractor in determining scope of work within Division 15 and 16. However, the General Contractor is ultimately responsible for coordination among their subcontractors regardless of what is listed in this Section.

2. The ‘HVAC Contractor’ in this Section refers to the primary Division 15 HVAC Contractor plus all of their subcontractors other than the Controls Contractor who is responsible for the work in this Section.

3. Dampers:
   a. General: Dampers and damper actuators shall be provided as indicated in the following Table:

<table>
<thead>
<tr>
<th>Damper</th>
<th>Supplied by</th>
<th>Mounted by</th>
<th>Actuator supplied and installed by</th>
<th>Actuator wired by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Box</td>
<td>See subsection</td>
<td>See subsection</td>
<td>See subsection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>below</td>
<td>below</td>
<td>below</td>
<td></td>
</tr>
<tr>
<td>Fire/Smoke Dampers</td>
<td>FSD Vendor</td>
<td>HVAC Contractor</td>
<td>FSD Vendor</td>
<td>Electrical Contractor</td>
</tr>
<tr>
<td>Fume Hood Exhaust air valves</td>
<td>Controls Contractor</td>
<td>HVAC Contractor</td>
<td>Controls Contractor</td>
<td>Controls Contractor</td>
</tr>
<tr>
<td>Backdraft and motorized dampers scheduled to be provided with exhaust fans</td>
<td>Fan Vendor</td>
<td>Fan Vendor</td>
<td>Fan Vendor</td>
<td>Controls Contractor</td>
</tr>
<tr>
<td>Fume Hood exhaust</td>
<td>HVAC</td>
<td>HVAC Contractor</td>
<td>Controls</td>
<td>Controls Contractor</td>
</tr>
</tbody>
</table>
b. Terminal boxes - Scope of work as outlined in the following Table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Supplied by</th>
<th>Mounted by</th>
<th>Connected by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Box</td>
<td>Box Vendor</td>
<td>HVAC Contractor</td>
<td>HVAC Contractor</td>
</tr>
<tr>
<td>Damper Actuator</td>
<td>Controls contractor</td>
<td>Box Vendor</td>
<td>Box Vendor</td>
</tr>
<tr>
<td>Digital Controller</td>
<td>Controls contractor</td>
<td>Box Vendor</td>
<td>Per this Table</td>
</tr>
<tr>
<td>Wall Sensor Module</td>
<td>Controls contractor</td>
<td>Box Vendor</td>
<td>Controls contractor</td>
</tr>
<tr>
<td>Air-flow Measurement</td>
<td>Box Vendor</td>
<td>Box Vendor</td>
<td>Box Vendor</td>
</tr>
<tr>
<td>Pickup and piping</td>
<td>Controls Contractor</td>
<td>Controls Contractor (integral to controller)</td>
<td>Controls Contractor</td>
</tr>
<tr>
<td>Transducer and wiring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24V transformer</td>
<td>Controls Contractor</td>
<td>Controls Contractor</td>
<td>Controls Contractor</td>
</tr>
<tr>
<td>Line Voltage side</td>
<td></td>
<td></td>
<td>Division 16</td>
</tr>
</tbody>
</table>

1) Transformers for reheat or cooling only VAV box control shall be centralized in a panel in electrical rooms with low-voltage wiring only to boxes. See “Panels” under Division 16.

c. Fire/smoke dampers:
1) All fire/smoke dampers (including actuators and end-switches where required) shall be provided and installed by the HVAC contractor.

4. Electrical Work.
a. Control devices: All HVAC control devices including thermostats, relays, controllers, etc. shall be provided by the Controls Contractor and located within temperature control panels, except the following which shall be provided by the Electrical contractor:
   1) Auxiliary contacts within electrician supplied motor starters.
   2) Time delay relays required for two-speed motor starters for change from high to low speed.
   3) Fire alarm and life safety control relays and switches.
   4) Wall switches, including speed switches for conference room exhaust fans (if any).
   5) Relocation of wall switch for EF-3 (Art Lab Exhaust Fan).

b. Control panels:
   1) The Electrical Contractor shall provide the necessary 120V power to the following control panels:
   2) Lighting Control panels: The Controls Contractor shall supply lighting control panels and provide all associated control and network wiring. Electrical Contractor shall be responsible for installing the lighting relay panels and wiring through power side of lighting relays.

5. Fume Hoods:
a. Fume hoods to be provided and installed by Division 11. All fume hood exhaust system controls to be provide EMCS contractor. EMCS contractor to provide and install fume hood monitor.

1.3 REFERENCE STANDARDS
A. Nothing in Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules and regulations. When Contract Documents differ from requirements of applicable laws, ordinances, rules and regulations, EMCS contractor shall comply with documents establishing the more stringent requirements.

B. The latest published or effective editions, including approved addenda or amendments, of the following codes and standards shall apply to the EMCS design and installation as applicable.

C. State and Local Codes.
   1. CBC – California Building Code
   2. CMC – California Mechanical Code
   3. CEC – California Electrical Code
   4. Local and County Codes

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

E. Electronics Industries Alliance
   1. EIA-232: Interface Between Data Terminal Equipment and Data Circuit – Terminating Equipment Employing Serial Binary Data Interchange.
   4. EIA-472: General and Sectional Specifications for Fiber Optic Cable.
   5. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications.
   7. EIA-590: Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications.

F. NEMA
   1. NEMA 250: Enclosure for Electrical Equipment.
   2. NEMA ICS: General Standards for Industrial Controls.

G. NFPA
   1. NFPA 90A: “Standard for the Installation of Air Conditioning and Ventilating Systems” where applicable to controls and control sequences.

1.4 APPROVED MANUFACTURERS

A. BETA (No Equal).

1.5 QUALITY ASSURANCE

A. EMCS Contractor’s Qualifications: EMCS Contractor shall be a firm that has been engaged in the design and installation of BETA controls systems for not less than five years. Project experience
shall include only those projects that have been fully completed and accepted. If installer is a Value Added Reseller (VAR), installer must demonstrate at least three years prior experience with that manufacturer's products.

B. EMCS Contractor's Project Manager Qualifications: Individual shall specialize in and be experienced with direct digital control system installation for not less than three years. Project Manager shall have experience with the installation of the proposed direct digital control equipment product line for not less than two projects of similar size and complexity. Project Manager must have proof of having successfully completed the most advanced training offered by the manufacturer of the proposed product line.

C. EMCS Contractor's Programming Qualifications: Individual(s) shall specialize in and be experienced with direct digital control systems programming for not less than three years and with the proposed direct digital control equipment product line for not less than one and half years. Programmer's must show proof of having successfully completed the most advanced programming training offered by the vendor of the programming application on the proposed product line.

D. EMCS Contractor's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. EMCS Contractor must document a minimum five year history of servicing installations of similar size and complexity. Installer must also document at least a one year history of servicing the proposed product line.

E. Installer's Response Time and Proximity

1. Installer must maintain a fully capable service facility within a 75 mile radius of the project site. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
2. Installer must demonstrate the ability to meet the emergency response times listed in §1.8B.

F. All products used in this project installation shall be new, currently under manufacture, and shall have been available from the manufacturer for a minimum of six months prior to date of proposal and previously installed and proven effective in installations of similar nature not including test sites. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner in writing. Spare parts shall be available for at least five years after completion of this contract.

G. All BACnet devices must either be certified a compliant with BACnet through the BACnet Manufacturers Association (BMA) or the vendor must supply proof of having submitted the device for testing by BMA.

H. Electrical and mechanical installation shall be by manufacture-trained mechanics, not subcontracted unless subcontractor has provided services for manufacturer for a period of five years or more.

1.6 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by Owner.

B. Advise Owner that work is ready for review at following times:

1. After all hardware and field devices have been installed, but prior to start-up and verification.
2. Prior to closing up walls, ceilings, etc. where work will be permanently concealed.

1.7 SUBMITTALS
A. **Drawings**

1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
2. Drawings shall be submitted in the following standard sizes: 11” x 17” (ANSI B).
3. Eight complete sets (copies) of submittal drawings shall be provided.
4. Drawings shall be available on CD-ROM.

B. **System Documentation**

1. Include the following in submittal package:
2. System configuration diagrams in simplified block format.
3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
5. Manufacturer’s instructions and drawings for installation, maintenance, and operation of all purchased items.

1.8 **WARRANTY**

A. Guarantee all materials, equipment, apparatus and workmanship (including programming) to be free of effective materials and faulty workmanship for period of one year from date of acceptance and issuance of notice of completion.

B. 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 EMCS Contractor shall respond to the Owner’s request for warranty service within 24 hours during normal business hours.

C. At the end of the final startup, testing, and demonstration phase, of equipment and systems are operating satisfactorily and Acceptance Testing has been performed shall the warranty period begin.

D. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the EMCS Contractor shall be provided at no charge during the warranty period. Software bugs (both due to programming misinterpretation and sequence errors) shall be corrected and any reasonable control sequence changes required to provide proper system operation shall also be at no additional cost during this period.

1.9 **COORDINATION**

A. Provide all necessary action and coordination with regards to ACCEPTANCE TESTING as outlined in Specification Section 15010.

**PART 2 - PRODUCTS**

2.1 **SOFTWARE**

A. Existing BETA software and hardware shall be utilized and extended to meet the requirements herein stated and per base building design as furnished and installed.
2.2 DDC HARDWARE

A. General:

1. The EMCS shall be composed of standalone intelligent control panels connected via a peer-to-peer communication network.
   a. Exception: VAV zone controller and similar application specific controllers may communicate on a master/slave network.

2. Point information from any panel (including zone controllers and application specific controllers) shall be capable of being used in a control sequence in and other panel. The use of Operator Workstations to serve as a communications server between control panels is not acceptable.

3. In general, a single standalone controller shall be provided for each system (e.g. each air handler) and each zone so that control can be maintained in case of communications failure. In no case shall a controlled variable and control point (output) be connected to different controllers.

4. For all controllers, operating configuration and software shall be retained in the event of a power outage without requiring a download from upper level controllers. Provide either:
   a. Non-volatile memory (e.g. flash, EEPROM). This is the preferred method, or
   b. Battery backup. Batteries shall have a minimum life of ten years and shall be docketed for easy field replacement. Batteries shall provide a minimum of seventy two hours of continuous operation in backup mode.

5. Controllers shall allow independent operation regardless of the status of the other units or Operator Workstation.

6. Knowledge of modulating device positions is required, i.e. if a floating-point actuator is used, feedback from the actuator is required as an analog input to determine damper position (For zone controls such as VAV boxes only, timing of open-close contacts to estimate position is acceptable.)

7. All safety and life safety controls, such as high-static switches and smoked detectors, shall remain hard-wired to equipment starters, not requiring DDC logic to perform.

8. Each controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected the controller shall:
   a. Assume a predetermined failure mode.
   b. Generate an alarm notification to the master controller and/or Operator Workstation.

9. Controller hardware shall be suitable for the anticipated ambient conditions.
   a. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosure and shall be rated for operation at -40°F to 150°F.
   b. Controllers used in conditioned space shall be mounted in dust-resistant enclosures and shall be rated for operation in 32°F to 120°F.

2.3 OPERATOR’S WORKSTATION

A. Existing.

2.4 SOFTWARE

A. Existing.

2.5 TERMINAL UNIT (VAV) APPLICATION CONTROLLERS

A. VAV boxes shall be electrically actuated with DDC integrated with central DDC system. Controls shall be provided to VAV box manufacturer for factory installation.
B. Controller shall be capable of providing the control sequences as specified.

C. Flow transducer (including impact of A-to-D conversion) shall be capable of stably controlling to a setpoint of 0.004" differential pressure or lower, shall be capable of sensing 0.002" differential pressure or lower and shall have a ±0.01" or lower resolution across the entire scale.

D. Flow sensing (and actuator position timers, if actuator pulse timing is used to estimate actuator position with floating point actuators) shall be re-zeroed regularly whenever fan system is off. For continuously operating systems, some means of calibration each 24 hour period shall be provided (e.g. temporarily shutting of the velocity pressure signal.)

E. Calibration and adjustment shall be possible through the room sensor via a hand-held terminal, as well as through the Operator Workstation. There shall be two air flow calibration points to allow for calibrating at both the minimum air flow and maximum airflow, with linear approximation in between.

2.6 LIGHTING CONTROLS

A. General:

1. Lighting control hardware shall consist of lighting control panels and gateway (if required) to DDC system. (Existing)

2. Tenant off-hour control shall be via Occupant Override Interface and via low voltage switches specified under Division 16. This interface shall also allow tenants to enable off-hour lighting usage in a manner similar to enabling off-hour HVAC. (Existing)

3. Janitor's switches. (Existing)
   a. Locate in one janitor's closet per floor.
   b. Switch shall be programmable to allow lights to be sequenced on by blocks to minimize the number of lights on at any one time. Program to turn on sufficient circuits to provide adequate lighting for cleaning during tenant improvements.

B. Each LCP (Lighting Control Panel) – (Existing) consists of a fully programmable controller operating in conjunction with low voltage relays which provide stand-alone or integrated lighting functions such as time scheduling, “flick” signals, ambient light control, cleaning schedules. Programming is provided either through the Operator Workstation or Portable Operator’s Terminal. Each controller shall be capable of providing all logic, control runtime data, status information and communication functions for each lighting control relay. Each relay is “soft-wired” into any desired group and into common groups by the Portable Operator’s Terminal, or Operator Workstation.

C. Each LCP enclosure includes multiple GE RR7 (or equal) pre-mounted relays, logic boards, terminals, power supplies, transformers, local override switches and a wiring schedule director. Relays shall be momentarily-pulsed, mechanically latching contactors rate at 20 amps, 10-277 VAC. Enclosure shall have lockable hinged door. (Existing)

D. Power supply shall have a transformer assembly with two 40 VA transformer, with separate secondary’s, one providing power to relays, LED’s and associated low voltage switches and occupancy sensors, the second providing power to intelligence cards. Transformers include internal over-current protection with automatic reset and metal oxide arrestor protection against power spikes. (Existing)

E. All lighting sequences’ programmed in the LCPs shall be stored in non-volatile EEPROM memory, which is not dependent upon the presence of a battery to be retained. Each LCP shall communicate with the Operator Workstation at a baud rate of note less than 19,200 baud. (Existing)
F. LCPs shall be capable of supporting the following scenarios: Schedule with Flick Warn, Time Delay Over-rides with Flick Warn, Common Area Interlock with Egress Timer, Master Switch Control with Flick Option, Cleaning Lights Automatic Daylight Switching with Occupant Interlock/Over-ride, Status and Runtime Data and Touch Tone Phone interface. (Existing)

G. All relay changes of state and programmable switch actions shall be communicated over the network LAN to support interactive graphics and on line status monitoring. All programming shall be on line or off line through the Portable Operator’s Terminal Operator Workstation. (Existing)

H. Each LCP shall be capable of stand-alone operation. None of the operating scenarios discussed above shall depend on the operation of an Operator Workstation or Portable Operator’s Terminal. The relays over-ride switches shall continue to operate should the LCP controller fail. (Existing)

I. Each LCP shall have framed, plastic-encased point list for all points in cabinet. (Existing)

2.7 CONTROL CABINETS

A. All indoor control cabinets shall be fully enclosed NEMA 1 construction with hinged door, key-lock latch. A single key shall be common to all field panels and sub-panels. Provide 3 keys.

B. Interconnection between internal and face-mounted devices shall be pre-wire with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 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.

C. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

D. Provide with:

1. Framed. Plastic-encased point list for all point in cabinet.
2. Nameplates for all devices on face.

2.8 AUTOMATIC VALVES

A. General

1. Globe valve shall be used for all modulating valves unless otherwise indicated.
   a. 2-way valves shall have equal percentage plugs.

2. Motorized ball valves are acceptable in lieu of globe valves provided:
   a. Valves are specifically designed for modulating duty.
   b. Maximum size: 2 inch.
   c. Industrial quality with bronze bodies and female NPT threads.
   d. AV valves shall have blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 PSE rating.
   e. Chromium plated bronze or stainless steel ball and brass stem.
   f. Valve characteristics shall be close to that for globe valve, as specified above.
   g. Guarantee average leak-free life span over 200,000 full stroke cycles.

B. Pressure ratings:

1. Hot water: 125 psi at 200°F.
C. Construction:

1. 2 inch and smaller: screwed or soldered.
2. Bodies and internal parts: bronze, stainless steel or other approved corrosion-resistant metal except as noted.

D. Sizes:

1. Modulating sizing shall be by automatic control system manufacturer with following limits on full-open pressure drop:
   a. Minimum pressure drop: equal to pressure drop of coil.
   b. Maximum pressure drop: 2 psi.
   c. Flow coefficient ($C_v$) shall not be less than 1.0 (to avoid clogging).

2.9 DAMPER AND VALVE ACTUATORS

A. Electric

1. Electric operators shall direct-coupled gear type, mounted directly to the damper/valve shaft without the need for connecting linkage. The fastening clamp assembly shall be of a ‘V’ bolt design with associated ‘V’ shaped toothed cradle attaching to the shaft for maximum strength and eliminating slippage. Spring return actuators shall have a ‘V’ clamp assembly of sufficient size to be directly mounted to an integral jackshaft on op to 1.05 inches when the damper is constructed in this manner. Single bolt or screw type fasteners are not acceptable.
2. Electric actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable. When operated at rate voltage each operator shall be capable of delivering the torque required for continuous uniform movement of the valve or damper. Actuators shall be UL Standard 873 Listed and CSA Class 4813 o2 Certified as meeting correct safety requirements and recognized industry standards. Actuators shall be designed for a minimum of 60,000 full-stroke cycles at the actuator’s rated torque.
3. Pneumatic: Not allowed except at lab controls.
4. Normal position: Actuators shall be spring return to the normal position. Normal position shall be as follows:
   a. Fume hood pressure control damper – CLOSED.
   b. Hot water reheat coil valves- OPEN (Non-spring acceptable).
   c. VAV box damper – OPEN (floating and non-spring acceptable).

2.10 SENSORS AND MISCELLANEOUS DEVICES

A. Duct temperature sensors: TS-1A & TS01B – match existing.

B. Room Temperature Sensors: TS-3A & TS-3B (conference room only) - match existing.

C. CO2 Room Sensors: match existing.

D. Differential Air Pressure Transmitters

1. General
   a. Capacitance type.
   b. Nylon or enameled steel housing suitable for surface mounting.
   c. Range as close as possible to that listed in point list on drawings.
2. DP-1: air
   a. Overall Accuracy: ±1%
   b. Duct static tip: Dwyer A-301
   c. Ambient static sensor: Dwyer A-306
   d. DPT-1A: Include LCD display or reading.

2.11 FUME HOOD AIR VALVE AND CONTROLS

A. Refer to 15820, Ductwork and Accessories.

B. Hood monitor

1. Input: Occupancy sensor contact closure.
2. Output:
   a. 24Vdc relay output command to two position air valve.
   b. Alarm dry contact to EMCS
3. Face Plate
   a. Normal and standby mode LEDs.
   b. Caution airflow alarm LD.
   c. Test/reset button.
   d. Mute button.

2.12 CONTROL POINTS

A. Table Column Definitions

1. Point description
2. Type
   a. AO: analog output (e.g. 0-1 Vdc, 4-20 mA).
   b. AI: analog input.
   c. DO: digital or binary output.
   d. DI: digital or binary input.
3. Trend Logging:
   a. Verification. Where listed, point is to be trended at the basis listed for verification and performance verification purposes. Trend may be deactivated after acceptance.
   b. Continuous. Where listed, point is to be trended at the basis listed continuously, initiated after system acceptance, for the purpose of future diagnostics.
   c. Trend Basis:
      1) Where range of engineering units is listed, trend on a change of value (COV) basis (i.e. record time stamp and value when point value changes by engineering unit listed).
      2) Where time interval is listed, trend on a time basis (i.e. record time stamp and value at interval listed). All points relating to a specific piece of equipment shall be trended at the same initiation time of day so data can be compared in text format.
4. Calibration
   a. F = factory calibration only is required (no field calibration).
   b. HH = field calibrate with handheld device. See §3.13E.5.a.2.

B. Fume Hood Fan System
### Trend Logging

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Device</th>
<th>Trend Logging</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Plenum static</td>
<td>AI</td>
<td>DPT-1A transmitter, 0-2.5&quot;</td>
<td>1 min.</td>
<td>10 min</td>
</tr>
<tr>
<td>Pressure control damper</td>
<td>AO</td>
<td>Connect to damper actuator</td>
<td>1 min.</td>
<td>±5%</td>
</tr>
<tr>
<td>Exhaust fan LEF-3 start/stop</td>
<td>DO</td>
<td>Connect to 120V start circuit</td>
<td>COV</td>
<td>COV</td>
</tr>
<tr>
<td>Exhaust fan LEF-4</td>
<td>DO</td>
<td>Connect to 120V start circuit</td>
<td>COV</td>
<td>COV</td>
</tr>
<tr>
<td>Occupancy sensor chem. lab</td>
<td>DI</td>
<td>Connect to lighting occupancy sensor</td>
<td>COV</td>
<td>COV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with multi-contact relay</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>contacts to monitor on each hood and one to DDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy sensor chem. prep</td>
<td>DI</td>
<td>Connect to lighting occupancy sensor</td>
<td>COV</td>
<td>COV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with multi-contact relay</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>contacts to monitor on each hood and one to DDC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**C. VAV Zone Control**

### Trend Logging

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Device</th>
<th>Trend Logging</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room air temperature</td>
<td>AI</td>
<td>Match existing</td>
<td>1 min.</td>
<td>±2°</td>
</tr>
<tr>
<td>Setpoint adjust</td>
<td>AI</td>
<td>Potentiometer on thermostat</td>
<td>10 min.</td>
<td>60 min.</td>
</tr>
<tr>
<td>Supply air temperature</td>
<td>AI</td>
<td>TS-1 single point duct sensor</td>
<td>1 min.</td>
<td>10 min.</td>
</tr>
<tr>
<td>(when box has reheat coil)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy sensor chem. lab</td>
<td>DI</td>
<td>Connect to lighting occupancy sensor</td>
<td>COV</td>
<td>COV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with multi-contact relay</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Hard wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>contacts to monitor on each hood and one to DDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hood alarm</td>
<td>DI</td>
<td>Connect to hood monitor</td>
<td>COV</td>
<td>COV</td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

### 3.1 POINT NAMING CONVENTION

#### A. General
1. All points shall be named using the convention established in this section. The purpose is to allow for “wild card” listing, automatic population on graphics, avoid conflicts with existing point is existing buildings connected to the system, etc.

2. In addition to point name, each point associated with a hardware device shall have its long-name and/or description field filled out with the following information:
   a. Devices make and model #. Include range of device if model number does not so identify.
   b. Device physical location description. Include floor and column line intersection to one decimal place (e.g. line 6.2 and line A.3).

B. Format

1. As specified by Owner.

3.2 SEQUENCE OF OPERATIONS

A. General

1. Control sequences listed below are to be the basis of design of the bid. EMCS Contractor shall review them prior to programming and suggest modifications where they feel performance will be improved or to match existing site programming.

2. Bids shall include costs for minor program modifications if required to provide stable performance of the system.

3. Unless otherwise indicated control loops shall be enabled and disabled based on the status of the system being controlled to prevent wind-up.

4. The term “PID loop” is used generically for all control loops and shall not be interpreted as required proportional plus integral plus derivative gains on all loops. Unless specifically indicated otherwise the following guidelines shall be followed:
   a. Use proportional only (P-only) loops for limiting loops (such as zone CO₂ limiting loops, etc.) to ensure there is no integral wind-up.
   b. Do not use the derivative term on any loops unless field tuning is not possible without it.

5. All setpoints, timers, deadband, PID gains, etc. listed in sequences shall be capable of being adjusted by the operator without having to access programming whether indicated as “adjustable” in sequences or not. Software (virtual) points shall be used for these setpoints. Fixed scalar numbers shall not be imbedded in programs unless the value will never need to be adjusted.

6. When zone data (e.g. damper or valve position control loop signal) is used for reset of the AHU/pump system serving the zone, the zone tag (name) shall be recorded when it is the zone driving the reset (e.g. zone requiring the most cooling). This data shall be available for Reports so that zones that are undersized or otherwise driving the system can be identified for remediation if required.

B. Zones:

1. This section applies to all single zone and sub-zones of air handling systems, such as VAV boxes.

2. Setpoints
   a. Each zone shall have separate unoccupied and occupied setpoint, and separate heating and cooling setpoint.
      1) As a default, the occupied heating setpoint shall be 70°F and the occupied cooling setpoint shall be 74°F in exterior zones and 73°F interior zones.
      2) As a default, the unoccupied heating setpoint shall be 60°F and the unoccupied cooling setpoint shall be 90°F.
   b. The software shall prevent:
1) The heating setpoint from exceeding the cooling setpoint minus 1°F (i.e. the minimum deadband shall be 1°F.)
2) The unoccupied heating setpoint from exceeding the occupied heating setpoint; and
3) The unoccupied cooling setpoint from being less than the occupied cooling setpoint.

c. Where the zone has a local occupant adjustable setpoint adjustment knob/button:
   1) The adjustment shall be capable of being limited in software.
   2) As a default, occupied cooling setpoint shall be limited between 72°F and 80°F.
   3) As a default, occupied heating setpoint shall be limited between 65°F and 72°F.
   4) The adjustment shall move both the existing heating and cooling setpoints upwards or downwards by the same unless the limit has been reached.
   5) The adjustment shall only be active in Occupied mode.
   6) If a demand limit setpoint adjustment is in place or the window switch indicates the window is open, the local setpoint adjustment shall be disabled.

d. Demand Limit setpoint adjustments. Cooling setpoints shall be increased upon demand limit requires from the associated Isolation Area.
   1) At Demand Limit Level 1, increase the current setpoint by 1°F.
   2) At Demand Limit Level 2, increase the current setpoint by 2°F.
   3) At Demand Limit Level 3, increase the current setpoint by 4°F.

e. Window switches. For zone that have operable windows with indicator switches, when the window switch indicates the window is open, the heating setpoint shall be temporarily set to 40°F and cooling setpoint shall be temporarily set to 120°F.

f. Occupancy sensors. For zones that have an occupancy sensor switch associated with the zone, when the lights switch indicates that space is unoccupied during the Occupied mode, the heating setpoint shall be reset to 4°F lower than the active setpoint and the cooling setpoint shall be reset to 4°F higher than the active setpoint.

g. Hierarchy of setpoint adjustments. The following adjustment restrictions shall prevail in order from highest to lower priority:
   1) Setpoint overlap restrictions (§3.2B.2.b.1).
   2) Window switches.
   3) Demand Limit.
   4) Occupancy sensors.
   5) Local setpoint adjustment.
   6) Scheduled setpoints based on Isolation Area mode.

3. Local override. When thermostat override buttons are depressed, the request for Occupied Mode Operation shall be set up to the Isolation Area control for 60 minutes.

4. Control Loops:
   a. Two separate control loops shall operate to maintain space temperature at setpoint, the Cooling Loop and the Heating Loop. Both loops shall be continuously active.
   b. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a virtual point ranging from 0% (no cooling) to +100% (full cooling).
   c. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a virtual point ranging from 0% (no heating) to +100% (full heating).
   d. Loops shall use proportional + integral logic or fuzzy logic. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable from the Operator Workstation.
   e. See other sections for how the outputs from these loops are used.

5. Zone modes:
   a. Heating mode: when the output of the space heating control loop is greater than zero.
   b. Cooling Mode: when the output of the space cooling control loop is greater zero and the output of the heating loop is equal to zero.
   c. Deadband Mode: when not in either the Heating or Cooling Mode.

6. Alarms:
a. Inhibit alarms after zone setpoint is changed for a period of 10 minutes per degree of change (e.g. if setpoint changes from 68°F to 70°F, inhibit alarm for 20 minutes after the change) and while Isolation Area in Warm-up or Cool-down Mode.

b. If the zone is 2°F above cooling or below heating setpoint, generate Level 3 alarm.

c. If the zone is 4°F above cooling or below heating setpoint, generate Level 2 alarm.

d. For zones with CO₂ sensors, if the CO₂ concentration is less than 300 ppm, or the zone is in unoccupied mode for more than 2 hours and zone CO₂ concentration exceeds 600 ppm, generate a Level 3 alarm, indicating sensor may be out of calibration.

e. For zones with window switches, generate a level 4 alarm if the window switch is open and the zone is in unoccupied mode.

C. VAV Reheat boxes:

1. See §3.2A. for setpoints, loops, and control modes.

2. Design air rate: Zone design maximum cooling ($V_{cool-max}$), zone minimum ($V_{min}$), and maximum heating airflow setpoints ($V_{heat-max}$) shall be as scheduled on plans.

3. The occupied cooling minimum $V_{min}^*$ shall be equal to $V_{min}$ except as follow:
   a. If $V_{min}$ is non-zero and less than the lowest possible airflow setpoint allowed by the controls ($V_m$), $V_{min}^*$ shall be set equal to $V_m$. The minimum setpoint $V_m$ shall be determined as follows:
      1) Determine the velocity pressure sensor reading $V_{p}$ in inches H₂O that results in a digital reading from the transducer and A/D converter of 12 bits or counts (assuming a 10 bit A/D converter). This is considered sufficient resolution for stable control. For Automated Logic this equates to 0.004”.
      2) Using the velocity pressure sensor amplification factor $F$ provided by the sensor manufacturer for each VAV box sensor size, calculate the minimum velocity $V_m$ for each box as:

$$V_m = 4005^* (V_{p}/F)^{0.5}$$

Where $F$ is not known it can be calculated from the measured CFM at 1” signal from the VP sensor:

$$F = (4005A/CFM_{gr})^2$$

Where $A$ is the nominal duct area ($ft^2$), equal to:

$$A = \pi(D/24)^2$$

Where $D$ is the nominal duct diameter (inches).

3) Calculate the minimum airflow setpoint allowed by the control ($V_m$) for each VAV box size as:

$$V_m = V_mA$$

b. If the VAV box is tied to an occupancy sensor, $V_{min}^*$ shall be zero when the room is unoccupied.

c. If the VAV box is tied to a window switch, $V_{min}^*$ shall be zero when the widow is open.

d. If the zone has a CO₂ sensor, during Occupied Mode, a P-only loop shall maintain CO₂ concentration at 1000 ppm. The output of this loop (0-100%) shall be mapped as shown below. The loops output from 0 to 50% shall reset the minimum airflow setpoint to the zone from $V_{min}$ up to maximum cooling airflow setpoint $V_{cool-max}$. The loop output from 50% to 100% is be used at the system level to reset outdoor air minimum.
4. Active cooling maximum and minimum setpoint shall vary depending on the mode of the Isolation Area the zone is a part of.

<table>
<thead>
<tr>
<th>Setpoint</th>
<th>Occupied</th>
<th>Cool-down</th>
<th>Setup</th>
<th>Warm-up</th>
<th>Setback</th>
<th>Unoccupied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Max</td>
<td>$V_{\text{cool-max}}$</td>
<td>$V_{\text{cool-max}}$</td>
<td>$V_{\text{cool-max}}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Minimum</td>
<td>$V_{\text{min}}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Heating Max</td>
<td>$V_{\text{heat-max}}$</td>
<td>$V_{\text{heat-max}}$</td>
<td>$V_{\text{heat-max}}$</td>
<td>$V_{\text{cool-max}}$</td>
<td>$V_{\text{cool-max}}$</td>
<td>0</td>
</tr>
</tbody>
</table>

5. Control Logic is depicted schematically in the figure below as described in the following sections:
   a. When the zone is in the Cooling Mode, the Cooling Loop output shall be mapped to the airflow from the cooling maximum to the minimum airflow setpoint. Hot water valve is closed.
   b. When the zone is in the Deadband Mode, the airflow setpoint shall be the minimum airflow setpoint. Hot water valve is closed.
   c. When the zone is in the Heating Mode, the Heating Loop shall maintain space temperature at the heating setpoint as follows:
      1) From 0-50%, the Heating Loop output shall reset the discharge temperature from 55°F to 95°F.
      2) From 50-100%, the Heating Loop output shall reset the zone airflow setpoint from the minimum airflow setpoint to the maximum heating airflow setpoint.
      3) The hot water valve shall be modulated using P+I loop to maintain the discharge temperature at setpoint. (Directly controlling HW valve off zone temperature PID loop is not acceptable.)
   d. The VAV damper shall be modulated to maintain the measured airflow at setpoint.

6. Automatic recalibration:
a. Damper position estimate: If damper position on a floating damper actuator is estimated by counting open/close pulses, the position shall be recalibrated to 0% when the damper is known to be closed (more than enough close pulses to ensure damper is closed) and to 100% when damper is known to be fully open.

7. Overrides - Provide software points to:
   a. Force zone airflow setpoint to zero.
   b. Force zone airflow setpoint to \( V_{\text{cool-max}} \).
   c. Force zone airflow setpoint to \( V_{\text{min}} \).
   d. Force damper full closed/open.

8. Alarms
   a. Low airflow.
      1) If the measured airflow is less than 70% of setpoint for 5 minutes, generate a Level 3 alarm.
      2) If the measured airflow is less than 50% of setpoint for 5 minutes, generate a Level 2 alarm.
   b. Low supply air temperature
      1) If the supply air temperature is 5°F less than setpoint for 5 minutes, generate a Level 3 alarm.
      2) If the supply air temperature is 10°F less than setpoint for 5 minutes, generate a Level 2 alarm.
   c. For floating point damper actuators, the zone controller will count the total number of damper movements (open or close) for each damper during each 24 hour period. If the total number of movements for any damper in a period exceeds 700, generate a Level 3 alarm indicating a control stability problem and excess damper motor wear.

D. Plant Biology Exhaust Fan (EF-3).
   1. Relocate existing on-off switch to new location next to room thermostat.

E. Art Lab Exhaust Fans (EF-5 & 6).
   1. Install on-off switch with pilot light and 0-12 hour timer next to thermostat.

F. Fume Hood Exhaust System Switched Two Stage System (Organic Chemistry Room 513)
   1. Fume Exhaust Valve Control
      a. Provide software switch to enable occupied/unoccupied control logic. Use of this mode must be approved by Cal-OSHA.
      b. When the room is occupied (based on occupancy sensor) then all two-position exhaust valves in that room shall be commanded to “normal” flow position.
      c. When the room is unoccupied (based on occupancy sensor) then all two-position exhaust valves in that room shall be commanded to “setback” flow position.
      d. Alarms
         1) Hood flow alarm Level 1.
   2. Supply Air VAV Reheat Boxes
      a. Constant volume reheat boxes: Air flow shall be controlled at constant volume to “normal” setpoint when room is occupied and to “setback” flow setpoint when room is unoccupied.
   3. Lab Exhaust Fan Control (LEF-3,4)
      a. Lab exhaust fans are active.
      b. Alarms
         1) Commanded on, status off: Level 1
         2) Commanded off, status on: Level 2
   4. Exhaust Plenum Pressure Control
      a. Modulating bypass damper at exhaust fan controlled with integral controls furnished with fan to maintain exhaust plenum pressure at setpoint.
3.3 GRAPHICS

A. Use existing software to depict new systems on each floor.

1. One version shall display HVAC VAV zones including temperature sensor locations with colors indicating temperature status.
2. One version shall display lighting control zones with colors indicating lighting status.
3. Operating schedules.
4. Summary graphics. Provide single page (or as few as possible) showing key variables listed in the columns for all similar equipment, as listed below:
   a. VAV boxes: operating mode, airflow rate, zone temperature, zone temperature setpoint, damper position, supply air temperature (reheat boxes), supply air temperature setpoint (reheat boxes).

B. Displays shall show all points relevant to the operation of the system, including setpoints and setpoint limits for setpoint that are automatically reset.

C. The current value and point name of every I/O point and setpoint shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

3.4 FUME HOOD CONTROLS

A. Mount Hood monitor on hood. All wiring concealed in hood housing or in conduit.

B. Install DC power supply. Provide necessary 120V power from emergency power source using control circuit in electrical room dedicated to control panels.

C. Wire monitor and air valve per manufacturer’s instructions. Wire occupancy sensor (provided by Division 16) to a multiple contact relay whose contacts are hard-wired to each hood monitor and to EMCS. See Points above.

D. Assist air balancer with adjustment of DP setpoints. See 15950 Testing, Adjusting, and Balancing.

E. Provide 20 psig compressed air control piping to each of the exhaust valves.

3.5 ELECTRICAL INSTALLATION

A. Wiring:

1. All control and interlock wiring shall comply with national and local electrical codes.
2. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC requirements and shall be installed by a licensed electrician.
3. 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.) Class 2 wiring shall be installed in UL Listed approved raceway, except where wires are in concealed accessible locations, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling return plenums shall be UL Listed specifically for that purpose.
4. 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).
5. Do not install Class 2 wiring in raceway containing tubing.
6. Where Class 2 wiring is used without raceway, it shall be supported from or anchored to structural members neatly tied at 10 foot intervals. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems and at least 1 foot above ceiling tiles and light fixtures.

7. All wire-to-wire device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

8. All field wiring shall be properly labeled at each end, with self-laminating typed labels indicating device address, for easy reference to the identification schematic. All power wiring shall be neatly labeled to indicate service, voltage, and breaker source.

9. Use coded conductors throughout with different colored conductors.

10. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

11. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available the Contractor should provide step-down transformers.

12. All wiring shall be installed continuous lengths with no splices permitted between termination points.

13. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all times.

14. 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.

15. Include one pull string in each raceway one inch or larger.

16. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control pane enclosures unless they also contain Class I starters.

17. Conceal all raceways, except within mechanical, electrical, or service rooms.

18. Secure 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.

19. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

20. The EMCS Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

21. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Flexible metal raceway less than ½" electrical trade size shall not be used. In areas exposed to moisture liquid-tight, flexible metal raceways shall be used.

22. 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.

23. Electrical service to controls panels and control devices shall be provided by isolated circuits, with no other loads attached to the circuit, clearly marked at its source. The location of the breaker shall be clearly identified in each panel served by it. If a spare breaker in not available within the electrical panel, the EMCS Contractor shall be responsible for providing any and all equipment and labor necessary to supply an isolated circuit.

24. Wire digital outputs to either the normally-closed or normally-open contactor of binary output depending on desired action in case of system failure. Unless otherwise indicated, wire to the NO contact.

25. Hardwire Interlocks
   a. The devices referenced in this section are hardwire interlocked to ensure equipment shutdown occurs even if control systems are down. Do not use software (alone) for these interlocks.
   b. Hardwire device NC contact to VFD enable contact.

B. Communication Wiring

1. The EMCS Contractor shall adhere to the requirements of §3.5A.
2. All cabling shall be installed in a neat and workmanlike manner. Follow all manufacturers’ installation recommendations for all communication cabling. Use shielded wiring if recommended by manufacturer.
3. Do not install communication wiring in raceway and enclosure containing Class 1 or other Class 2 wiring.
4. Maximum pulling, tensions, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.
5. EMCS Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
6. All runs of communication wiring shall be un-spliced length when that length is commercially available.
7. All communication wiring shall be labeled to indicate origination and destination data.
8. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector grounding.
9. Shielded cable shield shall be grounded only at one end.
10. Power-line carrier signal communication/transmission is not acceptable.
11. Owner shall be responsible for providing telephone lines, service, and terminations for modem connections.

3.6 CONTROL AIR TUBING

A. Main and sensor air tubing shall be sized by the EMCS Contractor.

B. Locate sensors to minimize tubing runs at the expense of increased wiring distances.

C. Mechanically attach tubing to supporting surfaces. Sleeve through concrete surfaces in minimum 1" sleeves, extended 6" above floors and 1" below bottom surface of slabs.

D. Purge tubing with dry, oil-free compressed air before connecting control instruments.

E. All control air piping shall be concealed except in equipment rooms or unfinished areas. Installation methods/materials are as follows:

1. Concealed and Inaccessible: Use FR plastic in metal raceway. Room thermostat drops in stud walls in areas with lay-in ceiling may be FR plastic tubing.
2. Concealed and Accessible tubing (including ceiling return air plenums) shall be ACR copper tubing or FR plastic tubing, subject to the following limitations:
   a. FR tubing shall be enclosed in metal raceway when required by local code.
   b. Quantity of FR tubing per cubic foot of plenum space shall not exceed manufacturer's published data for Class 1 installation.
   c. Exposed: Use hard-drawn ACR copper or FR plastic in metal raceway.

F. Pneumatic tubing shall not be run in raceway containing electrical wiring.

G. Where FR tubing exits the end of raceway or junction box, provide a snap-in nylon bushing.

H. Where pneumatic tubing exits control panels, provide bulkhead fittings. Where copper tubing exits junction boxes or panels, provide bulkhead fittings.

I. All tubing shall be number coded on each end and at each junction for easy identification.

J. Pressure gauges shall be provided on each pneumatic output signal to controlled devices. The gauges shall read in psi from 0 to 150 percent of the maximum pressure range of the application and be mounted in metal cabinets with other related pneumatic equipment/devices at each system controlled
and/or monitored. A capped port shall be installed at connection to the gauge for purpose of checking pressure with a calibrated instrument.

K. All control air piping shall be installed in a neat and workmanlike manner parallel to building lines with adequate support.

L. Piping above suspended ceilings shall be supported from or anchored to structural members or other piping and/or duct supports. Tubing shall not be supported by or anchored to electrical raceways or ceiling support systems.

M. For air pressures greater than 30 psig, compression or solder type connection shall be used.

N. When FR tubing is used for pressures 30 psig or less, brass-barbed fittings may be used. Plastic fittings are not acceptable.

O. Brass-barbed fittings shall be used at copper-to-FR tubing junctions. Plastic slipped-over copper tubing is not acceptable.

P. Perform a pressure test on the entire pneumatic system installed by EMCS Contractor as follows:

1. Work shall be done when building is not occupied.
2. Shut valves on each air valve.
3. Test low-pressure air tubing at 30 psig air pressure. Maintain this pressure for 2 hours without pumping.
4. If pressure drops more than 1 psi, determine the leak, repair with new equipment or piping. Leaks at pipe and tube joints shall be corrected by remaking of the joints.
5. Repair and retest until pressure is maintained.

3.7 INSTALLATION OF SENSORS

A. Install 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.

3.8 ACTUATORS

A. Mount and link control damper actuators per manufacturer's instructions.

B. Dampers

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage, or follow manufacturer's instructions to achieve same effect.
2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
3. Provide all mounting hardware and linkages for actuator installation.
4. Provide one actuator per damper. Do not use jackshafts, blade-to-blade linkages or shaft coupling.

3.9 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. All pneumatic tubing shall be labeled at each end within 2" of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show the instrument or item served.

D. Identify control panels with minimum Y2" letters on laminated plastic nameplates.

E. 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.

F. Identify room sensors relating to terminal box or valves with indelible marker on sensor hidden by cover.

G. Manufacturers' nameplates and UL or CSA labels to be visible and legible after equipment is installed.

H. Identifiers shall match record documents.

3.10 CUTTING, CORING, PATCHING & PAINTING

A. Cutting, cutting, and patching shall be held to the absolute minimum necessary. Openings shall be neatly cut and shall be kept as small as possible to avoid unnecessary damage. Structural elements shall not be cut without the written consent of Owner.

B. Penetrations through rated walls or floors shall be filled with an approved material to provide a code compliant fire-stop.

C. All damage to and openings in ductwork, piping insulation, and other materials and equipment resulting from demolition or construction shall be properly sealed, repaired; and/or re-insulated.

D. In areas visible to the public, patched areas shall be painted to match existing surfaces.

E. All replacing, patching, and repairing of materials and surfaces cut or damaged in the execution of the work shall be performed by experienced mechanics of the several trades involved.

3.11 CLEANING

A. The EMCS Contractor shall clean up all debris resulting from its activities daily. The EMCS Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and legally disposed of by EMCS Contractor.

B. Materials stored on-site shall be stored in an orderly manner, neatly stacked, or piled in the designated area assigned by the owner’s representative.
C. At the completion of work in any area, the EMCS Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

D. The EMCS Contractor shall use only cleaning materials recommended by the manufacturer of the surfaces to be cleaned and on surfaces recommended by the cleaning material manufacturer.

3.12 EMCS COMMISSIONING

A. Coordination

1. Testing, Adjusting, and Balancing
   a. Coordinate with TAB contractors in test and balance work as specified in Section 15950 Testing, Adjusting, and Balancing. A significant number of balancing procedures require the EMCS to be operational and require Contractor time to assist the TAB contractor in their work.
   b. Terminal unit calibration:
      1) Provide software and/or portable devices for terminal unit calibration.
      2) Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator’s terminal shall be at the sensor or at the terminal box.

B. Sequencing:

1. The following list outlines the general sequence of events for submittals and commissioning:
   a. Submit Submittal Package 1 (Hardware and Shop Drawings) and receive approval.
   b. Initiate installation of EMCS hardware, devices and wiring.
   c. Develop point database and application software.
   d. Simulate sequencing and debug programming off-line to the extent practical.
   e. Submit Submittal Package 2 (Programming and Graphics) and receive approval.
   f. Complete installation of EMCS hardware, devices and wiring.
   g. Install point database and application software in field panels.
   h. Submit Submittal Package 3 (Functional Testing) and receive approval.
   i. Field test application programs prior to functional testing.
   j. Perform and record functional tests and submit Functional Test Report for approval.
   k. Assist TAB contractor in TAB tests and determining setpoints as specified in Section 15950.
   l. Submit Package 4 (Training Materials) and receive approval.
   m. Receive EMCS Functional Test Report approval and approval to schedule Demonstration Tests.
   n. Perform Demonstration Tests to Commissioning Coordinator and Owner Representatives and submit Demonstration Test Report.
   o. Receive acceptance of Demonstration Tests.
   p. Train Owner personnel on EMCS operation and maintenance.
   q. Substantial Completion.
   r. Prepare and initiate commissioning Trend Logs.
   s. Submit Trend Logs in format specified for review and approval.
   t. Receive approval of successful Trend Log tests, or retest as required.
   u. Complete all items in Completion Requirements per Paragraph 1.8.
   v. Provide administration level password access to the Owner.
   w. Final Acceptance.
   x. Begin Warranty Period.
   y. Prepare and initiate post-occupancy Trend Logs.
   z. Two months prior to end of Warranty Period, submit Trend Logs in format specified for review and approval.
   aa. Receive approval of successful Trend Log tests, or retest as required.
bb. Revise and submit record documents and O&M Manuals.
c. Update all software as specified.
d. End of Warranty Period.

C. Functional Test Documentation

1. Pre-functional Tests
   a. Prepare forms to document the proper startup of the EMCS.
   b. All equipment shall be included test forms including but not limited to:
      1) Digital outputs: proper installation, normal position, response to command at
         CU.
      2) Digital inputs: proper installation, device test, response at C.
      3) Analog outputs: proper installation of devices, verification of maximum and
         minimum stroke.
      4) Analog inputs: proper installation of sensors, calibration.
      5) Wiring connections and other electrical issues.
      6) Panels.
      7) Alarms and safeties.
      8) Loop tuning.
      9) Network traffic.
   c. Each form shall have a header or footer where the technician performing the test can
      indicate his/her name and the date of the test.
   d. Submit forms for approval in Submittal Package 3.
   e. Complete work, document results on forms, and submit for approval as Pre-Functional
      Test Report.

2. Functional Tests
   a. Contractor will prepare functional testing forms to test all sequences in a formal
      manner. Test forms will include at a minimum: a column indicating the tests and
      simulations to be performed, the expected outcomes, the actual outcome, and check
      box indicating whether the system passed or failed.
   b. All control sequences shall be functionally tested. For systems that use identical
      control logic (e.g. VAV boxes), only one subsystem need be tested; any changes to
      programming resulting from tests shall be made to all identical applications.
   c. Each form shall have a header or footer where the technician performing the test can
      indicate his/her name and the date of the test.
   d. Submit forms for approval in Submittal Package 3.
   e. Complete work, document results on forms, and submit for approval as Functional
      Test Report.

D. Instrumentation

1. Instrumentation required verifying readings, calibrating sensors, and test the system and
   equipment performance shall be provided by Contractor.
2. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated
   within the preceding 6-month period. Certificates of calibration shall be submitted.
3. Test equipment used for testing and calibration of field devices shall be at least twice as
   accurate as respective field device (e.g., if field device is ±0.5% accurate, test equipment shall
   be ±0.25% accurate over same range).

E. Pre-functional tests

1. General
   a. Inspect the installation of all devices. Review the manufacturer's installation
      instructions and validate that the device is installed in accordance with them.
   b. Verify proper electrical voltages and amperages, and verify that all circuits are free
      from faults.
c. Verify integrity/safety of all electrical connections.
d. Verify that shielded cables are grounded only at one end.
e. Verify that all sensor locations are as indicated on drawings and are away from causes of erratic operation.
f. Ensure that minimum speed settings programmed into variable speed drive are at or below the minimum speed settings in control sequences.

2. Digital Outputs
   a. Verify that all digital output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

3. Digital Inputs
   a. Adjust setpoints, where applicable.
      1) For current switches used as status on fans, adjust current setpoint so that fan status is "off" when fan discharge damper (if present) is fully closed and when belt is broken (temporarily remove belt).

4. Analog Outputs
   a. Verify start and span are correct and control action is correct.
   b. Check all control valves and automatic dampers to ensure proper action and closure. Make any necessary adjustments to valve stem and damper blade travel.
   c. Check all normal positions of actuators with spring return.

5. Analog Input Calibration
   a. Sensors shall be calibrated as specified on the points list. Calibration methods shall be one of the following:
      1) Factory. Calibration by factory, to standard factory specifications. Field calibration is not required.
      2) Handheld. Field calibrate using a handheld device with accuracy meeting the requirements of Paragraph 1.13D.
   b. The calibrating parameters in software (e.g. slope and intercept) shall be adjusted as required. A calibration log shall be kept and initialed by the technician showing date and time, sensor and hand-held readings, and calibration constant adjustments and included in the Pre-functional Test Report.
   c. Inaccurate sensors must be replaced if calibration is not possible.

6. Alarms and Interlocks:
   a. A log shall be kept and initialed by the technician showing date and time, alarm/interlock description, action taken to initiate the alarm/interlock, and resulting action, and included in the Pre-functional Test Report.
   b. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
   c. Coordinate with Division 16 to test fire and life safety systems alarm contacts.
   d. 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.
   e. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

7. Tuning
   a. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the Pre-functional Test Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted):

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct pressure</td>
<td>±0.1&quot; w.g.</td>
</tr>
<tr>
<td>Airflow</td>
<td>±010%</td>
</tr>
<tr>
<td>Space Temperature</td>
<td>±1.5°F</td>
</tr>
<tr>
<td>Others</td>
<td>±2% times reported accuracy</td>
</tr>
</tbody>
</table>
8. Interface and Control Panels:
   a. Ensure devices are properly installed with adequate (clearance for maintenance and with clear labels in accordance with the record drawings.
   b. Ensure that terminations are safe, secure and labeled in accordance with the record drawings.
   c. Check power supplies for proper voltage ranges and loading.
   d. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.
   e. Check for adequate, signal strength on communication networks.
   f. Check for standalone performance of controllers by disconnecting the controller from the LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.
   g. Ensure that buffered and/or volatile information is held through power outage.
   h. With all system and communications operating normally, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.
   i. Check for adequate grounding of all DDC panels and devices.

9. Operator Interfaces:
   a. Verify that all elements on the graphics are functional and are properly bound to physical devices and/or virtual points, and that hot links or page jumps are functional and logical.
   b. Verify that the alarm printing, logging, paging, emailing etc. is functional and per requirements.

10. Trending/Network Traffic Test Perform this test to verify that system has been design adequately to simultaneously capture trends and allow proper operation of the control system.
   a. The test shall be performed after the verification trends (see paragraph 3.131.1) have been set up and are operational.
   b. Test 1:
      1) Randomly select a device whose failure will generate a Level 1 or 2 alarm and manually shut it off. The status points for the device must indicate the change of state of the device at the Operator Workstation within 5 seconds.
      2) The test shall be repeated for four devices in each building.
   c. Test 2:
      1) A clock signal from a field controller randomly selected will be sent as a programmable point to up to 3 Building Controllers (highest level of controller in system architecture). The clock signal stored in the BCs shall be sampled with the rest of the trend data. The system shall be considered acceptable if these clock signals are no more than 2 seconds off of the system clock as sampled concurrently during data collection.
      d. If the system fails any test, the system architecture shall be revised as required (e.g. more trend memory, more controllers with trend storage capability, network repeaters to allow an increase in network speed, etc.) followed by additional tests.

F. TAB tests

1. Setpoint Determination
   a. Assist the TAB contractor in determining fan and pump differential pressure setpoints, outdoor air damper minimum positions and DP setpoints, etc. as indicated in Section 15950 Testing, Adjusting and Balancing.

2. Coil Valve Leak Check
   a. Coordinate test procedures with those outlined in Section 15950 Testing, Adjusting and Balancing along with TAB contractor.
   b. Test for each hydronic system:
      1) Close all control valves
      2) Start all fans associated with control valves
3) Start both pumps and operate at full speed.
4) Observe flow meter (where applicable) before and after pumps are started. If reading changes after pumps start, there is a leaking valve.
5) Observe supply air temperature at each coil after test starts.
6) Should any supply air temperature rise, close the isolation valves to the coil to see if temperature changes. If so, this validates the valve is not fully closing.
7) Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

G. Functional Tests

1. Tests may be witnessed by an Owner Representative at the Owner's option.
2. All Functional Tests shall be conducted by the EMCS Contractor with results confirmed and signed by the Contractor's start-up technician.
3. Test documentation shall be submitted to the, Owner for review and approval.

H. Demonstration Test

1. Demonstration tests consist of a small representative sample of functional tests and systems randomly selected by the Owner. Tests will be designed to occur over no longer than 1 day.
2. Schedule the demonstration with the Owner's representative 1 week in advance. Demonstration shall not be scheduled until the Functional Test Report has been approved.
3. The Contractor shall supply all personnel, and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor-supplied personnel shall be those who conducted the Functional tests or who are otherwise competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems.
4. The system will be demonstrated following procedures that are the same or similar to those used in the Pre-Functional and Functional Tests. The Owner's representative will supply the test forms at the site "at the start of the tests.
5. Contractor shall conduct tests as directed by and in the presence of the Owner's representative and complete test forms. Completed forms shall be submitted as the Demonstration Test Report to the Owner after, tests are complete.
6. Demonstration Tests shall be successfully completed and approved prior to Substantial Completion.

I. Trend Log tests

1. Commissioning (Post Construction) Trend Test
   a. Trend logging shall not commence until Demonstration Tests are successfully completed.
   b. Contractor shall configure points to trend as indicated in the Commissioning Trend column listed in Paragraph 2.15 points list with the following qualifications.
      1) For equipment of identical function, such as VAV zones and AC units with identical components and control sequences, only a sample of such equipment need be trended. The sampling shall be 10% of the identical components, but no more than 10 and no less than three. Review with Owner representative before setting up trends.
      2) All points trended for one HVAC subsystem (e.g. AC unit, hot water system, etc.) shall be trended during the same trend period and the same time intervals so that data may be easily plotted using a spreadsheet.
   c. Trends shall include all relevant software points such as setpoints that are reset.
   d. Trends shall be uploaded to the Operator's Workstation in data format specified in Paragraph 2.4D.6.a.
   e. Trend logs of all points indicated above shall be collected for a three week Trend Period.
f. At the completion of the Trend Period, data shall be reviewed by the Contractor to ensure that the system is operating properly. If so, data shall be submitted to the Owner in an electronic format agreed to by the Owner and Contractor (e.g. CD-ROM, email, or via direct access to the OWS via the internet).

g. Data will be analyzed over approximately a two-to-three-week period by an Owners representative.

h. The system shall be accepted only if the trend review indicates proper system operation without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps e to g above shall be repeated for the same Trend Period until there is a complete Trend Period of error free operation.

2. Post Occupancy Trend Tests
   a. After successfully completing the Commissioning Trend Tests, the Contractor shall configure all points to trend as indicated in the Continuous Trend column listed in Paragraph 2.15 points list.
   b. Archive trends up to the OWS without overwriting stored data for the entire Warranty Period.
   c. Approximately 2 months prior to the end of the Warranty Period, data shall be submitted to the Owner in an electronic format agreed to by the Owner and Contractor (e.g. CD-ROM, email, or via direct access to the OWS via the internet).

J. Remedial Work
   1. Remedial work identified by site reviews, review of submittals, demonstration test, trend reviews, etc. shall be performed to the satisfaction of the Owner's Representative, at no additional cost to the Owner.
   2. Contractor shall compensate Owner and Owner's representative for costs required to repeat demonstration tests or trend reviews.

3.13 TRAINING
   A. Interim Training
      1. Provide minimal training so the operating staff can respond to tenant needs and, other operating requirements during construction and installation.

   B. Formal Training.
      1. Provide training sessions at locations and for personnel indicated in § 3.14F.
      2. Training shall be conducted after all start-up is complete and systems are fully operational.
      3. The length of each training period will depend on the complexity of the system and the audience, described below. Minimum training shall be 8 hours but period shall be longer if required to complete the training tasks described below.
      4. Owner shall be permitted to videotape training sessions.
      5. During the warranty period, provide unlimited telephone support for all trained operators.

   C. Operators are divided into three categories and shall receive training including but not limited to the tasks listed.
      1. Day-to-day Operators: shall be trained to:
         a. Proficiently operate the system
         b. Understand control system architecture and-configuration
         c. Understand DDC system components
d. Understand system operation and control sequences  
e. Operate the workstation and peripherals  
f. Log on and off the system  
g. Access graphics, point reports, and logs  
h. Adjust and change system set points, time schedules, and holiday schedules  
i. Recognize malfunctions of the system by observation of the printed copy and  
graphical visual signals  
j. Understand and acknowledge alarms  
k. Understand system drawings, and Operation and Maintenance manual  
l. Understand the job layout and location of control components  
m. Print point and predefined reports  

2. Advanced Operators shall be trained to do all items for Day-to-day operators plus:  
a. Make and change graphics on the workstation  
b. Create, delete, and modify alarms, including annunciation and routing  
c. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc  
basis and at user-definable time intervals  
d. Create, delete, and modify reports  
e. Add, remove, and modify system’s physical points  
f. Create, modify, and delete programming  
g. Add control panels  
h. Add Operator Workstations  
i. Create, delete, and modify system displays -both graphical and otherwise  
j. Perform DDC system field checkout procedures  
k. Perform DDC controller unit operation and maintenance procedures  
l. Perform workstation and peripheral operation and maintenance procedures  
m. Perform DDC system diagnostic procedures  
n. Configure hardware including PC boards, switches, communication, and I/O points  
o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware  
p. Adjust, calibrate, and replace system components  
q. Maintain software and prepare backups  

3. System Managers/Administrators shall be trained to do all items for Day-to-day operators  
plus:  
a. Maintain software and prepare backups  
b. Create and print custom reports, including tenant billing summaries.  
c. Interface with job-specific, third-party operator software  
d. Add new users and understand password security procedures  
e. Create and configure users for Occupant Override system.

D. Provide course outline and materials as per §1.7C.1. One copy of training material shall be provided  
per student.  

E. The instructor(s) shall be factory-trained instructors experienced in presenting this material.  

F. The type and number of personnel and location for training shall include.  

1. Advanced Operator: 1  
2. System Managers/Administrator: 1  
3. Day-to-day Operator: 0

END OF SECTION
SECTION 15950 – TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary General Conditions, Division 1 - General Requirements, and Section 15010 are hereby made a part of this Section as if repeated herein.

1.2 SECTION INCLUDES

A. Air systems.

B. Hydronic systems.

PART 2 - PRODUCTS - not used

PART 3 - EXECUTION

3.1 QUALIFICATION

A. Balancing to be performed by independent balancing specialty firm, certified member of Associated Air Balancing Council (AABC), in accordance with AABC guide and recommendations and shall be under the direct supervision of the general contractor. Shall adjust and re-adjust this part of the work until the operation complies with the requirements of the drawings and specifications.

3.2 COORDINATION

A. Coordinate required locations of duct test openings during construction period.

B. Provide all necessary action and coordination with regard to ACCEPTANCE TESTING as outlined in Specification Section 15010.

3.3 PROCEDURES - PRECONSTRUCTION PLAN CHECK & REVIEW

A. Use instruments accurately calibrated and maintained in good working order. If requested, conduct tests in the presence of a representative of the Architect and/or a representative of the Owner.

B. General: Submit to the Architect the following in accordance with conditions of the Contract and Division 1 specification sections.

1. Review the project documents and contractor submittals for their effect on the test and balance process and overall performance of the HVAC system.

2. Review location and type of volume dampers in the air distribution system.
3. Review inlet conditions to HVAC equipment.
4. Review locations, type and size of balancing valves, and automatic control valves in the water flow system.
5. Review location of pressure sensors in the air and water distribution systems.
6. Review automatic control systems as they affect the test and balance procedure and the final Acceptance Testing.

3.4 PROCEDURES - ONGOING JOB SITE INSPECTIONS

A. During construction, the balancing agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times. (Typically this is performed when 60% of the duct work is installed and again when 90% of the total system is installed and prior to insulation of the piping.)

B. The balancing agency shall submit a written report (3 copies) of each inspection to the Owner's representative, the consultant and the contractors responsible for correcting noted deficiencies.

C. Check for necessary balancing hardware (dampers, flow meters, valves, pressure taps, thermometer well, etc.) to determine if they are installed properly and readily accessible.

D. Identify and evaluate any variations from system design.

E. Identify and report possible restriction in systems (closed fire dampers, poorly designed duct fittings, etc.).

F. Notify HVAC contractor of air or water system performance deficiencies by the test before balancing the system.

G. Beginning of work means of acceptance existing conditions.

3.5 AIR SYSTEM TEST & BALANCE PROCEDURES

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers.

E. Vary total system air quantities first by adjustment of fan speeds. Provide drive changes as required. Vary branch air quantities by damper regulation as secondary adjustment.

F. Balancing and adjusting air systems:
   1. Perform the following tests, compile information and submit on report form with suitable cover, index, etc.
   2. Air balance shall be performed with filters partially blocked to simulate a 90 percent loading of filters.
3. Fan Speeds: Test and adjust fan RPM to achieve design CFM requirements. Make any changes in pulley sheave, belts, and dampers or add dampers necessary to correct balance at no additional cost to owner.


5. Pitot Tube Traverse: Perform a Pitot tube traverse of main supply and return ducts to obtain total CFM. If a Pitot tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation of why a traverse was not made must appear on the appropriate data sheet.

6. Static Pressure: Test and record system static pressures, including suction and discharge static pressure profile of each fan.

7. Air Temperature: Take dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on the entering and leaving side of each heating coil.

8. Branch Ducts: Adjust branch ducts to within design CFM requirements.

9. Tolerance: Test and balance each diffuser, grille, and register to within plus or minus 5 percent of design requirement.

10. Identification: Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.

11. Description: Record the size and type of each diffuser, grille, and register on air outlet data sheets.

12. Minimizing Drafts: Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

13. Exhaust Fans:
   a. Measure fan static pressures, total CFM, makeup air and fan RPM.
   b. Measure motor operating voltage and amperage.

14. Record the specified, against the actual, supplied horsepower and electrical characteristics of all motors.

3.6 WATER SYSTEM TEST & BALANCE PROCEDURES

A. Check for proper operation and setting, valves, strainers, air vents, and control valves.

B. Set all temperature controls so each system is placed in full demand mode.

C. Use calibrated fittings or equipment and pressure gages to determine flow rates for system balance. Where not installed, base flow balance on temperature difference across heat transfer elements.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings.

F. Balance all water quantities to the specified GPM's at flow devices to within plus or minus 5 percent of design. At all other locations balance by return water temperatures. Submit three (3) copies of following data:

   1. Flow devices: Service, location, size, required GPM, measured pressure difference, resultant actual GPM from venturi curves.

G. After completion of balancing, operate all systems and equipment under normal working conditions for three (3) consecutive seven (7) hour days and submit record of performance.

3.7 CONTROL SYSTEMS VERIFICATION

A. Verify that all control devices are properly connected.

B. Verify that all dampers, valves and other controlled devices are operated by the intended controller.
C. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).

D. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions.

E. Check that all valves are properly installed in the piping system in relation to direction of flow and location.

F. Check the sequence of operation that any control mode is in accordance with approved shop drawings.

G. Verify that all controller set points meet the design intent.

H. Check all dampers for free travel.

I. Verify the operation of all interlock systems.

J. Perform all system verification to assure the safety of the system and its components.

3.8 SYSTEM PERFORMANCE VERIFICATION

A. At the time of final inspection, the Test and Balance (TAB) Agency shall recheck, in the presence of the Owner's Representative, specific and random selection of data, air quantities, and air motion recorded in the Certified Report.

B. Points and areas for recheck shall be selected by the Owner's Representative.

C. Measurement and test procedures shall be the same as approved for work forming a basis of Certified Report.

D. Selections for recheck, specific plus random, will not normally exceed 25 percent of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.

E. If random tests elicit a measured flow deviation of ten percent or more from that recorded in the Certified Report listings, by ten percent or more of the selected recheck stations, the report is rejected, all systems shall be readjusted and tested, new data recorded, new Certified Report submitted, and new inspections tests made, all at no additional cost to Owner.

F. Following system verification of the Certified Report by the Owner's Representative, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked by the TAB Agency, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after system verification.

3.9 RECORDS

A. Keep continuous record of all test reading and submit three (3) copies of typewritten balancing reports upon completion. Submit floor plan indicating location of all measurements including terminal units, air outlets, and fans.

B. Upon completion of the work, submit all records and certifications approving the testing requirements to the Architect before final payment is made.

C. Defective work or material replaced or repaired, as necessary and the inspection and test repeated. Repairs made with new materials. No caulking of screwed joints or holes will be acceptable.
D. No part of any work covered until after it is inspected, tested and approved.

END OF SECTION
SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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B. Work Included: This Section includes general administrative and procedural requirements for Division 16. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 1.

1. Quality assurance
2. Definition of Terms
3. Submittals
4. Coordination
5. Record Documents
6. Operation and Maintenance Manuals
7. Rough-in
8. Electrical Installation
9. Cutting, Patching, Painting, and Sealing
10. Field Quality Control
11. Project Closeout
C. Related Work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.

1. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications; apply to all Division 16 Sections.

2. Miscellaneous Metal Work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 5, Miscellaneous Metals.

3. Miscellaneous Lumber and Framing Work: Include wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. Refer to Division 6, Rough Carpentry.

4. Moisture Protection and Smoke Barrier Penetrations: Include membrane clamps, sheet metal flashing, counterflashing caulking, and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs, and foundation walls.

5. Access Panels and Doors: Required in walls, ceilings, and floors to provide access to electrical devices and equipment. Refer to Division 8, Access Doors also, Division 5, Metals.

6. Painting: Include surface preparation, priming, and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 9, Painting.

7. Lighting Fixture Supports: Provide slack fixture support wire for lighting fixtures installation in acoustical tile or lay-in suspended ceilings. Refer to Division 9, Acoustical Treatment.

D. Work furnished under another Division requiring connections under this Division includes, but is not limited to:

1. Electric motors
2. Package Mechanical Equipment: VAV's, Fans, Fan Coil Units, Pumps, Boilers, Compressors, etc.
3. Pre-wired electrified partition furniture
4. Temperature Control Panel(s) (Line voltage only)
5. Electric Door Locks
6. Door hold-open/release devices
7. Variable Frequency Drive Units
8. Motorized Rolldown/Sliding Doors and Grills
9. Projection Screens

E. Items furnished under another division, but installed and connected under this division includes, but is not limited to: Wall mounted control stations for motorized rolldown and sliding doors.

1.2 QUALITY ASSURANCE

A. Reference to codes, standards, specifications, and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. 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 authority for reducing the quality, requirements or extent of the drawings and specifications. The contract documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules, and regulations including, but not limited to, the following minimum standards, whether statutory or not:
1. California Electric Code (CEC)
3. California Building Code : (CBC)
4. California Fire Code (CFC)
5. California Mechanical Code (CMC)

D. Standards: Equipment and materials specified under this division shall conform to the following standards where applicable:
1. ACI American Concrete Institute
2. ANSI American National Standards Institute
3. ASTM American Society for Testing Materials
4. CBM Certified Ballast Manufacturers
5. ETL Electrical Testing Laboratories
6. FS Federal Specification
7. IEEE Institute of Electrical and Electronics Engineers, Inc.
8. IPCNA Insulated Power Cable Engineer Association
9. NEMA National Electrical Manufacturer’s Association
10. UL Underwriter’s Laboratories

E. All base material shall be ASTM and/or ANSI standards.

F. All electrical apparatus furnished under this Section shall conform to NEMA standards and the NEC and bear the UL label where such label is applicable.

G. Certify that each welder performing work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

H. Electrical contractor shall have Class C-10 certification as certified by the state of California.

1.3 DEFINITION OF TERMS

A. The following list of terms as used in the Division 16 documents shall be defined as follows:
1. "Provide" shall mean furnish, install and connect unless otherwise indicated.
2. "Furnish" shall mean purchase and deliver to project site.
3. "Install" shall mean to physically install the items in-place.
4. "Connect" shall mean make final electrical connections for a complete operating piece of equipment.
5. "As directed" shall be as directed by the owner or their authorized representative.
6. "Utility companies" shall mean the company providing electrical, telephone, or cable television services to the project.

1.4 SUBMITTALS

A. Format: Furnish submittal data neatly bound in an 8-1/2 x 11 inch folder or binder for each specification section with a table of contents listing materials by section and paragraph number.

B. Submittals shall consist of detailed shop drawings, specifications, block wiring diagrams, catalog cuts and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication, and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and these which are excluded. Furnish quantities of each submittal as noted in Division 1.

C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp, stating that the submittal has been thoroughly reviewed by the contractor and is in full compliance with the requirements of the Contract Documents. Cover letters shall list in full the item and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. The contractor shall submit detailed drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the installation documents. Physical size of electrical equipment shown on the drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'-0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

E. As part of the equipment submittals, the manufacturer shall provide anchorage calculations for floor and wall mounted electrical equipment so that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of L25. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

F. The manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights and approximate centers of gravity.

G. All resubmittals shall include a cover letter that lists the action taken and revisions made to each drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

H. Shop drawings for the following systems must be prepared via a computer aided drafting (CAD) system for submission by the contractor. The engineer can provide files of the electrical contract documents to the contractor in Autocad 2009.

1. Manufactured Wiring System, Section 16123
2. Fire Alarm System, Section 16620

**1. Substitutions:**

1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 1.

2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor shall submit to the engineer all pertinent test data, catalog outs and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.

3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes, or equipment, which, in the opinion of the engineer, are equal in quality, utility and appearance, will be approved as substitutions to that specified.

4. Whenever any material, process or equipment is specified in accordance with a Federal Specification, an ASTM Standard, an ANSI Specification, UL rating or other association standard, the contractor shall present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the engineer, support test data to substantiate compliance shall be submitted by the contractor at no additional cost.

5. Substitutions shall be equal, in the opinion of the architect/engineer, to the specified product. The burden of proof of such shall rest with the contractor. When the architect/engineer in writing accepts a substitution, it is with the understanding that the contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the contractor of responsibilities for the proper execution of the work, or from any provisions of the specifications.

6. The contractor shall be responsible for all expenses in connection with the substitution materials, processes and equipment, including the effect of his substitution on him, his subcontractors or other Contractor's work. No substitution of material, processes or equipment shall be permitted without written authorization of the architect/engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the engineer are at the sole risk of the contractor.

### 1.5 COORDINATION

**A. Discrepancies:**

1. In the event of discrepancies within the Contract Documents, the engineer shall be so notified, within sufficient time, as delineated in Division 1, prior to the Bid Opening to allow the issuance of an addendum.

2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply. The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the contractor's bid. No
additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the bid.

B. Job Conditions:

1. Examination of Site: The Contractor shall visit the site and thoroughly review the locale, working conditions, conflicting utilities, and the eruditions in which the electrical work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that 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.

2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the project throughout the project duration.

C. Preparation:

1. Drawings:
   a. Layout: General layout shown on the Drawings shall be followed except where other work may conflict with the Drawings.
   b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.6 RECORD DOCUMENTS

A. Provide project record drawings as described herein:

1. Drawings shall fully represent installed eruditions 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 manufacturers and products actually installed, and revised panel schedules. Contractor shall record all changes in the work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the owner's representative to ascertain that they are current. If not current monthly payments maybe withheld.

2. Record drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD) process. A set of CAD files of the electrical documents will be provided to the contractor in AutoCad 2009.

3. Record drawing submissions shall be provided to the engineer for review upon the completion of the final electrical installation.

4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
   a. Device branch circuiting system
b. Manufactured wiring system
c. Fire alarm system

5. A single set of half size prints of the record drawings shall be submitted for review: Upon receipt of the engineer's review comments, corrections shall be made and the contractor shall provide the following:
   a. Two sets of full size prints
   b. Four sets of half size prints
   c. One set of full size reproducibles
   d. DXF files of drawings

B. Panel Schedules:
   1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 16442: Panelboards for requirements. Provide new schedules at panelboard with circuiting changes and new panelboards.
   2. A single set of the record panel schedules shall be submitted for review. Upon receipt of the engineer's review comments, corrections shall be made and the contractor shall provide the following:
      a. Fold and insert one copy of the appropriate schedule in the packet of the inner door of each panelboard.
      b. Three binders, each containing a full set of the panel schedules. Provide index listing all schedules and dividers for separation of schedules as follows:
         1) 277/480V Normal
         2) 277/480V Emergency
         3) 120/208V Normal
         4) 120/208V Emergency

1.7 OPERATION AND MAINTENANCE MANUALS

A. Prior to project closeout furnish to the owner, six (6) hardback 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each section all equipment furnished under Division 16. Binders shall be indexed into division sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

1.8 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. Overview: Contractor shall provide a project manager/engineer for the duration of the project to coordinate the Division 16 work with all other trades. Coordination, services, procedures, and documentation responsibility shall include, but shall not be limited to the items listed in this section.

B. Review of Shop Drawings Prepared by other Subcontractors:
   1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 16 work.
2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 16 contract documents. Document any discrepancy or deviation as follows:
   a. Prepare memo summarizing the discrepancy
   b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
3. Prepare and maintain a shop drawing review log indicating the following information:
   a. Shop drawing number and brief description of the system/material
   b. Date of your review
   c. Indication if follow-up coordination is required

C. Request for Information (RFI):
   1. Thoroughly review the contract documents prior to the preparation and submission of an RFI. If an RFI is submitted, attach 8-1/2 x 11 inch copies of all relevant documents to clarify the issue.
   2. Prepare and maintain an RFI log indicating the following information:
      a. RFI number and brief summary of the issue
      b. Date of issuance and receipt of response

D. Clarification Confirmation Memo (CCM):
   1. Either the contractor will prepare CCM memos for the engineer to confirm a decision clarifying the contract documents that does not impact cost or affect other trades.
   2. Prepare and maintain a CCM log indicating the following information:
      a. CCM number. Use CCM-C1, C2, etc. for memos issued by the contractor and CCM-E1, E2, etc. for memos issued by the engineer.

E. Brief summary of issue and date issued.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. 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.

B. Verify final locations for rough-ins with field measurements and with the requirements for the actual equipment to be connected.

C. Refer to equipment specification in Divisions 2 through 16 for rough-in requirements.
3.2 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling and installation shall be in accordance with manufacturers written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
   1. Shop drawings prepared by manufacturer.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and other structural components.
   5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting height is not detailed or dimensioned, contact the architect for direction prior to proceeding with rough-in.
   7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the architect.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
  11. Coordinate electrical systems, equipment, and materials installations with other building components.
  12. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 8.
  13. Install systems, materials, and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.

3.3 CUTTING, PATCHING, PAINTING AND SEALING

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 Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
C. Application of Joint Sealers:
1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.4 FIELD QUALITY CONTROL

A. General: Perform tests to prove installation is in accordance with contract requirements. Perform tests in presence of the Owner’s Representative 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.

B. Tests: In addition to specific system test described elsewhere, tests shall include:
1. Insulation Resistance: Perform 1000-volt DC tests for one minute on all equipment rated 300 volts and higher, feeder and branch circuit conductors, including the neutral. Make a typed record of all readings to be included in the maintenance instructions. Repair or replace circuits showing less than 10 megohms resistance to ground.
2. Circuit Continuity: Test all branch circuits for continuity. Test all neutrals for improper grounds.
4. Lighting Control Circuits: Test lighting circuits for correct operation through their control devices.
5. Circuit Numbering Verification: Select on a random basis various circuit breakers in the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.

C. Product Failure: Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative 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.

E. Cleaning: After other work such as sanding painting, etc. has been completed, clean lighting fixtures, panelboards, switchboards and other electrical equipment to remove dust, dirt, grease or other marks. Leave work in clean condition.

F. Voltage Check:
1. At completion of job, check voltage at several points of utilization on the system that has been installed under this contract. During test, energize all installed loads.
2. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120 volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving utility company.

3.5 PROJECT CLOSEOUT

A. Training: At the time of completion, a period of not less than 16 hours shall be allotted by the contractor for instruction of building operating and maintenance personnel in the use of all systems. This 16 hours of training is in addition to any instruction time called out in the specifications for specific systems; i.e. Fire Alarm, etc. All personnel shall be instructed at the 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 Users' Reference. Costs, if any, for the above services shall be paid by the contractor.

B. Special Tools: Provide one of each tool required for proper operation and maintenance of the equipment provided under this section. All tools shall be delivered to the Owner at project completion.

C. Keying: Provide two keys for each lock furnished under this section and turn over to Owner.

END OF SECTION
SECTION 16060 - DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this section.

1.2 SUMMARY

A. Work Included: Selective electrical demolition

1.3 SECTION INCLUDES

A. Disconnection, removal, and relocation of all wiring, light fixtures, outlets, conduit, and all other types of electrical equipment as described on drawings.

B. Purpose is to remove, relocate, and extend existing installations to accommodate new construction.

PART 2 - PRODUCT

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment necessary for patching and extending work, as specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions in the area of demolition prior to commencing work to insure complete understanding of existing installation in relationship to demolition work.

B. Note function of devices to remain that require removal and reinstallation.
3.2 GENERAL DEMOLITION

A. Remove all wiring, light fixtures, outlets, fire alarm devices, conduit, wiring and all other types of electrical equipment which are indicated to be removed. Devices which are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings which are to remain, blank coverplates are to be installed on outlet boxes. Coverplates shall be weatherproof at exterior locations.

B. Where remodeling interferes with circuits in areas which are otherwise undisturbed, circuits shall be reworked as required.

C. Existing devices and circuiting which are shown are indicated only for informational purposes. Contractor shall visit the site and shall verify conditions as they exist and shall remove, relocate and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all work with that of other trades.

D. Coordinate the routing of all conduits with the mechanical and plumbing contractors in order to avoid conflicts with ducts, pipes, etc.

E. The owner will identify equipment that shall be delivered to them. All other items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the site.

F. Cutting and patching necessary for the installation or removal of electrical work shall be included under this Section.

G. The existing power, signal, and communication systems are to remain in service, until new systems are completed, to provide for the school's continuous function (if necessary). Should it become necessary to shut down any system or portion of a system, approval in writing must be obtained from the owner and shall only be for the time agreed upon.

3.3 LIGHT FIXTURES

A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

3.4 OUTLETS

A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

3.5 CONDUIT

A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
3.6 WIRING

A. Remove abandoned wiring to source of supply.

3.7 EXISTING SYSTEMS

A. Electrical Distribution System: Disable system only to make switchovers and connections. Obtain permission from owner's designated representative at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

B. Fire Alarm System: Maintain the existing system in service. Disable system only to make connections to maintain service in work area(s). Notify owner and Fire Supervisory Service at least 24 hours before partially or completely disabling the system. Provide fire watch when system is disabled.

3.8 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION
SECTION 16061 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Power System Grounding
   2. Electrical Equipment and Raceway Grounding and Bonding

B. Related Work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 5: Building Steel
   2. Division 15: Cold Water Piping

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
   1. Underwriters Laboratories, Inc. (UL): UL467 - Grounding and Bonding Equipment

1.3 SYSTEM DESCRIPTION

A. Ground each separately derived system neutral as described herein and indicated on the drawings.

B. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, cable trays, boxes, cabinets, and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically shown or specified.

C. Resistance: Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20 Ohms.

1.4 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit manufacturer’s installation instructions.

1.5 QUALITY ASSURANCE

A. All materials, equipment, and parts comprising the units specified herein shall be new, unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
1. Grounding Bushings, Connectors, Jumpers, and Bus:
   a. O-Z Gedney
   b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 GROUND CONDUCTORS

A. General Purpose Insulated: UL approved and code sized copper conductor with dual rated THHN/THWN insulation, color identified green. Where continuous color-coded conductors are not commercially available, provide a minimum 4 inch long color band with green, nonaging, plastic tape in accordance with NEC.

B. Bonding Pigtails: Insulated copper conductor, identified green, sized per code, and provided with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.3 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150 degree centigrade molded plastic insulating throat and lay-in grounding lug.

2.4 CONNECTIONS TO PIPE

A. For Cable To Pipe: UL and NEC approved bolted connections
2.5 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

A. Where required by the drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high pressure compression type connectors.
   1. Exothermic welds shall be used for cable-to-cable and cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
   2. High pressure compression type connectors shall be used for cable-to-cable. Connections shall be as manufactured by Thomas & Betts #54300 Series, or equal.

2.6 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by the drawing or specified herein.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of grounding system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Grounding Electrode Conductor: Provide grounding electrode conductor as indicated on the drawings or size per NEC Table 250-94, whichever is greater.

B. Separately Derived Electrical System Grounding:
   1. Ground each separately derived system per requirements in NEC Article 250-26 as a minimum, unless greater requirements are required elsewhere in the contract documents.
   2. Transformers: Provide a dual rated four or six-barrel grounding lug with a 5/8"-11 threaded hold. Drill enclosure with 11/16" bit and attach lug to enclosure utilizing a torque bolt and a dragon tooth transition washer, or equal. Connect the following when present:
      a. Grounding electrode conductor
      b. Primary feeder ground
      c. Secondary feeder ground
      d. Main bond jumper
      e. Isolated ground conductor

C. Equipment Bonding/Grounding:
   1. Provide a NEC sized insulated copper ground conductor in all 120 VAC through 600 VAC feeder and branch circuit distribution conduits and cables.
   2. Provide a separate grounding bus at panelboard, switchboards. Connect all metallic enclosed equipment so that the maximum fault current flowing shall be maintained at no more than 34 volts above ground.
3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutter, etc. shall have grounding bushing and bonding jumpers installed interconnecting all such conduits.

4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold water piping system.

5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.

6. Provide external ground wire wrapped around flexible conduit and terminate to connectors designed for the purpose.

END OF SECTION
SECTION 16070 - ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Conduit Supports
   2. Equipment Supports
   3. Fastening Hardware

B. Related work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere, here to produce a complete installation.
   1. Division 5: Miscellaneous Metals; Hangers for electrical equipment
   2. Division 9: Ceiling Suspension Systems; Slack fixture support wires

1.2 SYSTEM DESCRIPTION

A. Provide devices specified in this section and related sections for support of electrical equipment furnished and installed under Division 16.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported

1.3 SUBMITTAL

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Clearly mark on each data sheet the specific items) being submitted and the proposed application.
   3. Submit manufacturer’s installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment, and parts comprising the units specified herein shall be new, unused, and of current manufacturer.

B. Only products and applications listed in this Section may be used on the project unless otherwise submitted.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Concrete Fasteners:
      a. Phillips "Red-Head".
      b. Remington
      c. Ramset
   2. Concrete Inserts and Construction Channel:
      a. Unistrut Corp.
      b. GS Metals "Globe Strut."
      c. Thomas & Betts "Kindorf" Corp.
   3. Conduit Straps:
      a. O-Z/Gedney
      b. Erico "Caddy" Fastening products
      c. Thomas & Betts "Kindorf" Corp.

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements.

2.2 CONCRETE FASTENERS

A. Provide expansion-shield type concrete anchors.

B. Provide powder driven concrete fasteners with washers. Obtain approval by architect and structural engineer prior to use.

2.3 CONCRETE INSERTS

A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.4 THREADED ROD

A. Provide steel threaded rod sized for the load, unless otherwise noted on the drawings or in the specifications.

2.5 CONSTRUCTION CHANNEL

A. Provide 1-1/2 inch by 1-1/2 inch, 12 gauge galvanized steel channel with 17/32-inch diameter bolt holes, and 1-1/2 inch on center in the base of the channel.
2.6 CONDUIT STRAPS

A. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling application.
   1. Use malleable strap with spacers for exterior and wet locations.
   2. Use steel strap without spacers for interior locations.

B. Steel conduit hanger for pendant support with threaded rod

C. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate size, shape and location of concrete pads with Division 3, Cast-In-Place Concrete.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where shown on the Drawings or Specification, install freestanding electrical equipment on concrete pads.

3.3 INSTALLATION

A. Furnish and install supporting devices as noted throughout Division 16.

B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor, or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the architect or structural engineer.

J. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four: anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.4 ERECTION OF METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.6 ANCHORAGE

A. All floor mounted, freestanding electrical equipment such as transformers, distribution boards, etc. shall be securely fastened to the floor structure.

B. Electrical equipment shall be seismically braced per California Building Code requirements.

END OF SECTION
SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
1. Electrical equipment nameplates
2. Panelboard directories.
3. Wire and cable identification
5. Inscribed device coverplates

B. Related work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere, here to produce a complete installation.
1. Division 9: Painting

1.2 SUBMITTAL

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein.
2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
1. Conduit and Wire Markers:
   a. Thomas & Betts "Kindorf" Corp.
   b. Brady
   c. Griffolyn
2. Inscription Tape:
   a. Kroy
   b. Merlin

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements.
2.2 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, sings, and instruction plates. Engrave stock melamine plastic laminate 1/16 inch minimum thickness for signs up to 20 square inches, or 98 inches in length, 1/8 inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.3 LEGEND PLATES

A. Type LP: Die stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Color and letter height as specified in Part 3: Execution

2.4 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener

B. Dimensions: 2 inch diameter 19 gauge

2.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6 x 8 inch minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering starting at the top, odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84); Section 3 (circuit numbers 85-126).

2.6 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable, or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by manufacturer for this purpose.

2.7 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4 inch wide, for identification of phase conductors. Scotch 35 Brand Tape, or equal.
2.8 INSCRIBED DEVICE COVERPLATES

A. Coverplate Material shall be as specified in Section 16140: Wiring Devices.

B. Methods of Inscription (unless otherwise noted):
   1. Type-On Tape:
      a. Imprinted or thermal transfer characters onto tape lettering system
      b. Tape trimmer
      c. Matte finish spray-on clear coating
   2. Engraving:
      a. 1/8 inch high letters
      b. Paint filled letters finished in black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of identification device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 NAMEPLATES

A. Installation:
   1. Degrease and clean surfaces to receive nameplates.
   2. Install nameplates parallel to equipment lines.
   3. Secure nameplates to equipment fronts using machine screws.

B. Provide Type NP color coded nameplates that present, as applicable, the following information:
   1. Equipment or device designation
   2. Amperage, KVA, or horsepower rating, where applicable
   3. Voltage or signal system name.
   4. Source of power or control.
   5. Examples:
      a. Boards: HD2A; 225A; 277/480V, 3PH, 4W; Served from EH2A-4
      b. Transformers: TX-2A; 150KVA; 480V pri. - 120/208V, 3PH, 4W sec.; Serve from: HD2A; Load Served: L2A
      c. Motor Control Centers:
         1) Main nameplate: MCC/1A; 600A Main Bus; 480V, 3PH, 3W; Served from HD1A
         2) Each compartment: EF-1; 20 H1; 100A Switch; Size 1 Starter
         3) Disconnects or Individual Motor Starters: EF-1; 20HP; 480V, 3PH, 3W; Served from MCC-1A

C. Nameplates for power system distribution equipment and devices shall be black.
D. Nameplates for signal systems equipment and devices shall be black except as follows:
   1. Fire Alarm and Life Safety - Red
   2. Clock - Blue

E. Minimum letter height shall be as follows:
   1. For panelboards, switchboard, battery panels, motor control center, etc.: 1/2 inch letters to identify equipment designation. Use 1/4 inch letters to identify primary and secondary voltages.
   2. For individual circuit breakers, switches, and motor starters in panelboards, switchboards, and motor control centers use 3/8 inch letters to identify equipment designation. Use 1/8 inch letters to identify all others.
   3. For individual mounted circuit breakers, disconnect switches; enclosed switches and motor starters use 3/8 inch letters to identify equipment designation. Use 1/8 inch letters to identify all others.
   4. For transformers use 1/2 inch letters to identify equipment designation. Use 1/4 inch letters to identify primary and secondary voltages, etc.
   5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8 inch letters to identify equipment designation.

3.3 LEGEND PLATES
   A. Provide panel-mounted operators devices such as pilot lights, reset buttons, hand-off-auto switches, etc.

3.4 BRASS TAGS
   A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection; i.e. “Transformer”, “Cold Water Bond” etc.

3.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)
   A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.
   B. Verify room numbers or area designation with project manager.
   C. Mount panelboard directories in a minimum 6 x 8 inch metal frame under clear plastic cover inside every panelboard.

3.6 WIRE AND CABLE IDENTIFICATION
   A. Provide wire markers on each conductor in panelboards, pull boxes, outlet and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment manufacturer’s shop drawings for control wiring.
B. Provide colored phase markers for conductors as noted in Section 16123: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.7 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull, and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.8 WARNING, CAUTION AND INSTRUCTION SIGNS

A. Provide warning, caution, or instruction signs where required by the NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

3.9 INSCRIBED DEVICE COVERPLATE

A. General:
   1. Lettering type: Helvetica, 12 point or 1/8 inch high
   2. Color of characters shall be black
   3. Locate the top of the inscription 1/2 inch below the top edge of the coverplate.
   4. Inscription shall be centered and square with coverplate.

B. Application:
   1. Provide inscribed coverplates for devices as outlined below:
      a. Outlets in surface raceways
      b. Multi-ganged (four or more) switch arrangement.
      c. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
   2. Type-on-tape inscriptions shall be provided for the following devices:
      a. Receptacles
      b. Outlets in surface raceways
      c. Data outlets
      d. Multi-ganged switches
   3. Engraved inscriptions shall be provided for the following devices:
      a. Special purpose switches
4. Type-On Tape Installation:
   a. Tape shall be trimmed to the height of the letters.
   b. Trim tape length to 1/4 inch back from each edge of coverplate.
   c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION
SECTION 16080 - ELECTRICAL COMMISSIONING

PART I - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the start-up and commissioning of the electrical systems, including but not limited to:
   1. Building Wire and Cable
   2. Transient voltage surge suppressors
   3. Panelboards
   4. Dry Type Transformers
   5. Overcurrent Protective Devices
   6. Lighting
   7. Lighting Control Systems, including dimming
   8. Fire Alarm System Additions
   9. Clock System Additions

B. Perform commissioning of electrical systems as directed by the owner's commissioning agent in accordance with the contract documents.

C. Electrical commissioning requires the participation of all parties related to the Division 16 contract to ensure that systems are operating in a manner consistent with the contract documents. The parties shall consist of, but not be limited to the following:
   1. Electrical contractor
   2. Special systems subcontractors or distributors
   3. Independent testing agency
   4. Factory-authorized service representatives

D. Additionally, there is participation required from parties outside of Division 16 contract to ensure that their systems are operating or monitoring in accordance with a sequence of operation consistent with the contract documents. The parties shall consist of, but not be limited to the following:
   1. Division 15: Division 15: HVAC, Plumbing and Controls - To ensure that under emergency power system operations all systems function per the sequence of operation.
   2. Division 15: HVAC - For control and monitoring of fan and fire/smoke damper system via the fire alarm system per the sequence of operation.
   3. Division 15: Controls - For control of lighting system via the BMS system as outlined in the contract documents.
   4. Division 15: Controls - For monitoring of electrical systems via the BMS system as outlined in the contract documents.

E. The commissioning responsibilities applicable to each of the parties indicated above are as follows:
   1. One representative from each of the above parties shall attend a commissioning scope meeting and all other meetings necessary to facilitate the commissioning process.
2. Contractor shall provide the commissioning agent with normal cut sheets and shop drawing submittals of all commissioned equipment.

3. Provide additional requested documentation, prior to normal O&M manual submittals, to the commissioning agent for development of startup and functional testing procedures.
   a. Typically this will include detailed manufacturer installation and startup, operating, troubleshooting and maintenance procedures, full factory testing reports (if any), and full warranty information with the responsibilities of the owner to keep the warranty in force clearly identified. In addition, the installation, startup and checkout materials that are shipped with the equipment, including field checkout sheet forms to be used by the factory or field technicians shall be submitted to the commissioning agent.
   b. The commissioning agent may request further documentation necessary for the commissioning process.

4. Contractor shall assist in clarifying the operation and control of commissioned equipment in areas where the Specifications, drawings or equipment documentation is not sufficient for writing detailed testing procedures.

5. Develop a full startup and initial checkout plan using manufacturer's startup procedures and the prefunctional check lists from the commissioning agent for all commissioned equipment. Submit to commissioning agent for review and approval prior to startup.

6. Provide assistance to the commissioning agent in preparing the specific functional performance test procedures.

7. During the startup and initial checkout process, execute the electrical related portions of the prefunctional checklist for all commissioned equipment.

8. Perform and clearly document all completed startup system operational checkout procedures, providing a copy to the commissioning agent.

9. Address current architectural/engineering punch list items before functional testing.

10. Ensure that the appropriate technicians are available and present to execute the startup and functional performance testing of commissioned equipment for the duration required to complete the necessary tests, adjustments and problem solving.

11. Perform functional performance testing under the direction of the commissioning agent for specified equipment. Assist the commissioning agent in interpreting the monitored data, as necessary.

12. Correct deficiencies as interpreted by the commissioning agent and retest the equipment.

13. Prepare O&M manuals according to the contract documents, including clarifying and updating to correspond with as-built conditions.

14. Provide training of the owner's operating personnel as specified. The commissioning process does not take away from or reduce the responsibility of the installing contractor to provide a finished and fully functioning installation.

1.2 REFERENCES

A. The system shall be tested in strict accordance with the latest edition of the following applicable specifications and standards and any other applicable standards, except as otherwise shown or specified:

1. National Fire Protection Association (NFPA)
2. National Electrical Code (NEC)
3. International Electrical Testing Association, Inc. (NETA)
4. American National Standards Institute, Inc. (ANSI)
5. National Electrical Manufacturer Association (NEMA)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. Insulated Cable Engineers Association (ICEA)
8. Occupational Safety and Health Administration (OSHA)
9. Factory Mutual (FM) Standards

1.3 DEFINITIONS

A. Startup
B. Prefunctional Checklist
C. Prefunctional Testing
D. Functional Performance Testing

1.4 SYSTEM DESCRIPTION

A. Commissioning is a systemic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, prefunctional checklist, functional performance testing and training.

B. Commissioning on this project is intended to achieve the following specific objectives according to the contract documents:
1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry acceptable minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the owner's operating personnel are adequately trained.

C. Commissioning Process:
1. The owner shall provide the services of a commissioning agent to develop the commissioning plan and to direct, review and approve the commissioning work.
2. The following is an overview of the anticipated commissioning tasks during construction:
   a. Commissioning during construction shall begin with a scope meeting conducted by the commissioning agent where the commissioning process is reviewed with all commissioning team members.
   b. Additional meetings shall be required throughout construction, scheduled by the commissioning agent with necessary parties attending, to plan, scope, coordinate, schedule activities and resolve problems.
   c. Equipment documentation shall be submitted to the commissioning agent during normal submittal process, including detailed startup procedures.
   d. The commissioning agent shall work with the contractors in developing stamp plans and startup documentation formats, including providing contractors with prefunctional checklists to be completed during the startup process.
e. The checkout and performance verification shall proceed from simple to complex; from component level to equipment to systems and inter-system levels with prefunctional checklists being completed before functional testing.

f. The contractors, under their own direction, shall execute and document the prefunctional checklists and perform startup and initial checkout. The commissioning agent shall document that the check lists and startup were completed according to the approved plans. This may include the commissioning agent witnessing startup of selected equipment.

g. The commissioning agent develops specific equipment and system functional performance test procedures for review by the contractors.

h. The procedures are executed by the contractors, under the direction of, and documented by the commissioning agent.

i. Items of non-compliance in material, installation or setup are corrected at the contractor’s expense and the system retested.

j. The commissioning agent reviews the O&M documentation submitted by the contractor for completeness.

k. The commissioning agent reviews, pre-approves and coordinates the training process provided by the contractor and verifies that it was completed.

1.5 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:

1. Provide a complete list of equipment to be commissioned per the requirements of the Division 16 Specifications.

2. Manufacturer’s written instruction manuals applicable to commissioned equipment to include special inspection, detailed startup procedures and testing requirements.

3. Plan for startup and initial checkout of commissioned equipment.

4. Upon completion of startup and prefunctional testing for commissioned equipment or systems, provide a test report in the format developed by the commissioning agent.

5. Submit schedule for training of all commissioned equipment for coordination and approval by owner’s operating personnel.

B. Provide qualifications for independent testing agency.

1.6 QUALITY ASSURANCE

A. Provide testing equipment and accessories that are free of defects and are certified for intended use.

B. Provide testing equipment with current calibration labels.

C. Independent testing agency shall be a financially stable organization and able to function as an unbiased testing authority, professionally independent of manufacturers, suppliers and installers of equipment or systems evaluated by the testing agency. They shall also be a member of the International Electrical Testing Association (NETA), specializing in the testing of equipment or apparatus specified in this Division with a minimum of 5 years experience.
PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The contractor shall provide all standard testing equipment required to perform startup, initial checkout, required functional performance testing and commissioning. Also, the contractor shall provide two-way radios to facilitate communications during commissioning.

B. Special equipment, tools, and instruments (only available from vendors, Specific to a piece of equipment) required for testing equipment, according to these contract documents shall be included.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the specified tolerances. All equipment should be calibrated according to the manufacturer’s recommended intervals.

PART 3 - EXECUTION

3.1 MEETINGS

A. Within 90 days of commencement of construction, the commissioning agent will schedule, plan and conduct a commissioning scope meeting with the entire commissioning team in attendance. The commissioning agent will distribute meeting minutes to all parties. Information gathering from this meeting will allow the commissioning agent to prepare and finalize the commissioning plan, which will also be distributed to all parties.

B. Other meetings will be planned and conducted by the commissioning agent as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular contractors. The commissioning agent will plan these meetings and will minimize unnecessary time being spent by contractors. These meetings may be held monthly, until the final three months of construction when they may increase in frequency to one per week. Inspect commissioned equipment and confirm that it is clean and ready for operation. All shipping tags removed, nameplate installed and equipment manuals in place.

3.2 EXAMINATION

A. Inspect commissioned equipment and confirm that it is clean and ready for operation. All shipping tags removed, nameplate installed, and equipment manuals in place.

B. Verify that startup plan and prefuntional checklist are completed and approved for commissioned equipment prior to beginning procedures.

C. Verify that operational manual/procedures are complete prior to starting the functional performance testing.

D. Verify that startup and prefuntional testing is complete prior to starting the functional performance testing.
3.3 PREPARATION

A. Provide required personnel with tools and equipment necessary to perform functional performance testing.

B. Provide equipment factory representative for startup and commissioning work as necessary or as required by the specifications.

C. Provide certified independent testing agency personnel for start-up and commissioning work as required by the specifications.

3.4 REPORTING

A. The commissioning agent will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. Testing or review approvals and non-conformance and deficiency reports are made regularly with the required action by the contractor.

3.5 STARTUP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all systems and all equipment to be commissioned.

B. Commissioning agent will prepare prefuctional checklist to ensure that the equipment and systems are hooked up and operational. The prefuctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. The commissioning agent shall assist the commissioning team members, responsible for startup of any equipment, in the development of detailed startup plans for equipment. The primary role of the commissioning agent in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefuctional checklists and startup are identified in the commissioning scope meeting and in the checklist forms. All required factory startups of equipment must be performed under the guidance and witnessed by the commissioning agent.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. Objective:
   1. The objective of the functional performance testing is to demonstrate that each system is operating according to the documented design intent and contract documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation, and functioning of the systems.
2. Each system shall be operated through all modes of operation where there is a specified system response. Verification of each sequence in the sequence of operation is required. Proper responses to such modes and conditions shall also be tested.

B. The commissioning agent shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the contractor for review and approval.

C. Non-Conformance:
   1. The commissioning agent will record the results of the functional performance test on the procedure or test forms. All deficiencies or non-conformance issues shall be noted and reported to the contractor on a standard non-compliance form.
   2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the commissioning agent. In such cases the deficiency and resolution will be documented on the procedure form.
   3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the commissioning agent will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the contractor.
   4. As tests progress and a deficiency is identified, the commissioning agent shall discuss the issue with the executing contractor:
      a. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it:
         1) The commissioning agent documents the deficiency and the contractor's response with their intentions to correct and continues on with the testing. After the day's work, the commissioning agent submits the non-compliance reports to the contractor. The contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and submits it back to the commissioning agent.
         2) The commissioning agent reschedules the test and the test is repeated.
      b. If there is a dispute, regarding whether it is a deficiency or determining who is responsible:
         1) The deficiency shall be documented on the non-compliance form with the contractor's response and a copy given to the contractor.
         2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the architect/engineer. Final acceptance authority is with the Project Manager.
         3) The commissioning agent documents the resolution.
         4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and submits it to the commissioning agent.
         5) The commissioning agent reschedules the test and the test is repeated.

D. Architectural Dimming System

E. Lighting Control Systems
F. Fire Alarm System:
   1. Functional testing for fire alarm system shall include the involvement of the following trades.
      a. Division 15, HVAC Contractor, for the operation of the smoke control system upon initiation of an alarm condition.
      b. Division 15, Controls Contractor, for the operation and override of the fire alarm system in smoke control mode during and alarm condition.

3.7 TRAINING

A. The contractor shall be responsible for training coordination, scheduling and ultimately to ensure that the training is completed in accordance with the specifications.

B. The commissioning agent shall be responsible for overseeing and approving the content and adequacy of the training of owner personnel for commissioned equipment.

C. The electrical contractor shall have the following training responsibilities:
   1. Provide the commissioning agent with a training plan two weeks before the planned training.
   2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.
   3. Training shall normally start with classroom sessions, followed by hands-on training on each piece of equipment or system, which shall illustrate the various modes of operation.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manuals, Specifications or sequence of operation, the system will be repaired or adjusted as necessary and the demonstration repeated.
   5. The appropriate trade or manufacturer's representative shall provide the instructions and hands-on training on each major piece of equipment or systems. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific equipment or system is required. More than one party may be required to execute the training.
   6. The training sessions shall follow the outline in the Table of Contents of the O&M manuals and illustrate whenever possible the use of the O&M manuals for reference.
   7. Training shall include:
      a. Use of printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. A review of the written O&M instructions emphasizing safe and proper operating procedures, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown and emergency procedures.
      c. Discussion of relevant safety issues and concerns.
      d. Discussion of warranties and guarantees.
      e. Common troubleshooting problems and solutions.
      f. Explanatory information included in the O&M manuals and location of all plans and manuals in the facility.
      g. Discussion of any peculiarities of equipment or system installation or operation.
8. Training shall occur after functional performance testing is complete, unless approved otherwise by the commissioning agent.

END OF SECTION
SECTION 16123 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Building Wire
   2. Cable
   3. Wiring Connections and Terminations
   4. Manufacturer Wiring System

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. Federal Specifications (FS):
      a. FS J-C-30A Cable and Wire, Electrical (Power, Fixed Installation)
      b. FS W-S-610C Splice Conductor
      c. FS I-JH;I-595C Insulation Tape, Electrical, Pressure Sensitive Adhesive, Plastic
   2. Underwriters Laboratories, Inc. (UL):
      a. UL 83 Thermoplastic-Insulated Wires and Cables
      b. UL 486A Wire Connector/Soldering Lugs for use w/copper Conductors
      c. UL486C Splicing Wire Conductors
      d. UL493 Thermoplastic-Insulated Underground Feeder/Branch Circuit Cables
      e. UL 854 Service - Entrance Cables
   3. National Electrical Manufacturer Association (NEMA):
      a. NEMA WC-5 Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
      b. NEMA WC7: Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
   4. Institute of Electrical and Electronic Engineers (IEEE):
      a. IEEE 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors
1.3 SUBMITTALS

A. Submit the following items in accordance with the requirements of Section 16010: Basic Electrical Requirements:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. Clearly mark on each datasheet the specific item(s) being submitted and the proposed application.
   3. Submit manufacturer’s installation instructions.
   4. MC Cable device branch circuiting shop drawings: Provide shop drawings indicating all device connections, layout, wire quantities, etc. from above suspended ceiling power distribution junction boxes to complete branch circuiting net shown on drawings. Prepare drawings in accordance with Section 16010: Submittals.
   5. Manufactured Wiring System Shop Drawings: Indicating system layout of cable types and lengths, distribution boxes, switching arrangements, circuiting arrangement and cable routing. Prepare drawings in accordance with Section 16010: Submittals.

1.4 RECORD DRAWINGS

A. Furnish Record Drawings as described in Section 16010; Basic Electrical Requirements, utilizing shop drawing submissions with updated field conditions. These drawings shall include but not be limited to the following:
   1. Device branch circuiting system with MC cable
   2. Manufactured wiring system

B. Final acceptance will not be made until the engineer has approved the Record Drawings.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered provided that all features of the specified product are provided:
   1. Building Wire:
      a. America Insulated Wire Corp.
      b. Rome Cable
      c. Southwire Company
2. Metal-Clad:
   a. American Cable Systems

3. Flexible Cords and Cables:
   a. Carol Cable Company
   b. PWC Corp.
   c. ITT Royal Electric

4. Wiring Connectors and Terminations:
   a. 3M Company
   b. Ideal
   c. Blackburn-Holub
   d. Burndy
   e. Thomas & Betts Corp.
   f. Beau Barrier

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements:

2.2 BUILDING WIRE

A. Conductor Material:
   1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
   2. Wire AWG #8 and larger shall be stranded, unless otherwise indicated.
   3. Wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation Material:
   1. All insulated wire, conductor, and cable shall be 600 volt rated unless otherwise noted on the drawings.
   2. Thermoplastic-insulated building wire: NEMA WC 5
   3. Rubber-insulated building wire: NEMA WC 3
   4. Feeders and branch circuits larger than 6 AWG: Type THW, XHHW, or dual rated THHN/THWN.
   5. Feeders and branch circuits 6 AWG and smaller: Type TW, THW, XI- THW, or dual rated THHN/THWN.
   6. Control Circuits: Type THW, or dual rated THHN/THWN
   7. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.3 METAL-CLAD CABLE (MC)

A. MC cable shall be an armored assembly of two or more dual rated THHN/THWN conductors. A full sized green insulated ground wire.

B. MC cable sheath shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

C. Fittings: Connectors shall be of the single screw clamp variety with steel or east malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.
2.4 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted Pressure Connectors: Provide wide range-taking connectors with east bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical Spring Wire Connectors:
   1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
   2. Self-stripping pigtai1l and tap U-contact connectors shall not be used.

C. Compression Type Terminating Lugs:
   1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug manufacturer or as indicated on the drawings. Notch or single point type crimping is not acceptable.
   2. Two hole, long barrel lugs shall be provided for size (4/0) and later wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

D. Splicing and Insulating Tape: Provide black, ultraviolet proof, self-extinguishing, 7 rail thick vinyl general purpose electrical tape with a dielectric strength of 10,000 volts suitable for temperatures from minus 18 degrees C to 105 degrees C. Federal Spec. HH-I-595, Scotch 33+ or equal minimum.

E. Insulating Putty:
   1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
   2. Use putty suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C with a dielectric strength of 570-volts/rail minimum.

F. Insulating Resin:
   1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
   2. Use resin with a set up time of approximately 30 minutes at 21.1 degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

G. Terminal Strips:
   1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
   2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
   3. Identify all terminals with numbering sequence being used for a particular system.

H. Crimp Type Connectors:
   1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support.
   2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with flannel wire entry and insulation support.

4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

I. Cable Ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by manufacturer of ties.

J. Wire Lubricating Compound:
   1. UL listed for the wire insulation and conduit type, and shall not harden or become adhesive.
   2. Shall not be used on wire for isolated type electrical power systems.

K. Bolt Termination Hardware:
   1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
   2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B 18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
   3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, conforming to ANSI 27.2. SAE or narrow series shall not be used.
   4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
   5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
      a. 1/4" bolt - 125 amps
      b. 5/16" bolt- 175 amps
      c. 3/8" bolt - 225 amps
      d. 1/2" bolt- 300 amps
      e. 5/8" volt - 375 amps
      f. 3/4" bolt - 450 amps

2.5 MANUFACTURED WIRING SYSTEM

A. The manufactured wiring system shall be complete, including all tap boxes, cable sets, tap cables, lighting fixture adapter assemblies and all accessories.

B. The system shall be constructed such that all system components will be metal encased, forming a fully grounded system. All spare and unused connectors in the system shall be covered with caps provided for the purpose. System shall be listed for use in plenums and spaces used for environmental air.

C. Cable Assembly:
   1. All cables shall have factory pre-wired connectors. Cable sets shall have a power-in connector on one end and a power-out connector on the opposite end. Tap cables shall have a power-in connector on one end and 6 inch pigtail leads on the opposite end for field terminations within transition and switch boxes.
   2. Each cable shall have a positive means to engage the connectors in system components such as distribution boxes, tap boxes and lighting fixtures.
3. The cable shall provide grounding of non-current carrying metal equipment by means of a separate grounding conductor.
4. All cables shall be clearly-marked and color-coded for designation of service and voltage.
5. Line voltage branch circuit cable sets shall have #12 AWG stranded copper conductors, 600 volts, plus a bare #12 AWG solid copper equipment grounding conductor with galvanized steel armor interlocked overall.

D. Connectors: The connectors shall be so polarized that only unit of the same service, voltage and function can be physically mated and electrically connected.

E. Lighting Fixture Adapter Assemblies:
1. The wiring system manufacturer shall furnish fixture adapter assemblies to the lighting fixture manufacturer for installation in all fixtures to be connected to this system.
2. Lighting fixtures shall be factory pre-wired with manufactured wiring system adapter assemblies furnished under this Section and shall be shipped to the job site ready for connection with the manufactured wiring system.
3. Lighting fixture adapter assemblies shall be manufactured such that field installation is possible by stalling the assembly through standard knockouts in the fixtures.
4. Fixture adapter assemblies shall be mounted in the side or end of the fixture. When installed, no portion of the flexible wiring system shall extend above the top of the fixture.
5. Adapter assemblies shall be UL recognized components. The lighting fixture manufacturers shall be responsible for obtaining UL listing for the combination.
6. Lighting fixtures and other equipment shall be adapted with power-in connector, power-out connector or both as dictated by system requirements and as shown on the Drawings.

F. Tap Boxes:
1. All tap boxes shall be complete with provisions for interface unit, conduit entry, and mounting.
2. All box connectors (interface units) shall be prewired with #12 AWG, 600 volt phase conductors, neutral and equipment grounding conductor which shall be connected to the metal box. A separate color shall be used for each phase conductor.
3. Interface units shall be power-out type, uniquely polarized for service and function. The connector shall receive the cable heads by a positive means of engagement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions in the area for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATIONS

A. All wire, conductor, and cable with their respective connectors, firings and supports shall be UL listed for the installed application and ambient condition.
B. Feeders and branch circuits in wet locations shall be rated 75 degree C.
C. Feeders and branch circuits in dry locations shall be rated 90 degree C.

D. Minimum conductor size:
   1. Provide minimum AWG #12 for all power and lighting branch circuits.
   2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

E. Color Coding:
   1. For 120/208 volt, 3 phase, 4 wire systems:
      a. Phase A - Black
      b. Phase B - Red
      c. Phase C - Blue
      d. Neutral - White
      e. Ground - Green
   2. For 277/480 volt, 3 phase, 4 wire systems:
      a. Phase A - Brown
      b. Phase B - Orange
      c. Phase C - Yellow
      d. Neutral - Gray
      e. Ground - Green
   3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.
   4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.3 WIRING METHODS

A. Install wires and cables in accordance with manufacturer’s written instructions, as shown on drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. 20 amp power and lighting branch circuits shall contain no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208 volt circuits located outside a 75 foot radius of panel source and for 277 volt branch circuits located outside a 200 foot radius of panel source, unless otherwise noted.

F. 20 amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208 volt circuits located
outside a 65 foot radius of panel source and for 277/480 volt circuits located outside a 150 foot radius of panel source.

G. Provide #10 AWG pig tails on all 20A and 30A wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes. Group and bundle with tie wraps each neutral with its associated phase conductor where more than one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the NEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train, and tie the cables in individual circuits; for panelboards, cabinets, wireways, switches, and equipment assemblies.

K. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

L. Stranded wire shall be terminated using fitting lugs or devices listed for the application. However, in no ease shall stranded wire be terminated solely by wrapping it around a screw or bolt.

M. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to manufacturers published installation instructions.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely and thoroughly swab raceway system before installing conductors.

C. Do not use block and tackle, power driven winch, or other mechanical means for pulling conductors of size smaller than AWG #1.

D. Wire Pulling:
   1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
   2. Use rope made of nonmetallic material for pulling feeders.
   3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
   4. Pull in together multiple conductors or cables in a single conduit.

E. Install and test all cables in accordance with manufacturers instructions and warranty.
3.5 MC CABLE INSTALLATION

A. The drawings indicate above suspended ceiling power distribution junction boxes for conversion from hardwire to MC cable wiring system. Install these boxes such that they are accessible from below. MC cable shall be run to each device as described in documents. MC cable runs have not been shown. Refer to shop drawings for installation.

B. Install MC cable in accordance with manufacturers instructions and in strict accordance with NEC Article 334. Follow manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.

C. Support cables every 6 feet, and within 12 inches of boxes, per NEC Article 334, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

D. Suspended ceiling drop wire may be used to directly support a maximum of two separate MC cables.

E. Provide separate drop wire above accessible ceiling to support more than two MC cables.

F. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

G. Bend the cable per NEC Article 334.

H. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.6 MANUFACTURED WIRING SYSTEM INSTALLATION

A. The drawings indicate manufactured wiring distribution boxes for conversion from hardwire to flexible wiring systems. Provide these boxes above the suspended ceiling accessible from below at locations shown on drawings. Flexible wiring shall then be run to the fixtures to conform to circuiting and control shown on plans. Actual flexible wiring runs have not been shown. Utilize corresponding circuiting shown adjacent to distribution boxes.

B. Install all components and assemblies in accordance with manufacturer’s instructions.

C. System shall be furnished complete with all accessories and hardware required for a completely operational system.

D. Support cables every 6 feet per NEC Article 334, using separate spring metal clip or metal cable tie (not steel tie wire) for each cable. Cables shall not be bundled together.

E. Provide supports for all system box per the requirements of this division.

F. Suspended ceiling drop wire may be used to directly support a maximum of two separate manufactured wiring system cables.
G. Provide separate drop wire above accessible ceiling to support more than (2) two manufactured wiring system cables.

H. Where switches are shown in areas using manufactured wiring systems, provide the following:
   1. Provide conduit and necessary wires from the switch to a manufactured wiring system tap box. Unless otherwise noted, provide two conductors for every SPST switch, three conductors for every three-way switch, and four conductors for every four-way switch.
   2. Manufactured wiring system tap boxes shall be located above the suspended ceiling accessible from below. Flexible wiring shall then be run to the fixtures as described in the plans. Actual flexible wiring runs have not been shown.
   3. Each switching station controls only those fixtures within the same room as the switch. In small rooms, circuit numbers are indicated by the switching station only. Connect all fixtures to switch legs as indicated on the plans.

I. Mark each connector with the circuit number(s) being supplied to the fixture, switch box, or transition box.

3.7 WIRE SPLICES, JOINTS, AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, NEC and manufacturer’s instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it is determined that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost.

F. Terminate wires in terminal cabinets, relay and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pullboxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtailed and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least six (6) inches of tail and neatly packaged in box after splice is made up.
K. Branch Circuits (#10 AWG and smaller):
   1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600 volt, 105-degree C° with integral insulation, approved for copper conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped wires.
   3. The number, size, and combination of conductors as listed on the manufacturers packaging shall be strictly complied with.

L. Feeder Circuits: (#6 to 750 MCM)
   1. Join or tap conductors from #6 AWG to 750 MCM using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
   2. Terminate conductors from size #6 AWG to 750 MCM copper using bolted pressure or mechanical compression lugs in accordance with manufacturer recommendation or as specified elsewhere.
   3. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
   4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination Hardware Assemblies:
   1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer, and nut.
   2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer, and nut.
   3. The crown of Belleville washers shall be under the nut.
   4. Bolt assemblies shall be torque to manufacturer recommendation. Where manufacturer’s recommendation are not obtainable, the following values shall be used:
      a. 1/4" - 20 bolt at 180 inch pounds torque.
      b. 5/16" - 18 bolt at 180-inch pounds torque
      c. 3/8" - 16 bolt at 20-foot pounds torque
      d. 5/8" - 11 bolt at 55-foot pounds torque
      e. 3/4" - 10 bolt at 158-foot pounds torque

3.8 IDENTIFICATION

A. Refer to Section 16075: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors size #8 and larger using specified phase color markers and identification tags.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.
E. In manholes, pullboxes, and handholes, provide tags of the embossed brass type and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.9 FIELD QUALITY CONTROL

A. Independent Testing: Electrical contractor shall arrange and pay for the services of an independent testing agency to perform all quality control electrical testing required herein.

B. Prefunctional Testing:
  1. Visual and Mechanical Inspection:
     a. Inspect wires and cables for physical damage and proper connections.
     b. Insure wire and cable identification has been installed as specified herein.
  2. Electrical Testing:
     a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances.
     b. Tests shall be performed by 600 VDC megger for a continuous 10 seconds. Test conductors phase-to-phase and phase-to-ground. Conductors shall test free from short circuit and ground faults.
     c. Contractor shall furnish instruments, materials, and labor for these tests.
     d. Torque test conductor connections and terminations for conformance with specifications.
  3. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION
SECTION 16131 - CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to but not limited to:
1. Rigid steel conduit and fittings
2. Intermediate metal conduit and fittings
3. Electrical metallic tubing and fittings
4. Flexible metallic conduit and fittings
5. Liquidtight flexible metallic conduit and fittings
6. Rigid aluminum conduit and fittings
7. Miscellaneous conduit fittings and products

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
1. Division 1: Cutting and Patching
2. Division 7: Sheet metal flashing and trim
3. Division 9: Painting; exposed conduit and other devices

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
1. Federal Specifications (FS):
   a. FS WW-C-563 Electrical Metallic Tubing
   b. FS WW-C-566 Specification for Flexible Metal Conduit
   c. FS WW-C-581 Specification for Galvanized Rigid Conduit
   d. FS W-C-1094A Conduit and Conduit Fittings Plastic, Rigid
2. American National Standards Institute, Inc. (ANSI):
   a. ANSI C80.1 Rigid Steel Conduit, Zinc Coated
   b. ANSI C80.3 Electrical Metallic Tubing Zinc Coated
   c. ANSI C80.5 Rigid Aluminum Conduit
3. Underwriters Laboratories, Inc. (UL):
   a. UL 1 Flexible Metal Conduit
   b. UL 6 Rigid Metal Conduit
   c. UL 797 Electrical Metallic Tubing
   d. UL 1242 Intermediate Metal Conduit
4. National Electrical Manufacturer Association (NEMA):
   a. NEMA RN1 PVC Externally Coated Galvanized rigid Steel Conduit
1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. Clearly mark on each datasheet the specific item(s) being submitted and the proposed application.
   3. Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Equal Products by the following manufacturers will be considered provided that all features of the specified product are provided:
   1. Metal Conduit:
      a. Allied Tube and Conduit Co.
      b. Triangle PWC, Inc.
      c. Western Tube and Conduit Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Alflex Corp. g. American Flexible Metal Conduit Co.
   2. Fittings:
      a. Appleton Electric Co.
      b. OZ/Gedney
      c. Thomas & Betts Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).

2.2 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
C. Three Piece Couplings: Electroplated, cast malleable iron

D. Insulating Bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree minimum.

E. Insulated Grounding Bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated Metallic Bushings: Threaded cast malleable iron body with plastic insulated threat rated 150 degrees C.

G. All fittings and connectors shall be threaded.

2.3 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 rail thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.

B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Conduit: Hot dip galvanized steel meeting the requirements of NEC Article 345 and conforming to ANSI C80.6 and UL 1242.

B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 specifications and shall meet UL requirements.

B. Set Screw Type Couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of ease hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

C. Set Screw Type Connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Set screw shall be same as for couplings.

D. Raintight Couplings: Electroplate steel or cast malleable iron UL listed raintight and concrete tight, using gland and ring compression type construction.
2.6 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be the single screw clamp, variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.7 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut: shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "0" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.8 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight Conduit Entrance Seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight Cable Sealing Bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated east malleable iron locking collar.

C. Expansion Fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/Deflection Couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL167 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF, or equal.

E. Fire Rated Penetration Seals:
1. UL building materials directory classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
3. The fire rated sealant material shall be the product best suited for each type of penetration, and may be a caulk, putty, composite sheet or wrap/strip.

F. Standard Products Not Specified Herein:
1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e.: locknuts, bushings, etc.
2. Listing shall include manufacturers name, part numbers, and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material, and construction to similar items herein specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions in the area for acceptance of conduit system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

A. Galvanized rigid steel conduit (GRS) shall be used in the following applications:
1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks, or in hazardous locations in accordance with NEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.

B. Intermediate Metal Conduit (IMC): Shall be used for the same application as galvanized rigid steel conduit as specified herein.

C. Electrical Metallic Tubing (EMT): Shall be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces, EMT shall not be installed exposed below 6 feet above the finish floor except within electrical, communication or signal rooms or closets.

D. Flexible Metallic Conduit (FMC): Shall be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices, and to lighting fixtures installed in suspended ceiling% minimum sizes shall be 3/8" for lighting fixtures and control wiring and 1/2" for motor and transformer connections. U.O.N.

E. Liquidtight Flexible Metallic Conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches, or similar
devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2 inch.

3.3 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.

D. Conduits shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

F. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness, and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center 6" concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

G. In long runs of conduit, provide sufficient pullboxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150 feet. Support pullboxes from structure independent of conduit supports. These pullboxes are not shown on the Drawings.

H. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, shown, or specified in the contract documents or not.

I. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit or MC cable extending from a junction box to the fixture or manufactured wiring system.

3.4 INSTALLATION

A. Install conduit in accordance with manufacturer's written instructions, as shown on drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2 inch for interior applications and 3/4 inch for fire alarm.
C. All conduit sizes shown on the drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the contractor shall be responsible for resizing conduits upward to meet Code.

D. Except in electrical, communication and mechanical rooms, conduit connections to motors and surface cabinets shall be concealed unless exposed work is clearly called for on the drawings.

E. Install conduits in complete runs before pulling in cables or wires.

F. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

G. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

H. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to insure low resistance ground continuity through conduit, and to prevent seizing and corrosion.

I. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

J. In all empty conduits or ducts, install a polyethylene pulling rope.

K. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not shown on the Drawings. Refer to Section 16061: Grounding and Bonding.

L. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

M. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

N. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360 degrees, total).

O. Emergency Power Raceway System: Install entirely independent of other raceway system, except where specifically allowed by NEC Article 517.

3.5 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
   1. Where shown on the structural drawings
   2. As approved by the structural engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
B. Cutting or Holes:
   1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the structural engineer as required by limited working space. Obtain the approval of the structural engineer prior to drilling through structural sections.
   2. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
   3. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.

C. Sealing:
   1. Non-Rated Penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
   2. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire rated partitions, walls, smoke partitions, or floor, install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in division 7: Sealants and Caulking.
   1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
   2. For roof penetrations furnish and install roof flashing; counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the specifications. Waterproofing At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 7: Sealants and Caulking.
   3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
   4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.6 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibrations, use bonding bushings or wedges to assure electrical continuity. Where
subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts. 

D. Conduit terminations exposed at weatherproof enclosures and east outlet boxes shall be made watertight using Specified connectors and hubs. 

E. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside fee plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor. 

F. Install specified 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 raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes. 

G. Raceway Seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms; water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects, and rodents. Install raceway sealing foam at the following points: 
   1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.) 
   2. Where conduits enter or leave research labs. 

H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows: 
   1. Conduits three inches and larger shall be rigidly secured to the building structure on opposite sides of a building expansion joint, and provided with expansion or deflection couplings. Install the couplings in accordance with the manufacturer’s recommendations. 
   2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits. 

I. Use short length (maximum of 6 ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with FMC or LFMC conduit.
3.7 SUPPORTS

A. Provide supports for raceways as specified in Section 16070: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the NEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard me-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. Individual 1/2 inch and 3/4 inch conduits installed above suspended ceilings may be attached to the ceiling’s hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:
   1. After Concrete Installation:
      a. Steel expansion anchors not less than ½ inch bolt size and not less than 1-1/8 inch embedment.
      b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than three inches.
      c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION
SECTION 16132 - SURFACE RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
1. Surface Metal Raceways
2. Multi-Outlet Assemblies
3. Wireways

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
1. Federal Specifications (FS):
a. FS W-C-582 - Conduit Raceway, Metal, and Fitting Surface

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit manufacturer’s installation instructions. Provide written instructions for raceway product special installation techniques.
4. Complete bill of material listing all components.
5. Shop Drawings: Indicate layout, dimensions, support locations and mounting details.
6. Furnish structural calculations for suspended wireway support as described in Section 16010: Basic Electrical Requirements.

1.4 QUALITY ASSURANCE

A. All materials, equipment, and parts comprising the units specified herein shall be new, unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Surface Metal Raceways and Multi-outlet Assemblies:
      a. The Wiremold Co.
      b. Isoduct (Aluminum)
   2. Wireways:
      b. Circle AW Products
      c. Square D Co.

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 SURFACE METAL RACEWAYS

A. Assembly: Single or double compartment raceway shall be complete to include bases, covers, end plates, compartment divider, fittings and connections as required. Raceways shall be UL labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of Cold rolled steel with 0.094" minimum wall thickness of extruded aluminum of No. 6063-T5 aluminum alloy extrusions. Corner extrusions shall be identical to linear extrusions.

C. Size: Raceway size and length shall be as indicated in drawings.

D. Fittings: Boxes, extension rings, couplings, elbows, and connectors shall be designed for use with raceway system.

E. Finish: Gray enamel Stainless Steel 215 R1 clear anodized.

2.3 MULTI-OUTLET ASSEMBLIES

A. Assembly: Single or Double compartment raceway shall be factory pre-assembled, pre-cut and complete, including bases, covers, end plates, compartment dividers, wiring, receptacles, fittings and connections as required. Raceway shall be U.L labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of cold rolled steel with 0.094" minimum wall thickness of extruded aluminum of No. 6063-T5 aluminum alloy extrusion. Corner extrusions shall be identical to linear extrusions.

C. Size: Raceway size and length shall be as indicated on the drawings.

D. Receptacles: Convenience receptacles mounted in cover shall be NEMA 5-20R in accordance with Specification Section 16140: Wiring Devices. Space receptacles on center as indicated on drawings.
E. Coverplates: Device coverplates shall be of the same material and finish as the raceway.

F. Wiring: Receptacle circuits shall be prewired or field wired with minimum #12 AWG conductors throughout entire length of section. 12 inch pigtails shall be provided for field connections. Pigtails shall be properly tagged with circuit identification in the field. Tap splicing shall be accomplished with No. 562 "Scotch-Lok" tap connectors.

G. Wire retention clips shall be installed in sufficient numbers to securely hold all wire lengths in place.

H. Grounding: Ground continuity shall be maintained to receptacles throughout the entire length of raceway by means of a separate, insulated, code sized ground conductor.

I. Fittings: Boxes, extension rings, couplings, elbows, and connectors shall be designed for use with raceway system.

J. Finish: Gray enamel Stainless Steel 215 R1 clear anodized.

2.4 WIREWAYS

A. Assembly: Wireway shall be complete to include channel, cover, end plates, fittings and connectors as required. Wireway shall be U.L labeled.

B. Construction: Wireway channel, cover and end plates shall be constructed of galvanized code gauge sheet steel for general-propose use. Wireway shall have concentric knockouts, spaced a maximum of 12 inches on center, on both sides of hinged opening.

C. Size: Wireway size and length shall be as indicated on the drawings.

D. Cover: Hinged covers with screw retention.

E. Connector: Shall be slip-in construction with hinged cover.

F. Fittings: Lay-in types with removable covers and designed for use with wireway system.

G. Finish: Rust-inhibiting primer coat with gray enamel finish

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of surface raceway installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
3.2 SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY

A. Installation:
1. Install raceway in accordance with manufacturer’s written instructions, as shown on drawings and as specified herein.
2. Contractor shall coordinate raceway lengths with building walls, counter, and actual field conditions.
3. Raceways mounted on walls above benches and counters shall align exactly with each end of bench or counter.
4. Use flat-head screws to fasten channel to surfaces, at heights indicated on the drawings, per manufacturers instructions. Mount plumb and level.
5. Install complete with all necessary corner connectors, T-connectors, feed connectors, compartment dividers, and any other hardware required to provide a complete system as described in the drawings.
6. Provide fittings to feed the raceway from the back

B. Branch Circuiting: Provide connection to pre-wired or field wired assembly as indicated on the drawings. Install circuit identification tags on pigtails. Receptacles shall be identified with panel and circuit ID above each outlet with gray Dymo label.

C. Grounding: Ground continuity shall be maintained throughout entire raceway length per NEC.

3.3 WIREWAYS

A. Preparation:
1. Locations of wireways shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
2. Exposed wireways shall be run parallel at right angles to the centerlines of columns and beams.
3. Wireways shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

B. Installation:
1. Install wireways in accordance with manufacturers written instructions, as shown on drawings and as specified herein.
2. Installed complete with all necessary corner connectors, T-connectors feed connectors, and any other hardware required to install raceway systems as indicated in drawings.
3. Conduits shall be securely fastened to wireways using two locknuts and an insulating bushing or specified insulated connectors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric knockouts.

C. Supports:
1. All wireways shall be secured to building structures using specified fasteners, clamps and hangers spaced according to Code.
2. Suspended wireways shall be supported with universal hangers attached to structure above, spaced according to manufacturer installation instructions.
3. Provide lateral bracing support along suspended wireway spaced at a maximum of 30'-0" on center. Bracing shall consist of 3/8 inch threaded rod installed at a 45-degree angle up to structural slab and anchored. Alternate bracing on both sides of cable tray.

4. Grounding: Ground continuity shall be maintained throughout the entire raceway length per NEC.

END OF SECTION
SECTION 16135 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Wall and ceiling outlet boxes
   2. Pull and junction boxes.

B. Related work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 8: Access doors - Wall and ceiling access doors

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. American National Standards Institute/National Electrical Manufacturer Association:
      a. ANSI/NEMA OS-1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
      b. ANSI/NEMA OS-2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
      c. NEMA 250 Enclosures for Electrical Equipment (1000 volts maximum)

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.
PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Outlet and Junction Boxes:
      a. Spring City Electrical Manufacturing Co.
      b. Thomas & Betts Corp.
      c. Raco, Inc.
   2. Cast Boxes:
      a. Appleton Electric Co.
      b. Crouse-Hinds
   3. Floor Boxes:
      a. Hubbell Inc.
      b. Walker
      c. Raceway Components, Inc.
      d. Thomas & Betts Corp.
   4. Pullboxes:
      a. Circle AW Products

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 OUTLET BOXES

A. Standard Outlet Box:
   1. Provide galvanized, one-piece die formed or drawn steel, knockout type box of size and configuration best suited to the application indicated on the Drawings.
   2. 4-inch square by 1-1/2 inch deep shall be minimum box size.
   3. ANSI/NEMA OS-1

B. Concrete Box:
   1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
   2. Select height as necessary to position knockouts above concrete reinforcing steel.
   3. ANSI/NEMA OS-1

C. Tile Box:
   1. Provide outlet boxes for installation in tile or concrete block walls.
   2. Standard outlet boxes with raised, square comers and device covers are acceptable.
   3. ANSI/NEMA OS-1

D. Cast Metal Outlet Body:
   1. Provide four inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
   2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.
E. Conduit Outlet Body: Provide cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.3 PULL AND JUNCTION BOXES

A. Sheet Metal Pull and Junction Box:
1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16 gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
2. ANSI/NEMA OS-1

B. Cast Metal Pull and Junction Box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

C. Flush Mounted Pullboxes and Junction Boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

2.4 FLOOR BOXES

A. Refer to Section 16140: Wiring Devices for Floor Mounted Service Boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions acceptance of box installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed work is called for on the drawings.

B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.

C. Install outlet boxes 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.

D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed lighting fixtures.

F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire rated walls separate boxes by at least 24" and wall stud.

G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.3 INSTALLATION

A. Install boxes in accordance with manufacturer's written instructions, as shown on drawings and as specified herein.

B. Locate electrical boxes as shown on drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. 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. Note that these boxes are not shown on the drawings.

D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.

E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

F. Provide east metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

G. Provide precast concrete boxes in exterior planting areas, walk-ways, roads etc.

H. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.

I. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

J. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

K. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

L. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.

M. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.
3.4 SUPPORTS

A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.

B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16 gauge metal channel bars attached to main ceiling runners.

C. Support boxes independently of conduit system.

D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted lighting fixtures are to be installed from the box.

E. Support boxes, mounted above suspended acoustical file ceilings, directly from the structure above.

END OF SECTION
SECTION 16136 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Hinged Cover Enclosures
   2. Cabinets

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. National Electrical Manufacturer Association (NEMA):
      a. NEMA 250 Enclosures for Electrical Equipment
      b. NEMA ICS 1 Industrial Control and Systems
      c. NEMA ICS 4 Terminal Blocks and Industrial Use
      d. NEMA ICS 6 Enclosures for Industrial Controls and Systems
   2. Underwriters Laboratories (UL):
      a. UL 50 Cabinets and Boxes

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe project construction, material, finish, and any specific features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Submit manufacturer's installation instructions.
   5. Shop Drawings: Indicate wiring diagrams and equipment arrangement within cabinets.
   6. Furnish structural calculations for equipment anchorage as described in Section 16010: Basic Electrical Requirements.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Outlet and Junction Boxes:
      b. Circle AW Products

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 CABINETS AND ENCLOSURES

A. Construction: Shall be code gauge galvanized steel with standard concentric knockouts for conduit terminations. Size shall be as indicated in drawings. Cabinet shall be NEMA 250 Type 1. Finish: Manufacturer’s standard gray baked enamel finish.

B. Covers: Continuous hinged steel door, lockable and keyed to match panelboard locks.

C. Mounting:
   1. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
   2. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.

2.3 BACKBOARDS

A. Furnish cabinet with 3/4-inch fire retardant plywood mounting backboard on unless otherwise indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions acceptance of cabinets and enclosures installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
3.2 INSTALLATION

A. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

B. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with that referenced in Section 16010: Basic Electrical Requirement.

C. Train interior wiring, brindle, and clamp using specified plastic wire wraps.

D. Replace doors or trim exhibiting dents, beads, warps, or poor fit that may impede ready access, security or integrity.

E. Terminate conduit in cabinet with lock nut and grounding bushing:

F. Terminate wiring on terminal blocks and identify each with heat shrink tags.

3.3 CLEANING

A. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

B. Vacuum clean cabinet at completion of installation.

END OF SECTION
SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Wall Switches
   2. Receptacles
   3. Coverplates

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. Federal Specifications (FS):
      a. FS W-P-455A Plate, Wall Electrical
      b. FS W-C-596 Electrical Power connector, Plug, Receptacle, and Cable Outlet
      c. FS W-S-896 Switch, Toggle
   2. National Electrical Manufacturer Association (NEMA):
      a. NEMA WD-1 General Purpose Wiring Devices
      b. NEMA WD-2 Semi-Conductor Dimmers for Incandescent Lamps
      c. NEMA WD-5 Specific Purpose Wiring Devices
   3. Underwriters Laboratories, Inc. (UL):
      a. UL 514A Metallic Outlet Boxes

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Provide color finishes for architect to select from.
   4. Submit manufacturer's installation instructions.

B. Where inscribed device coverplates are noted on the drawings or in the specifications, conform to the requirements of Section 16075: Electrical Identification
1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Switches, Receptacles and Coverplates:
      a. Leviton to match existing.
   2. Floor Mounted Service Boxes:
      a. Wiremold
      b. Hubbell
      c. Walker

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 WALL SWITCHES

A. Standards: Provide general-purpose 120/277 VAC switches that conform to NEMA WD-1 specifications.

B. Color. Device color shall be as selected by the architect, unless otherwise noted.

C. Wall Switches:
   1. Provide twenty ampere, 120/277 volt, specification grade, designer Decora style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed ease.
   4. Three Way Switches: Hubbell #2123 series, Pass & Seymour #26023 series, or Leviton #5623-2 series.
   5. Four Way Switches: Hubbell #2124 series, Pass & Seymour #26024 series, or Leviton #5624-2 series.

D. Pilot Light Switches:
1. Provide twenty ampere, 120/277 volt, specification grade, toggle handle Decora style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with red handle lighted by a neon lamp which is lighted when the switch is in the ‘on’ position.
2. Single Pole, Single Throw Switches: Hubbell #1221PL/PL7, Leviton #1221 PLG/7PG or Pass & Seymour #20AC 1-1LPL.
3. Double Pole, Single Throw Switches: Hubbell #1222 PL/PL7, Leviton #1222 PLG/7PG, Pass & Seymour #20AC2-RPL.
4. Three Way Switches: Hubbell #1223 PL/PL7, Leviton #1223 PLG17PG, or Pass & Seymour #20AC3-RPL.

2.3 RECEPTACLES

A. Standards:
1. Provide general purpose 15 and 20 ampere, 125/250 VAC receptacles that conform to NEMA WD-1 specifications. Specialty receptacles shall conform to NEMA WD-5 specifications as applicable.
2. Provide NEMA 5-20R, specification grade, 20 amp, 125 VAC, 2 pole, 3 wire grounding type receptacle.
3. Receptacles shall be the designer Decora style device.

B. Color:
1. Device color shall be as selected by the architect unless otherwise noted.

C. General Purpose Single Outlets:
1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #2161 series, Pass & Seymour #26361 series, or Leviton #16351 series.

D. General Purpose Duplex Receptacles:
1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #2162 Series, Pass & Seymour #26362 Series, or Leviton #16352 Series.

E. Ground Fault Circuit Interrupting (GFCI) Receptacles:
1. Provide 20 amp, 125 VAC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5 milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset and test mechanisms and with point of use and multi-outlet protection.
3. Use Pass & Seymour #2091-S series, Hubbell GF-5362 series, Leviton #6898 series, for specification grade GFCI receptacles.

F. Special Purpose Receptacles: Provide specification grade devices with the NEMA configuration, voltage, and current rating number of poles and ground provisions as noted on the Drawings.
2.4 FLOOR MOUNTED SERVICE BOXES

A. Poke-Through Floor Fittings:
   1. Flush style fire-rated poke-through device for installation in a 2 or 3 inch cured hole through a concrete floor. Provide with finish ring receptacle, cable access, box, etc. or any other accessories to facilitate the installation shown on drawings.
   2. See detail on drawings for device requirements.

2.5 COVERPLATES

A. General:
   1. Provide all coverplates with rounded edges and comers, smooth and free of grooves, embossing or other embellishment.
   2. Provide mounting screws to match the plate finish.
   3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
   4. Provide plates of one design, designer Decora style, throughout the project unless otherwise specified.

B. Color: Coverplate color shall be as specified by the architect unless otherwise noted.

C. Plastic Coverplates:
   1. Provide smooth, high impact, self-extinguishing nylon coverplates, and 0.100 inches thick with rounded edges and comers.
   2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Weatherproof Coverplates:
   1. Non-Public Areas:
      a. Provide horizontal mounted, weatherproof coverplate for one duplex or one GFI receptacle. Provide gasketed, spring loaded, vertically self-closing covers suitable for use in damp and wet locations as described in UL514 and NEC 410.
      b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
      c. Use Pass & Seymour Sierra WPD-8 or equal coverplate for duplex receptacles.
      d. Use Pass & Seymour Sierra WPH-26 or equal coverplate for GFCI receptacles.
   2. Public Area Receptacles:
      a. Provide weatherproof coverplate for one duplex or one GFI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL514 and NEC 410.
      b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
      c. Use Pass & Seymour Sierra WPH-SL or equal coverplate for duplex receptacles.
      d. Use Pass & Seymour Sierra WP-26L or equal coverplate for GFCI receptacle.
      e. Provide two (2) keys for each looking type coverplate.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions acceptance of wiring device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.3 INSTALLATION

A. Install wiring devices in accordance with manufacturer’s written instructions, as shown on the drawings and as specified herein.

B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.

C. Mount switches at 48 inches above finished floor unless otherwise noted.

D. Mount receptacles vertically with the centerline 18 inches above finished floor and with grounding slot at bottom.

E. Mount receptacles vertically when mounting above counters, mount with grounding slot to the left.

F. Mount GFCI receptacles above counters in bathrooms and at counters within 6'-0" of sinks, whether indicated as GFCI type or not.

G. Provide coverplates for all outlet boxes, switches, receptacles, etc.

H. Install blank coverplates on all outlet boxes in which no device is required or installed.

I. Provide coverplates that completely cover wall opening and seat against wall.

3.4 FLOOR MOUNTED SERVICE BOXES

A. Installation: Core drill hole in floor (core size based on manufacturer’s installation instructions) for insert of poke-through devices. Make conduit connection to poke-through box from floor below.
B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.5 FIELD QUALITY CONTROL

A. Electrical Testing:
1. Test proper polarity of all receptacles.
2. Test ground continuity of all wiring devices.
3. Test ground fault interrupting device operation.

B. Visual and Mechanical Inspection:
1. Check proper operation of all switches.
2. Visually inspect and replace damaged or defective devices.

3.6 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION
SECTION 16280 - TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Transient voltage surge suppressors (TVSS)

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. American National Standards Institute, Inc. (ANSI)/Institute of Electrical and Electronics Engineers (IEEE):
      b. ANSI/IEEE C62.11 Standard for MOV Surge Arrestors Low-Voltage AC Power Circuits
      c. ANSI/IEEE C62.41 IEEE Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits
   2. Underwriters Laboratory, Inc. (UL):
      a. UL 50 Cabinets and Boxes.
      b. UL 1283 EMI/RFI Facility Filters
      c. UL 1449 Standard for Transient Voltage Surge Suppressors
   3. National Electrical Manufacturers Association (NEMA):
      a. NEMA LS1 Low Voltage Surge Protective Devices
      b. NEMA PB1.1 Instructions for Safety Instruction Operation and Maintenance of Panelboard Rated 600 Volts or less

1.3 SYSTEM DESCRIPTION

A. All specifications noted herein apply to the panelboard.

B. The TVSS shall be a parallel design transient voltage surge suppression system. The system utilizes diversion modules to suppress and divert transient voltage and surge currents. The system is designed to provide protection for sensitive electronic devices against the effects of surges, transients and electrical line noise.
C. Environmental Requirements:
1. Operating temperature: -40°C to 60°C
2. Relative humidity: 0 - 95%
3. Operating altitude: 0 - 12,000 feet
4. Audible noise: Less than 35 dB

D. Electrical Requirements:
1. The TVSS shall have unlimited nominal current handling when installed in a parallel configuration.
2. The TVSS system voltage shall be as shown on the drawings.
3. Protection Modes: For a WYE configured system, the device must have directly connected suppression elements between line-to-neutral (L-N), line-to-ground (L-G), and neutral-to-ground (N-G). For a Delta configured system, the device must have suppression elements between line-to-line (L-L) and line-to-ground (L-G).
4. Each unit's mode of operation shall protect against surges and transients from line-to-ground and line-to-line or line-to-ground, line-to-neutral, and neutral-to-ground if a neutral wire is present.
5. The TVSS shall be a hybrid device capable of suppressing the following amperage per mode:
   a. 120/208-volt branch panelboards: 50,000 amps minimum.

E. Operating Parameters:
1. The maximum response time shall not exceed 1 nanosecond.
2. Electrical noise filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be no less than 55 dB at 100 kHz.
3. The TVSS system shall operate over a frequency range of 47 hertz to 63 hertz.
4. The TVSS system shall limit total harmonic distortion produced to less than one percent.
5. The system's filtering mode shall provide sine wave tracking to within +/- 20 percent.
6. The maximum surge voltage rating for devices must not exceed the following:

<table>
<thead>
<tr>
<th>MODES</th>
<th>120/208V</th>
<th>277/480V</th>
<th>347/600V</th>
</tr>
</thead>
<tbody>
<tr>
<td>WYE: L-N; L-G; N-G</td>
<td>400V</td>
<td>800V</td>
<td>1200V</td>
</tr>
<tr>
<td>Delta: L-L; L-G</td>
<td>800V</td>
<td>1500V</td>
<td>2000V</td>
</tr>
</tbody>
</table>

7. The let through voltage for Category C3 surges (20 kV, 10 kA) shall be less than:

<table>
<thead>
<tr>
<th>MODES</th>
<th>120/208V</th>
<th>277/480V</th>
<th>347/600V</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-N</td>
<td>500V</td>
<td>900V</td>
<td>1300V</td>
</tr>
</tbody>
</table>

8. The let through voltage for Category B3 surges (6 kV, 500 amps) shall be less than:

<table>
<thead>
<tr>
<th>MODES</th>
<th>120/208V</th>
<th>277/480V</th>
<th>347/600V</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-N</td>
<td>170V</td>
<td>300V</td>
<td>470V</td>
</tr>
</tbody>
</table>

9. All devices must be tested to the specified surge voltage ratings to ensure the devices achieve the required life expectancy and reliability. Testing to full ratings also verifies internal construction quality of the suppressors.
1.4 SUBMITTALS

A. Items specified under this Section are Priority 1. Refer to Section 16010: Basic Electrical Requirements for specific Priority 1 Requirements.

B. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment, and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Shop drawings: Include elevations, cabinet dimensions, complete component listing and layout within cabinet, amperage ratings and capacities, system characteristics, and wiring diagrams.
5. Furnish structural calculations for equipment anchorage as described in Section 16010: Basic Electrical Requirements.
6. Submit manufacturer’s installation instructions.
7. Complete bill of material listing all components.
8. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system
2. Instruments for routine maintenance
3. Pictorial parts list and parts number
4. Telephone numbers for authorized parts and service distributors

1.6 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this Section may be used on the project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: TVSS components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.
C. Handling: Handle in accordance with the manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.8 WARRANTY

A. Units and components offered under this section shall be covered by a 5-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Current Technology
   2. EFI Electronics
   3. Clipper Power System (Cutler-Hammer) Advanced Protection Technologies, Inc. (Square D)
   4. Liebert
   5. General Electric

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements to manufacturer.

2.2 PROTECTION AND FILTERING ELEMENTS

A. The TVSS system shall consist of protection modules designed to suppress and divert transient voltage and surge currents. Each protection module shall be rated to suppress the per phase surge current, as noted above, for the application. Each protection modules shall contain multiple individually fused metal oxide varistor(s) Capable of withstanding over 1000 surges of current rated at 10,000 amperes and 20,000 volts per ANSI C62.41-1991, Category C with less than 10% degradation.

B. The protection for the switchboard units shall be of the plug-in type for ease in installation and/or replacement. No special tools should be required to replace the module. Modules in the panelboard units do not have to be the plug-in type.

C. The line-to-neutral mode shall contain filtering elements capable of providing noise attenuation as specified above.
2.3  ENCLOSURES

A. Panelboard Units Mounted Internally:
   1. Unit shall have minimal conflict with branch circuit wiring and conduit terminations. The unit shall be mounted in the bottom of the panelboard where the majority of branch circuits exit from the top of the panel. Conversely, units shall be mounted on the top of the panelboard where the majority of branch circuits exit from the bottom of the panel. Coordinate with the Construction Drawings.
   2. Viewing of the unit's monitoring status indicator lights shall be possible without opening the panelboard. This may be accomplished by providing remote cover mounted indicating lights or by a cutout in the outer door metal cover directly over the indicating lights. The cutout shall be as small as possible and not void any UL or NEC ratings or requirements. It is advisable that the unit be factory installed in the panelboard. Provide black engraved nameplate, with white letters, denoting the purpose and meaning of the indicating lights directly over the lights.
   3. Access to the traits mounted inside panelboards shall be via the same standard one piece, door-in-door trim, using the outer door.

2.4  OVERCURRENT PROTECTION

A. Panelboards: The units provided for branch panelboards shall be direct bus connection. Each unit shall maintain its own internal overcurrent protection.

B. All internal devices shall be fused in such a manner as to prevent violent failures or propelling particles under any failure condition up to the full AIC rating listed for the associated switchboard or panelboard. Main power fuses do not meet this requirement.

2.5  MONITORING FEATURES

A. Panelboards: Provide the following features:
   1. Each unit shall contain a pulsing green light and solid red light for easy viewing. The normal operation of the protection module shall provide positive indication utilizing the pulsing green light. Failure of the protection module shall provide negative indication utilizing the solid red light.
   2. Auxiliary form-C dry contacts for remote monitoring of status; these contacts shall be tied into the EMCS system.

2.6  SOURCE QUALITY CONTROL

A. System shall be thoroughly factory-tested before shipment. Testing of each system shall include but not be limited to "HI-POT" tests at two times rated voltage plus 1000 volts per UL requirements, ANSI C62.41, Category B surge test, UL ground leakage tests, and operational and calibration tests.

B. Provide factory test report to verify the operational integrity of each unit's suppression system.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of TVSS installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install TVSS in accordance with manufacturers written instructions, as shown on the drawings and as specified herein.

B. Set cabinets plumb and symmetrical with building lines in conformance with PB 1.2. Furnish and install all construction channel belts, angles, etc., required to mount the equipment furnished under this Section.

C. Conductors from the power source to the surge suppressor shall be #8 AWG copper in panelboards. Conductors shall be muted without sharp bends and straight and short as possible. The absolute maximum of 7'-0" long for units in switchboards and 1'-0" long for units in panelboards.

3.3 FIELD QUALITY CONTROL

A. Prefunctional Testing:
   1. Visual and Mechanical Inspection
      a. Inspect for physical damage, defects, alignment and fit.
      b. Compare nameplate information and connections to contract documents.
      c. Check tightness of all control and power connections.
   2. Field test EMCS annunciation of each unit's status contacts.

END OF SECTION
SECTION 16411 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Disconnect Switches

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown on specified:
   1. Federal Specifications (FS):
      a. FS W-F-870 Fuseholders (for plug and enclosed cartridge fuses)
      b. FS W-S-865 Switch, Box (enclosed), Surface-Mounted
   2. National Electrical Manufacturer Association (NEMA):
      a. NEMA KS 1 Enclosed Switches

1.3 SUBMITTALS

A. Items specified under this section are Priority 1; Refer to Section 16010: Basic Electrical Requirements for specific Priority 1 requirements.

B. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. As a minimum the following characteristics shall be indicated:
      a. NEMA types
      b. Current rating
      c. Number of poles
      d. Fuse provisions
      e. Enclosure dimensions
      f. Voltage
      g. Horsepower rating (if applicable)
      h. Short circuit rating
   3. Clearly mark on each data sheet the specific items) being submitted and the proposed application.
   4. Submit manufacturer’s installation instructions.
1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacture.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all specified features are provided.
   1. Cutler-Hammer/Westinghouse
   2. General Electric
   3. Siemens/ITE
   4. Square D

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements.

2.2 DISCONNECT SWITCHES

A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the "OFF" position.

B. Switch interior: Provide switch with switchblades that are fully visible in the "OFF" position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.

C. Switch Mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the "ON" position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.

D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose, sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rest-inhibiting phosphate primer and finished in gray baked enamel.

E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600 VAC as required for the circuit involved and that meet "I-SQUARED-T" requirements. Fusible switches to have provisions for the types of fuses specified in Section 16490: Overcurrent Protective Devices. UL listed short circuit rating when equipped with fuses to be 200,000 amperes RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600 amps. 800 amp switches and larger to have provisions for Class L fuses.
F. Auxiliary contacts provide one normally closed 120 VAC contact for indicated of power on the load side of the disconnect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of disconnect switch installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate locations of switches and equipment in the field to provide code required clearances in float of switches and to insure that switches are insight of the controller as described in NEC Article 430.

3.3 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Include construction channel and mounting hardware as required to support disconnect switch.

3.4 IDENTIFICATION

3.5 Provide engraved, machine screw retained Type NP nameplate on each disconnect switch. See Section 16075: Electrical Identification.

3.6 CLEANING

A. Upon completion of project prior to final acceptance, the contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION
SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Branch Circuit Panelboards

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. Federal Specifications (FS):
      a. FS W-C-375 Circuit Breakers, Molded Case, Branch Circuit and Service
      b. FS W-P-115 Power Distribution Panel
      c. FS W-S-865C Enclosed Knife Switch
   2. National Electrical Manufacturer Association (NEMA):
      a. NEMA AB 1 Molded Case circuit Breakers
      b. NEMA KS 1 Enclosed Switches
      c. NEMA PB 1 Panelboards
      d. NEMA PB 1.1 Instructions for safety instruction, operation and maintenance of panelboard rated 600 volts or less
      e. NEMA PB 1.2 Application Guide for Ground Fault Protective Devices for Equipment

1.3 SUBMITTALS

A. Items specified under this Section are Priority 1. Refer to Section 16010: Basic Electrical Requirements for specific Priority 1 requirements.

B. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contractors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
   4. Furnish structural calculations for equipment anchorage as described in Section 16010: Basic Electrical Requirements.
5. Submit manufacturer’s installation instructions.
6. Complete bill of material listing all components.
7. Warranty.

C. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the engineer prior to release of order.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
   1. Detailed explanation of the operation of the system
   2. Instructions for routine maintenance
   3. Pictorial parts list and parts number
   4. Telephone numbers for authorized parts and Service distributors
   5. Final testing reports

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer

1.6 PRODUCE DELIVERY, STORAGE, AND HANDLING

A. Delivery: Panelboard components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and retimed to manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PBI.1 and manufacturer’s written instructions. Be careful to prevent inertial component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.7 WARRANTY

A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the owner.
1.8 EXTRA MATERIAL

A. Turn over two (2) sets of panelboard keys to the owner at completion of project. All panelboards shall be keyed alike.

B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
   1. General Electric to match existing.
   2. Siemens/ITE to match existing.

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 PANELBOARDS - GENERAL

A. Enclosure:
   1. Cabinets shall be NEMA Type 1 enclosure, door and trim of code gauge galvanized steel. Provide NEMA Type 3R enclosure for exterior mounted panelboard.
   2. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
   3. Provide combination spring catch and look on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.

B. Bus Assembly and Terminations:
   1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices
   2. Cross connectors shall be copper, drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.
   3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.
   4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder. In addition to ground bus provide an isolated ground bus when indicated on drawings or in schedules.
   5. Refer to panelboard schedules on drawings for bus rating. Bus rating shall match or be greater than main device or main lug rating.
6. As a minimum, bus bars shall be rated 10,000 AIC for 120/208 volt panelboards and 14,000 AIC for 277/480 volt panelboards. Unless otherwise noted.
7. Provide full sized bussing in all sections of multi-section panelboards.
8. No panelboard section shall have greater than 42 poles.
10. All "SPACES" shall be ready for installation of future overcurrent protective device.

C. Miscellaneous Requirements:
1. Circuit Numbering: Starting at the top, indicate odd numbered circuits in sequence down, n the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126). Provide metal embossed circuit identification of panelboards.
2. Directories: A 6 x 8 inch minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of work. Directory shall be typewritten denoting loads served by room number or area for each circuit.

D. Refer to Panelboard Schedules for the following:
1. Mounting style; service voltage; terminal lug size, location and quantity, bus ampacity; interrupting capacity of bus and breakers; quantity, poles and rating of overcurrent protective devices.
2. If shown on the Panelboard Schedules and/or electrical drawings provide contactors, relays, time clocks, etc. mounted within panelboard enclosure. Enclosure shall be fabricated such that circuit breaker portion of panel and contactor section shall have separate, lockable, hinged doors.

E. Overcurrent Protective Devices:
1. Refer to Section 16490: Overcurrent Protection Devices.
2. Overcurrent protective devices shall be molded case circuit breakers indicated on panelboard schedules or electrical drawings.
3. Main devices shall be hard bus connected to the panelboard bus bars.
4. In all cases, panelboards fed directly from a transformer shall have an overcurrent protective device. If not shown on the Drawings or Panelboard Schedules; provide this device sized to provide the full capacity of the transformer rating.
5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the branch devices are not acceptable; i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.
6. Panelboards overcurrent protective devices layout shall conform to the layout shown on the panelboard schedules.

F. Finish: Five step zinc phosphate pre-treatment, one coat of rest inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).
2.3 BRANCH CIRCUIT PANELBOARDS

A. Enclosure shall be 20 in. wide x 5-3/4 in. deep, surface or flush mounted and shall comply with NEMA PB 1 and FS W-P-115.

B. Flush panelboards mounted adjacent to each other shall be same physical size.

C. Where "SPACE" is indicated on panelboard schedules or drawings, install minimum 100-ampere branch circuit cress connectors and mounting hardware. For future device spaces larger than 100 amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of panelboard installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory. Install panelboards in accordance with manufacturer’s written instructions, as shown on the drawings and as specified herein.

B. Set panels plumb and symmetrical with building lines in conformance with PB 1.1. Furnish and install all construction channel bolts, angles, etc. required to mount the equipment furnished under this section.

C. Mounting height shall be 6 feet.

D. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 16010: Basic Electrical Requirements.

E. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.

F. Train interior wiring; bundle and clamp using specified plastic wire wraps specified under Section 16123: Building Wire and Cable.

G. Replace panel pieces, doors, or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

H. Conduits terminating in concentric, eccentric or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.

I. Check and tighten all bolts and connections with a torque wrench using manufacturer’s recommended values.

J. Provide four 3/4 inch spare conduits stubbed-out of flush mounted panelboards to nearest accessible ceiling space.

K. Visually inspect panelboard for rust and corrosion. If signs of rest and corrosion are present, restore or replace panelboard to new condition.
L. In damp and wet locations mount panelboards with a minimum one inch of air space between cabinet and the wall or other supporting material.

M. Provide close up plugs in all unused openings in the cabinet.

N. Circuit breakers feeding "Fire Alarm Control Panel(s)" shall be red in color.

3.2 FIELD QUALITY CONTROLS

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Independent Testing: Electrical contractor shall arrange and pay for the services of an independent testing agency to perform all quality control electrical testing calibration and inspection required herein. Testing agencies objectives shall be to:
   1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to insure operation in accordance with manufacturers recommendations and specifications.
   3. Prepare final test report including results, observations, failures, adjustments and remedies.
   4. Apply label on panelboards upon satisfactory completion of tests and results.
   5. Verify ratings and settings and make final adjustments.

C. At least three weeks prior to any testing, notify the engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineer's witnessed test.

D. The electrical contractor shall supply suitable and stable source of electrical power to each test site. The testing agency shall specify the specific power requirements.

E. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

F. Prefunctional Testing:
   1. Provide testing agency with contract documents and manufacturer instructions for installation and testing.
   2. Visual and Mechanical Inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with manufacturer's instructions.
      c. Compare nameplate information and connections to contract documents.
      d. Check tightness of all power connections.
      e. Check that all covers, barriers, and doors are secure.
   3. Electrical Tests:
      a. Insulation Resistance: 1000 volt DC tests for one minute on all 600 volt and lower rated equipment, components, buses, feeder and branch circuits, and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10 megohms resistance to ground shall be repaired or replaced.
      b. Circuit Continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
c. Ground Resistance: Test resistance to ground of system and equipment ground connection.

d. Test overcurrent protection devices per Section 16490: Overcurrent Protective Devices.

G. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the employee’s hourly rate.

H. Contractor shall replace at no costs to the owner all devices which are found defective or do not operate within factory specified tolerances.

I. Contractor shall submit the testing agency's final report for review prior to project closeout and final acceptance by the owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.3 CLEANING

A. Prior to energizing of panelboards the contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using manufacturer’s approved methods and materials.

B. Upon completion of project prior to final acceptance the contractor shall thoroughly clean both the interior and exterior of panelboards per manufacturers approved methods and materials. Remove paint splatters and ether spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION
SECTION 16460 - DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Dry Type Ventilated Transformers

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. American National Standards Institute (ANSI):
      a. ANSI C57 Pertaining to Power/Distribution Transformer
   2. National Electrical Manufacturer Association (NEMA):
      a. NEMA ST 20 Dry Type Transformers
      b. NEMA TP-1 Guide for Determining Energy Efficiency for Distribution Transformers

1.3 SUBMITTALS

A. Items specified under this Section are Priority 1. Refer to Section 16010: Basic Electrical Requirements for specific Priority 1 requirements.

B. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Shop drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contractors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
   4. Furnish structural calculations for equipment anchorage as described in Section 16010: Basic Electrical Requirements.
   5. Submit manufacturer’s installation instructions.
   6. Warranty.
1.4 OPERATION AND MAINTENANCE MANUALS
   A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
      1. Detailed explanation of the operation of the system
      2. Instructions for routine maintenance
      3. Pictorial parts list and parts number
      4. Telephone numbers for authorized parts and service distributors
      5. Final testing reports

1.5 QUALITY ASSURANCE
   A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer

1.6 PRODUCE DELIVERY, STORAGE, AND HANDLING
   A. Delivery: Panelboard components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and retimed to manufacturer at no cost to owner.
   B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.
   C. Handling: Handle in accordance with NEMA PBI.1 and manufacturer’s written instructions. Be careful to prevent inertial component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.7 WARRANTY
   A. Units and components offered under this section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the owner.

1.8 EXTRA MATERIAL
   A. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
   1. Cutler-Hammer/Westinghouse
   2. General Electric
   3. Siemens/ITE
   4. Westinghouse

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 DRY TYPE TRANSFORMER - GENERAL

A. Rating. Provide KVA rating primary and secondary voltage, frequency and phase as indicated on the drawings. The designated rating is for continuous duty without the use of cooling fans unless specifically noted otherwise on the drawings.

B. Windings: Three phase dry type transformers shall be of the two-winding type.

C. Taps: All dry type transformers rated 15 KVA and larger shall have two 2-1/2 percent full capacity taps above normal (FCAN) and four 2-1/2 percent full capacity taps below normal (FCBNO) rated primary voltage.

D. Noise Attenuation:
   1. Isolate core and coil unit from the enclosure by means of vibration absorbing mounts that preclude metal-to-metal contact between the core-coil and the enclosure.
   2. Provide sound levels that do not exceed the following maximum levels in accordance with NEMA and ANSI standards:
      a. Up to 9 KVA; 40 db
      b. 10 to 50 KVA; 45 db
      c. 51 to 150 KVA; 60 db
      d. 151 to 300 KVA; 55 db

E. Impedance:
   1. Transformer impedance shall conform to NEMA standards. Do not use low impedance type transformers unless the circuits and equipment affected by the larger short circuit currents through such transformers are increased in short circuit current rating, as required, at no additional cost to the owner.
   2. The following impedance are used as our basis of design:
      a. Three phase transformers:
         1) 15 KVA 6.4Z
         2) 25 KVA 5.8Z
         3) 30 KVA 5.2Z
         4) 37 1/2 KVA 5.5Z
         5) 45 KVA 5.0Z
         6) 75 KVA 4.7Z
         7) 112 1/2 KVA 5.1Z
8) 150 KVA 5.3Z
9) 225 KVA 5.7Z

F. Basic Impulse Level (BL): 10 KV for transformers less than 300 KVA, 30 KV for transformers 300 KVA and larger.

G. Energy Efficiency: Transformers rated 15 KVA and larger shall be energy efficient designs and NEMA TP-1 compliant. The energy efficient transformers shall be specifically designed to meet the energy efficiency standards set forth in NEMA Standards publication, TP-1, 1996.

H. Grounding: Ground core and coil assembly to enclosure by means of a visible flexible copper strap.

I. Enclosures:
   1. Material: Code gauge steel
   2. Manufacturers Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.
   3. Type: Provide NEMA type as indicated ca drawings or specified herein, drip-proof, self-bracing enclosure designed to prevent accidental contact with electrically energized parts unless otherwise noted.
   4. Mounting transformers 75 KVA and less shall be suitable for wall, floor, flame or trapeze mounting. Transformers larger than 75 KVA shall be suitable for floor mounting.
   5. Finish: Clean, degrease, zinc phosphate, prime and finish paint steel parts with a baked-on synthetic enamel, ANSI 61 (light gray).
   6. Accessories: Provide accessories as indicated on the drawings.
   7. Size: Dimensions and configurations shall conform to the spaces allocated on the drawings.

2.3 DRY TYPE VENTILATED TRANSFORMERS

A. General:
   1. In Indoor, convection air-cooled, dry type transformers with NEMA Type I enclosure unless otherwise noted.
   2. Transformers shall have been tested to UL standards and constructed to NEMA standards.
   3. Transformers shall be specifically designed to supply circuits with a harmonic profile equal to or less than a K-factor of 13 without exceeding the rated temperature rise.

B. Insulation
   1. Insulation system and average winding temperature rise for KVA as follows unless otherwise indicated:

<table>
<thead>
<tr>
<th>KVA Rating</th>
<th>Class H</th>
<th>Rise in Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-15</td>
<td>220c</td>
<td>115c</td>
</tr>
<tr>
<td>16-500</td>
<td>220c</td>
<td>115c</td>
</tr>
</tbody>
</table>

   2. Case temperature shall not exceed 40 degrees centigrade rise above ambient at its warmest point.
3. Provide insulating materials that are in accordance with the latest edition of NEMA ST20 Standards for a 220-degree centigrade, UL component recognized insulation system for extended life.

C. Core construction: High grade, non-aging, silicon steel, clamped with structural angles and bolted to the transformer enclosure on vibration isolating pads.

D. Coil Construction:
   1. Continuous wound with aluminum wire, without splices except for taps
   2. Pressure type, primary, secondary, and tap connections
   3. End fillers or tie downs for maximum strength
   4. Vacuum impregnated with non-hygrosopic, thermosetting varnish
   5. All connections shall be accessible from the front of the transformer to allow rear of transformer to be positioned within six inches of the adjacent wall
   6. Isolate core and coil from enclosure using vibration-absorbing mounts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of transformer installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Ensure all conduit stub-ups for bottom entry into switchboard are in place and located as required per shop drawings.

B. Where noted on the drawings, provide a 4 inch high concrete housekeeping pad beneath equipment. Coordinate actual sizes of equipment base with approved shop drawings and extend pad 4 inches in all directions beyond overall dimension of base. Provide reinforcing bars as required structurally within pad to insure proper support of equipment.

3.3 INSTALLATION

A. Install transformer in accordance with manufacturer’s written instructions, as shown on the drawings and as specified herein.

B. Transformers shall be installed to provide adequate air circulation for the removal of the heat they produce, in accordance with manufacturer recommendations.

C. Transformers not specifically designed for wall mounting, shall be spaced a minimum of 6 inches from adjacent walls, ceiling and equipment.

D. Transformers shall be anchored and braced to withstand seismic forces as calculated per Section 16010: Basic Electrical Requirements.
E. Loosen and/or remove all shipping bolts in accordance with manufacturers instructions.

F. Install the transformers on the noise and vibration isolation pads designed to suppress the transformer noise from the building structure. Select and arrange the pads in accordance with the weight and mounting Of the transformers. These pads are in addition to any internal vibration pads. Provide a neoprene sleeve over the portion of the bolt that passes through the transformer base or mounting bracket. Provide a rubber washer between the bolt head and the mounting channel. Use Kinetics Model KIP or equal.

3.4 TERMINATIONS

A. Provide all transformers with lugs for both primary and secondary conductor sizes for conductors shown on Drawing. Connect lug to termination point with appropriate bolt, nut, flat and Belleville washers.

B. Provide high-pressure compression lugs, for primary and secondary phase and neutral terminations for transformers 45 KVA and larger. Utilize only the tool and dies designed for uses in installing the lugs provided.

C. Use flexible conduit indoors in dry locations or liquidtight flexible conduit in damp/wet locations; two-foot minimum in length, for primary and secondary connections to transformer case. Make connections to side panels of enclosure, except for floor mounted transformers fed from directly below enclosure.

3.5 GROUNDING

A. Provide transformer with a dual rated font-barrel solderless grounding lug with a 5/8LI 1 threaded hole. Drill transformer enclosure With 11/16 inch bit and attach lug to enclosure utilizing a torque bolt and Dragon Tooth transition washer. Connect the following:
   1. Primary feeder ground
   2. Secondary feeder ground
   3. Grounding electrode
   4. Main bond jumper to neutral (when present).

3.6 IDENTIFICATION

A. Provide transformer nameplate as describe in Section 16075: Electrical Identification.

3.7 FIELD QUALITY CONTROLS

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Independent Testing: Electrical contractor shall arrange and pay for the services of an independent testing agency to perform all quality control electrical testing calibration and inspection required herein. Testing agencies objectives shall be to:
   1. Assure transformer installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with manufacturers recommendations and specifications.
3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Apply label on panelboards upon satisfactory completion of tests and results.
5. Verify ratings and settings and make final adjustments.

C. At least three weeks prior to any testing notify the engineer so that arrangements can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineer's witnessed test.

D. The electrical contractor shall supply suitable and stable source of electrical power to each test site. The testing agency shall specify the specific power requirements.

E. Prefunctional Testing:
   1. Provide testing agency with contract documents and manufacturer instruction for installation and testing. Inspect for physical damage, defects alignment and fit.
   2. Visual and Mechanical Inspection:
      a. Compare nameplate infatuation and connections to contract documents.
      b. Check tightness of all control and power connections.
      c. Check that all covers, barriers, and doors are secure.
   3. Electrical Tests:
      a. Insulation Resistance: 1000 volt DC tests for one minute on all primary and secondary winding-to-winding and winding-to-ground.
      b. Verify secondary voltages.

F. Contractor shall replace at no cost to the owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the testing agency's final report for review prior to project closeout and final acceptance by the owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.8 ADJUSTING

A. Adjust primary taps so that secondary voltage is above and within 2 percent of rated voltage.

3.9 CLEANING

A. Prior to energizing of the transformer, the contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using manufacturer's approved methods and materials.

B. Upon completion of project prior to final acceptance the contractor shall thoroughly clean both the interior and exterior of panelboards per manufacturers approved methods and materials. Remove paint splatters and ether spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION
SECTION 16490 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Fuses
   2. Fused Switches
   3. Molded Case Circuit Breakers

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified.
   1. Federal Specifications (FS):
      a. FS W-C-375 Circuit Breakers, Molded Case, Branch Circuit and Service
      b. FS W-C-870 Fuseholders for plug and enclosed cartridge fuses
      c. FS W-C-865 Enclosed Knife Switch
   2. Underwriters Laboratories, Inc. (UL):
      a. UL 198 Fuses (Applicable Subsections)
      b. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
   3. National Electrical Manufacturer Association (NEMA):
      a. NEMA AB 1 Molded Case Circuit Breakers
      b. NEMA KS 1 Enclosed Switches
      c. NEMA SG 3 Low Voltage Power Circuit Breakers

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements for specific Priority 1 requirements:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe product operation, equipment, and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
5. Provide current let-through and melting time information for each type and rating of fuses.
6. Submit manufacturer’s installation instructions.
7. Complete bill of material listing all components.
8. Warranty.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system
   2. Instructions for routine maintenance
   3. Parts list and part numbers
   4. Telephone numbers for authorized parts and service distributors
   5. Final testing reports

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent protective device components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring: Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.7 WARRANTY

A. Units and components offered under this Section shall be covered by a one-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the owner.
PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Fuses:
      a. Bussmann Division, Cooper Industries
      b. Gould Shawmut
   2. Fused Switches:
      a. Cutler Hammer/Westinghouse
      b. General Electric
      c. Siemens/ITE
   3. Circuit Breakers:
      a. Cutler Hammer/Westinghouse
      b. General Electric
      c. Siemens/ITE

B. Substitutions: Under provisions of Section 16010: Basic Electrical Requirements

2.2 FUSES

A. General: All power fuses shall be time-delay, high interrupting (300 K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single manufacturer, and shall be selectively coordinated when applied in 2:1 ratios. Types of fuses shall be as follows:
   1. 0 - 600 Amperes: UL Class J, dual element, time delay type fuse with separate overload and short-circuit elements. The fuse shall hold 500% of rated current for a minimum of 10 seconds.
   2. 601 - 4000 Amperes: UL Class L, time delay type fuses with 99.9% pure silver fuse links and "O-rings" to seal between the end bells and the fuse barrel. Fuses shall had 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in 0.01 seconds or less.
   3. Motor Branch Circuit Fuses (0-600 amperes): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters. See Section 16420: Motor Controls.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the manufacturer of the equipment being protected.

C. Fuses for installation in current limiting circuit breakers or motor circuit protectors shall meet the specific requirements of the manufacturers of that equivalent to insure compatibility.
2.3 FUSED SWITCHES

A. General: This section covers fused switches for mounting in switchboards and distribution boards for sizes 30 amp through 800 amp.

B. Fusible switches shall be quick-make, quick-break of the sizes shown on the drawings. The units shall be listed and approved by Underwriters' Laboratories and, where applicable, shall be dual horsepower rated for both standards one-time or dual element uses.

C. Fusible switches shall be group mounted in switchboards. Each switch is to be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Incorporate safety cover interlocks to prevent opening the cover with the switch in the "ON" position or prevent placing the switch in the "ON" position with the cover open. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service.

D. Provide handles with provisions for padlocking and shall clearly indicate the "ON" and "OFF" positions. Provide front cover doors capable of being padlocked in the closed position.

E. Switches shall pass industry standard I2t withstand tests and fuse race tests.

F. Fusible switches shall be suitable for use on circuits having available fault currents as of 200,000 RMS symmetrical amperes.

G. Furnish fusible switches 30 amperes through 600 amperes frays with rejection type fuse clips. Furnish fusible switches 800 amperes through 1200 amperes with Class L fuse clips.

H. Switches 400 amperes through 1200 amperes shall be designed to accommodate UL listed shunt trip. Where shown on the drawings, provide the following accessories:
   1. UL listed 120 VAC shunt trip
   2. Zero sequence ground protection system including test panel. Ground fault shall include separate time and current pick-up adjustments.

2.4 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breaker shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are shown on the drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that shown on the drawings, or if not shown, not less than 25,000 RMS symmetrical amps for 480 volt systems and 10,000 RMS symmetrical amps for 208 volt systems.

D. Covers shall be sealed m non-interchangeable breakers, and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation, or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.
E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided.

G. All terminals shall be rated for aluminum or copper wire.

H. Circuit breakers with trip ratings 100 amp and smaller shall be ambient temperature compensated, thermal: magnetic type unless otherwise noted. Breakers shall be of full size, one inch per pole type. Panels with more than one branch breaker larger than 100 amps shall be installed in distribution type panels.

I. Circuit breakers with trip ratings 101 amp through 400 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as shown on the drawings at the voltage indicated.

J. Accessories: Provide accessories as noted on the drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

K. Spaces in the boards shall be able to accept any combination of 1, 2 or 3 pole circuit breakers as indicated. Provide all necessary bus, device supports and mounting hardware sized for frame, not trip rating.

L. Series rated breakers are not acceptable unless specifically noted on the Drawings.

M. Refer to the drawings for breakers requiring ground fault protection. See Section 16441: Switchboards, for requirements of ground fault protection system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions acceptance of overcurrent protective device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install overcurrent protective devices in accordance with manufacturer’s written instructions, as shown on the drawings and as specified herein.

B. A fuse identification label shall be placed inside the door of each fused switch. Each label shall show fuse type, ampere rating, and manufacturer.
C. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors. Where manufacturers torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

D. Install overcurrent protective devices and accessories in accordance with manufacturers written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable NEC and NEMA standards for installation.

E. Circuit breakers serving fire alarm control panel(s) shall be red in color.

3.3 FIELD QUALITY CONTROL

FIELD QUALITY CONTROL

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Independent testing electrical contractor shall arrange and pay for the services of an independent testing agency to perform all quality control electrical testing, calibrating and inspection required herein. Testing agencies objectives shall be to:
   1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to insure operation in accordance with manufacturer’s recommendations and specifications.
   3. Prepare final test report including results, observations, failures, adjustments and remedies.
   4. Verify ratings and settings and make final adjustments.

C. At least three weeks prior to any testing notify the engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineers witnessed test.

D. The electrical contractor shall supply a suitable and stable source of electrical power to each test site. The testing agency shall specify the specific power requirements.

E. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

F. Prefunctional Testing:
   1. Provide testing agency with contract documents and manufacturer instructions for installation and testing.
   2. Visual and Mechanical Inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operation tests in accordance with manufacturer’s instructions.
      c. Compare nameplate information and connections to contract documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers, and doors are secure.
3. Electrical Tests:
   a. Circuit Continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
   b. Determine that circuit breaker will trip under overcurrent condition with tripping time in conformance with NEMA AV1 requirements
   c. Test all circuit breakers with a frame size 225 amps and larger and 10% of all circuit breakers with frame sizes less than 225 amps in each panelboard, unless otherwise noted.

G. Contractor shall replace, at no cost to the owner, all devices which are found defective or do not operate within factory specified tolerances.

H. Contractor shall submit the testing agency’s final report for review prior to project closeout and final acceptance by the owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.4 CLEANING

A. Upon completion of project, prior to final acceptance, the contractor shall thoroughly clean overcurrent protective devices per manufacturer’s approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION
SECTION 16510 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install lighting fixtures as shown on drawings and herein specified.

1.2 DEFINITIONS

A. The term Architect refers to the Architect, Interior Designer, Lighting Designer, or Owner’s Representative individually or collectively.

1.3 GENERAL REQUIREMENTS

A. Provide all lighting fixtures as shown complete with all lamps, completely wired, controlled, and securely attached to supports.

B. Where a catalog number and a narrative or pictorial description are provided, the written description shall take precedence and prevail.

C. General contractor shall provide electrical subcontractor with entire lighting specification (including fixture illustrations and sketches); electrical subcontractor shall provide each specified manufacturer with complete information about the fixtures they will supply.

D. Type of fixtures shall be as indicated alphanumerically and as specified.

E. Fixture details shown may be modified by the manufacturer provided all of the following conditions have been met:
   1. Fixture performance is equal or improved.
   2. Structural, mechanical, electrical, safety, and maintenance characteristics are equal or improved.
   3. Cost to the owner is reduced or equal.
   4. Modifications have been reviewed by the architect and have been approved by the Architect in writing.

1.4 STANDARDS

A. The standards and regulating committees referred in this specification and to which compliance with is required are:
   1. UL Underwriters Laboratories
   2. NEC National Electric code
   3. ANSI American National Standards Institute
   4. NEMA National Electrical Manufacturers Association
5. CBM Certified Ballast Manufacturers

B. All fixtures and assembled components shall be new, of good quality, and be approved by and bear the label of UL or other approved testing agencies, i.e. CSA, ETL, unless otherwise specified in writing.

C. All fixtures shall meet all required local, state, and/or national building, electrical, and energy codes and regulations.

D. Fixtures installed outdoors in areas exposed directly to weather shall be UL listed for wet locations. Fixtures installed in outdoor protected area (such as building soffits) and indoors in areas subject to water or extreme humidity shall be UL listed for damp locations.

1.5 SUBSTITUTIONS

A. No substitutions. New fixtures shall match existing for consistency throughout project.

1.6 SUBMITTALS

A. For standard catalog items with no modifications, submit catalog cut sheets prepared by the manufacturer which clearly show all elements to be supplied and all corresponding product data (including taping; ballast manufacturer and model number; voltage; accessories or options and any miscellaneous items detailed in the written description of the specification.) If cut sheet shows more than one (1) fixture type, all non-applicable information shall be crossed out.

B. For Standard Cataloged Fixtures:
   1. Submit one sample cone for each fixture type for review. Submit a certificate of compliance with Alzak finish requirements with all requests for approval.
   2. When more than one louver panel occurs in a fixture, submit as a part of shop drawings the dimensioned layout of individual louver panels and supporting "tee" members.
   3. Fixture cuts and shop drawings shall be submitted in quantities and format as described in the general conditions section of the specifications.

C. The lighting designer shall make the final determination as to whether or not the submittal contains sufficient information and reserves the right to request a shop drawing if the fixture cut is insufficient.

1.7 WARRANTIES

A. All fixtures and workmanship shall be guaranteed free of defects and fully operational for a minimum of one year after the acceptance of the project by the Owner. Any fixtures or workmanship found to be defective during the warranty period will be either fixed or replaced by the Contractor at no cost to the owner.

B. Ballasts for fluorescent and high intensity discharge fixtures shall be covered by a two year warranty against defects in workmanship or material. Warranty shall include in-warranty
service program providing for payment of authorized labor charges incurred in replacement of inoperative, in-warranty ballasts.

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

A. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked paint process to prevent corrosion and discoloration of adjacent materials.

B. For weatherproof and vapor-tight installation, painted finishes of fixtures and accessories shall be weatherproof enamel using proper primers or hot dipped galvanized and bonderized epoxy, in accordance with manufacturer's requirements. Unless otherwise specified all painted surfaces shall have a life expectancy of not less than twenty years.
   1. Hangers shall be conduit with chemically resistant, weatherproof, baked enamel finish.
   2. Where aluminum parts come in contact with bronze parts, apply to both surfaces a coating material to prevent corrosion.
   3. Colors shall be as specified in the Lighting Fixture Schedule.

C. Fasteners shall be manufactured of non-magnetic stainless steel or anodized aluminum, except in indoor applications where galvanized steel shall be acceptable.

D. Fixtures shall be free of light leaks and shall be designed to provide sufficient ventilation of lamps and ballasts including vent holes where required.

E. All sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All sheet metal shall be free of light leaks. All edges shall be finished so there are no sharp edges exposed. All miters shall be in accurate alignment with abutting intersecting members. Piecing of plates in individual runs in single planes and the use of spliced pieces or filler material to cover defective workmanship shall not be acceptable. Sheet metal work shall be properly fabricated so that planes will not deform (i.e. become concave or convex, due to normal expected ambient and operating conditions).

F. Lampholders shall hold lamps securely against normal vibrations and maintenance handling. Provide solid nickel or nickel-and-silver-plated contacts in lampholders for following types of lamps:
   1. Mogul screw base incandescent, metal halide, mercury vapor lamps and high pressure sodium.
   2. Lamps in outdoor fixtures
   3. Tungsten-halogen lamps

G. Wiring channels and lampholder mountings shall be rigid and accurately made.
H. Reflector Cones:
   1. Provide 45° lamp and lamp image cutoff unless otherwise specified. In fixtures where
      upper reflector is separate form cone, cut-off shall be 45° unless otherwise specified.
   2. Plastic materials shall not be used for reflector cones or aperture plates.
   3. Fixtures in which reflector cones are riveted or welded to housing or where removal of
      cone requires pressure to be applied to finished surface of reflector shall not be
      acceptable.
   4. Cone flange shall be formed as an integral part of the cone and shall have identical color
      and finish as the cone, except as shown. The flange major surface shall be perpendicular
      to the cone axis. The width of the flange shall adequately cover the ceiling opening
      without light leaks. No fixture parts (housing, mounting frame, etc.) shall be visible
      between the ceiling surface and the edge of the cone flange. The same requirement shall
      be applicable to fixtures where main reflector extends down to the bottom edge of the
      fixture without a separate cone. In such case, the flange shall be formed as an integral
      part of the main reflector.
   5. Reflector cones shall be manufactured of uniform gauge, not less than 0.032 inches
      thick, high purity aluminum Alcoa 3002 alloy free of spin marks or other defects or
      blemishes caused during manufacturing.
   6. The finish of the inner surface of the reflector shall be highly specular as produced under
      the Alzak process. The reflector shall have an anodic coating of not less than four mils
      thick. The reflector inner surface shall be free of water spotting and shall maintain a
      reflectivity ratio of not less than 83% on clear specular finish. The reflector shall have a
      low iridescence finish free from multiple colors seen from normal viewing angles. Colors
      shall be derived from dyes supplied by Sandoz Chemical Company or approved equal.
   7. The reflecting surface of the cone shall be tested for proper sealing. Test per ASTM B
      136-63T.
   8. Fixtures with Alzak reflector cones, unless otherwise specified, must be furnished by the
      same manufacturer.
   9. Reflector cone retention devices shall not deform cone in any manner whatsoever.
   10. Submit a certificate of compliance with Alzak finish requirements with all requests for
       approval.

I. Lenses:
   1. Fresnel:
      a. Lens shall have uniform brightness throughout the entire visible area at angles
         from 45° to 90° from vertical, without bright spots or striations.
      b. Lens shall have uniform brightness throughout the entire visible area at angles
         from 45° to 90° from vertical, without bright spots or striations. Lens shall have
         opaque risers; color shall be as specified in Section 2.02 Lighting Fixture
         Descriptions.
      c. Finish of visible regress surface of door shall be matte baked enamel paint,
         special color as selected by Architect.
      d. All fixtures with fresnel lenses; unless otherwise specified, must be furnished by
         the same manufacture.
   2. Glass:
      a. Flat glass lenses shall be heat tempered borosilicate glass unless otherwise noted.
      b. Glass finishes, i.e. sandblasting, etching, polishing shall be performed as described
         in the fixture description.
3. Acrylic:
   a. Lenses shall be of injection molded crystal clear material 100% virgin acrylic (except as shown). For lenses with male pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones), or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.
   b. Lenses shall fully eliminate lamp images when viewed from all directions within the \(45^\circ\) to \(90^\circ\) angle from vertical when the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from \(0^\circ\) to \(45^\circ\) the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
   c. Finishes, i.e. sandblasting, etching, polishing shall be performed as described in the fixture description.

J. Louvers:
   1. Parabolic:
      a. Louvers shall be continuously bound in channel formed frame, finish, and color and specified or as selected.
      b. Louver shall provide a minimum visual cutoff to the lamp of \(45^\circ\)
      c. The finish of the inner surface of the reflector shall be highly specular as produced under the Alzak process. The reflector shall have an anodic coating of not less than four mills thick. The reflector inner surface shall be free of water spotting and shall maintain a reflectivity ratio of not less than 83% on clear specular finish. The reflector shall have a low iridescence finish free from multiple colors seen from normal viewing angles.
   2. Flat Blade:
      a. Provide flat blade louvers within formed frame, finish and color as specified.
      b. Louvers to provide minimum of \(45^\circ\) degree cutoff from lamp image.
      c. Blade thickness to minimum 125" flat steel.

K. In adjustable fixtures, aiming and positive locking devices shall be provided.

L. Fixtures with an adjustable lamp and using a lamp with an asymmetrical light pattern shall have an aiming stop which can be permanently set so that the lamp shall remain correctly positioned after service or relamping.

M. Fluorescent Fixtures:
   1. Hot Cathode:
      a. Housing:
         1) 22 (20 gauge NYC) minimum gauge steel, bonderized, or equal, rust protected, or No. 16 gauge aluminum rigid construction, suitable for continuous row mounting where indicated.
         2) Finish: Baked enamel paint finish unless otherwise specified, color as specified or as selected. For exterior finish, refer to "Exterior Fixture Finishes" below.
      b. Reflector: Minimum 85% reflectance
      c. Lightshields:
         1) Frames: Provide extruded aluminum frames with mitered comers filled and ground smooth. Provided with concealed hinges and invisible latching.
2) No cross bars shall be permitted over lightshields.

d. For rapid start lamps on single ballasts, provide one (1) grounding lampholder per lamp. Lampholders operating with open circuit voltage in excess of 300 volts shall be safety type and shall open supply circuit when lamp is removed from lampholder.
   1) Mount lamps used in rapid start circuits 430mA and below: within 1/2" of grounded metal as long as the lamp.
   2) 800mA and 1500mA lamps: mount within 1" of grounded metal as long as the lamp.

e. Fluorescent fixtures shall conform to NEMA Standards, including references to fixture dimensions and temperature ratings.

f. T8 ballasts shall be high efficiency, high power factor (greater than 95%), ballast factor of 78%) approved by UL and CBM and certified by. ETL. Ballasts shall certified for voltage and number of lamps specified and equipped with internal thermal protectors unless otherwise specified.
   1) Ballasts shall have a Total Harmonic Distortion (THD) of ten percent and less than twenty percent or loss.
   2) Ballasts shall have a Crest Factor of less than one and seven-tenths
   3) Ballasts for indoor applications shall be Class P.
   4) Provide multi-lamp ballasts where possible including continuous rows of one-lamp fixtures, and one-lamp ballasts only where the fixture layout does not permit the use of multi-lamp ballasts.
   5) Ballasts shall operate lamps properly through the following supply voltage ranges:
      a) Volt ballasts: 254-289 volts
      b) Volt ballasts: 110-125 volts

6) Frequency shall be 30 KHz or greater except as noted.

7) Ballast minimum sound ratings:
   a) 265 mA: Class A
   b) 430 mA: Class A
   c) 800 mA: Class B
   d) 1500mA, Class C

8) All fixtures installed in exterior or unheated interior spaces shall be supplied with ballasts which-start lamps down to 0°F unless noted otherwise.

9) Ballast, unless specified otherwise, shall be same manufacturer and model in each fixture of the same type. Acceptable ballast manufacturers, unless otherwise noted are:
   a) Osram/Sylvania QHE Series
   b) Advance QHES Series


g. Dimming Ballasts:
   1) Lutron HiLume and SE

h. Lighting fixtures recessed in a hung ceiling where the space above the hung ceiling is used as a plenum chamber for either supply or return air for the air conditioning system shall be designed, manufactured and wired to conform to NEC Article 300-22.

i. Compact Fluorescent Ballasts:
   1) Rapid-Start (4 Pin) Lamps: Ballasts for the operation of rapid-start compact fluorescent lamps shall be electronic rapid start type unless otherwise indicated by the Fixture Schedule.
2) Listed Class P.
3) Circuitry: Series or parallel wired with cathode heating applied prior to lamp starting and continuously applied during lamp operation.
4) Operating Frequency: 30Khz or higher.
5) Power Factor: 95% minimum
6) Ballast Factor: \(0.96 \pm 0.025\) (2 lamp, 26w Quad)
7) Current Crest Factor: 1.6 maximum for rapid start circuits
8) Interference: Ballasts shall comply with EMI and RFI limits set by the FCC (CFR 47 part 18) for non-residential applications.
9) Surge and Transient Withstand: As specified by ANSI C.62.41 for location category A3, normal mode; and location category A1, common mode.
10) Audible Sound: "A" sound-rated; replace noisy ballast at no cost to the District.
11) Harmonic Distortion: Total harmonic distortion shall not exceed 20 percent.

N. Three-year replacement warranty against defective parts and workmanship.

O. Wiring:
1. Voltage Rating:
   a. For voltages up to 120 volts fixture wiring shall be rated for 300 volts minimum.
   b. For voltages above 120 volts fixture wiring shall be rated for 600 volts minimum.
2. Temperature Rating - Internal to Fixture:
   a. All wiring shall be code approved for fixture wiring and shall comply with the following temperature ratings unless fixture design or local codes require higher temperature wire.
   b. Fluorescent:
      1) Minimum rating between lampholder(s) and internal ballast.
      2) Minimum rating between ballast and separate junction box or connection within integral wireway.
3. Temperature Rating - External to Fixture
   a. All flexible cord wiring between fixture components or to electrical receptacle m wireways shall have a minimum temperature rating of 105°C.
   b. Cord type shall be suitable for application and shall be fitted with proper strain relief and watertight entries where required by application.
4. Splices:
   a. Splices internal to fixture shall be made within separate splice compartments and shall utilize nylon insulated crimped connections or insulated quick disconnects.
   b. Splices to branch circuit wiring in separate junction boxes shall utilize flame retardant thermoplastic caps with fully seated helical metal spring and threaded entry,
   c. No internal wiring shall be visible at normal viewing angles, i.e., above 45° from vertical. Use additional wire clamps if necessary. Anticipate increased visibility if fixtures are mounted on or recessed within a sloping surface.
   d. Any fixture fed from more than one panel, i.e., for normal and night or emergency operation, shall have separate neutrals to each panel.
5. Furnish code approved wiring in ceiling cavities forming air plenums.
P. Lamps:

1. Hot cathode fluorescent lamps shall be 3000° K with 85 CRI or greater except as shown. All lamps, except as specified, shall be of the same manufacturer.
   a. Osram/Sylvania
   b. General Electric
   c. North American Philips

2. T8 lamps shall be Super T8 3100 lumen minimum.
   a. Osram XPS Series
   b. General Electric
   c. Philips

END OF SECTION
SECTION 16573 - AUTOMATIC LIGHTING CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this division, including but limited to:
   1. Occupancy Sensor Switches
   2. Architectural Dimming System

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
   1. Federal Specification (FS):
      a. FW W-P-455A Plate, Wall Electrical
   2. National Electrical Manufacturers Association (NEMA):
      a. NEMA ICS 2; Industrial Control Devices, Controllers, and Assemblies
      b. NEMA ICS 6; Enclosures for Industrial Controls and Systems
   3. Underwriters Laboratories, Inc. (UL):
      a. UL 508 Industrial Control Equipment
      b. UL 514A Metallic Outlet Boxes

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and main} indicating compliance with all listed standards.
   2. Describe system operation, equipment, dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Shop Drawings: Include complete lighting control wrong diagram showing lighting control devices, terminal numbers, and circuits controlled as described on drawings.
   5. Complete bill of material listing all components.
   6. Warranty
B. Dimensions and configurations of lighting control equipment shall conform to the space allocated on the drawings. The contractor shall submit a revised layout if equipment furnished varies in size from that shown on drawings for the engineer's approval.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system.
   2. Instructions for routine maintenance.
   3. Pictorial parts list and part numbers
   4. Pictorial and schematic electrical drawings of wiring systems including control diagrams, typical connection wiring, and control devices. Drawings shall identify devices being used and circuits being controlled.
   5. Telephone numbers for the authorized parts and service distributors.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Automatic lighting control equipment components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extreme. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.7 WARRANTY

A. Under this Section shall be covered by a one year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the owner.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
   1. Occupancy Sensors Switches:
      a. Watt Stopper
      b. Sensor Switch
      c. Leviton
   2. Architectural Dimming System:
      a. Lutron "Grafix Eye" No Equal

2.2 OCCUPANCY SENSOR SWITCHES

A. General:
   1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.
   2. Occupancy sensors shall be Dual Technology as specified herein with voltage and wattage rating equal to the lights being controlled.
   3. All sensors shall have an adjustable time delay for turning off lights and a sensitivity adjustment.
   4. Ceiling mounted sensors shall operate on line voltage. Control unit shall contain power supply and relays for switching loads.
   5. Units shall be furnished to cover the areas being controlled. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

B. Color: Device color shall be as selected by architect, unless otherwise noted.

C. Wall Mounted Single Level Control Sensors:
   1. Sensor shall be Dual Technology type with single level switching capability and coverage up to 300 square feet.
   2. Operation shall be manual "ON" and manual or automatic "OFF".
   3. Time delay adjustment from 30 seconds to 30 minutes. Set adjustment at 4 minutes.
   4. Load capacity of 0 to 1200 watts at connected voltage.
   5. For use in small utility closets where dual level switching is not indicated.

D. Wall Mounted Dual Level Control Sensors:
   1. Sensor shall be Dual Technology type with dual level Switching capability and coverage up to 300 square feet.
   2. Operation shall be manual "ON" and manual (in two levels) or automatic (full) "OFF".
   3. Time delay adjustment from 30 seconds to 30 minutes: Set adjustment at 10 minutes. Set sensitivity adjustment at maximum.
   4. Load capacity of 50 to 1000 watts connected voltages.
   5. For use in offices where dual level switching is indicated.
E. Ceiling Mounted Sensors:
   1. Sensor shall be Dual Technology line voltage type with coverage up to 1600 square feet.
   2. Operation shall be automatic "ON" and automatic "OFF". Provide with a manual override switch.
   3. Time delay adjustment from 30 seconds to 30 minutes. Set adjustment at 10 minutes.
      Set sensitivity adjustment at maximum.
   4. Load capacity of 20 amps per power pack at connected voltage.
   5. Power pack consisting of Class 2, 24 V output transformer and relay in single housing capable of powering up 4 sensors and mounted inside standard 4-inch square box.
   6. Power line voltage sensors where indicated.
   7. For use in small office areas, classrooms, and lecture rooms

2.3 ARCHITECTURAL DIMMING SYSTEM

A. Provide Lutron Grafix Eye Dimming System.
   1. Provide all accessories for a complete and operable system including but not limited to:
      a. Fluorescent Hi-Lume SE modules
      b. A/V input module
      c. Occupancy sensors and input module
      d. Remote switches
      e. Multi-scene switch

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of automatic lighting control equipment installation to verify conformance with manufacturer and specification tolerances. Do not begin installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install automatic lighting control equipment in accordance with manufacturer's written instruction, as shown on the drawings and as specified herein.

3.3 OCCUPANCY SENSOR SWITCHES

A. Set time delays in sensors in accordance with owner's directions.

B. Where substituted occupancy sensors are used, it shall be the responsibility of the contractor to place sensors in the proper place and with proper alignment to cover to all the area intended in the contract documents.
C. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces. Mount devices at 43 inches above finished floor unless otherwise noted.

3.4 ARCHITECTURAL DIMMING SYSTEM
A. Install architectural dimming system per manufacturer’s instructions and wiring diagrams.
B. Provide services of manufacturer’s representative for review of system and initial settings.

3.5 FIELD QUALITY CONTROL
A. Refer to Specification Section 16080: Electrical Commissioning.
B. Manufacturer Field Service: Electrical contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the automatic lighting control equipment.
C. At least three weeks prior to any testing, notify the engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineer’s witnessed test.
D. Prefunctional Testing:
   1. Visual and Mechanical Inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with manufacturer’s instructions. Compare nameplate information and connections to contract documents.
      c. Check tightness of all control and power connections. Check that all covers, barriers, and doors are secure.
   2. Contractor shall provide all necessary programming assistance to set up and program the automatic lighting control equipment.
   3. Electrical Tests:
      a. The system shall be completely tested in accordance with operational parameters and manufacturer’s instructions. Any problem shall be documented and corrected.
      b. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
E. Contractor shall replace at no costs to the owner all devices which are found defective or do not operate within factory specified tolerances.
F. Contractor shall submit the testing final report for review prior to project closeout and final acceptance by the owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.
3.6 CLEANING

A. Upon completion of project prior to final acceptance the contractor shall thoroughly clean the automatic lighting control equipment. Remove paint splatters and other spots, dirt, and debris.

3.7 TRAINING

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Factory authorized service representative shall conduct a 1 hour training seminar for Owner's Representative upon completion and acceptance of system. Instructions shall include operation, maintenance, and testing of equipment.

C. Contractor shall train owner on occupancy sensors.

D. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION
SECTION 16620 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
   1. Initiating Devices
   2. Notification Devices
   3. Submittal Drawings by Simplex
   4. Coordination with Simplex for final
   5. Record Drawings
   6. Pretesting and Final Testing

B. Work furnished and installed under another section, but connected under this section:
   1. Door hold-open/closure devices with/without integral smoke detectors.
   2. Fire/smoke dampers

C. Work furnished and connected to alarm system under this section but installed and connected to HVAC system under another section.
   1. Duct smoke detectors
   2. In-duct mounted smoke detectors for fire/smoke damper control. Wiring for damper, power, control, and monitoring shall be under this contract.

D. Work furnished and installed under another section: HVAC shutdown wiring via dry contacts in FACP, duct mounted smoke detector, remote mounted relays.

E. Related Work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.
   1. Division 8: Rolldown Doors, Door Hardware
   2. Division 15: HVAC System, Fire Sprinkler System

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
   1. American National Standards Institute, Inc. (ANSI):
      a. ANSI C62.41 Guide for Surge Voltage in Low-Voltage AC Power Circuits
   2. National Fire Protection Association (NFPA):
      a. NFPA 72 National Fire Alarm Code
   3. Underwriters Laboratories, Inc. (UL):
      a. UL 38 Manually Actuated Signal Boxes for Use with Fire-Protection Signaling Systems
      b. UL 268 Smoke Detectors for Fire Protective Signaling Systems
      c. UL 268A Smoke Detectors for Duct Application
d. UL 464 Audible Signal Appliances  
e. UL 521 Heat Detectors for Fire Protective Signaling Systems  
f. UL 864 Control Units for Fire Protective Signaling Systems  
g. UL 1638 Visual Signaling Appliances Standard  
h. UL 1971 Signal Devices for Hearing Impaired  

4. Factory Mutual System:  
a. FM P7825 Approval Guide  

1.3 DEFINITIONS  

A. Alarm Signal: A signal that indicates a state of emergency requiring immediate notification of the fire department and building occupants.  

B. Supervisory Signal: A signal that indicates the impairment of a fire protection system, which may prevent its normal operation.  

C. Trouble Signal: A signal that indicates that a fault, such as an open circuit or ground, has occurred in the fire alarm system or in a separate subsystem monitored by the fire alarm system.  

D. Initiating Device: A system component that originates transmission of a change of state condition, which initiates an appropriate response via the fire alarm system.  

E. Notification Device Circuit: A circuit to which notification devices are connected to visually and audibly indicate an alarm signal.  

F. Signaling Line Circuit: A circuit to which any combination of circuit interfaces, control units, or transmitters are connected and over which multiple system input signals or output signals are carried.  

G. Class A Wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short, or a single loss of carrier erudition will, be indicated by a trouble signal on the FACP no matter where the break; short or loss of carrier condition occurs and will allow all functions of the affected circuit to remain operational. This would be Style 7 wiring for signaling line circuits.  

1.4 SYSTEM DESCRIPTION  

A. The fire alarm system is a zone non-coded addressable. System shall be 24 VDC closed circuit, electronically supervised, common signaling, device indicating automatic alarm type; operating from manual pull stations, smoke detectors, heat detectors, and sprinkler system switches. The system shall include all wiring, raceways, pullboxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification devices, and all other accessories required for a complete operating system.  

B. Provide system with the following circuit functions:  
1. Style A for initiating device circuits  
2. Style 7 for signaling line circuits interconnecting the riser loop or network  
3. Style Y for notification device circuits  

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Project No. 0802C  
FIRE ALARM SYSTEM  
16620-2  
BERKELEY CITY COLLEGE  
Phase 3: Build-Out
C. Activation of any alarm initiating device shall:
   1. Cause all audible and visible evacuation alarm devices to sound and/or pulse throughout the system until silenced at the FACP.
   2. Release all associated door hold-open/closure devices, roll-down doors, shutters, and fire/smoke dampers
   3. Display individual addressable initiating device and/or zone number in alarm with a minimum of 80 character alphanumeric display at FACP.
   4. Illuminate the zone of the initiating devices in alarm at the addressable FRAP.
   5. Display on terminal and printout a hard copy record of the device type, location, status, time and date on printer.

D. Transmit alarm signal to remote monitoring station.

E. Activation of detectors in elevator lobbies elevator shaft or elevator equipment room shall cause elevators to be recalled to ground floor, or an alternate floor if ground floor detector is in alarm.

F. Activation of heat detectors in elevator equipment room or elevator shaft shall cause the power service to elevator machine room equipment to be automatically disconnected.

G. Activation of smoke detectors in HVAC ducts shall shut down associated air handling equipment.

H. Activation of smoke detectors at fire/smoke dampers shall cause associated dampers to close.

I. Activation of atrium zone detectors shall cause associated fan to exhaust atrium. System shall provide supervisory signals for the following:
   1. System trouble, consisting of:
      a. Removal of an initiating device for any circuit
      b. An open or ground fault in any initiating circuit
      c. An open, short or ground fault in an annunciation circuit
      d. A ground fault on any DC line.
      e. Removal of system input, output, or control modules.
      f. Improper condition of battery or charger.
   2. Sprinkler valve monitor (tamper) switch.
   3. Post indicating valve
   4. Fire pump running, loss of power, phase reversal.
   5. Emergency generator trouble.

J. Failure of any circuit supervised by the FACP shall:
   1. Cause the trouble buzzer at the FACP to sound continuously until silenced.
   2. Cause the offending addressable device and/or zone to display at the FACP.
   3. Cause the offending zone to illuminate the trouble light on the FRAP.
   4. Display on terminal and printout on the system printer.
   5. Transmit a trouble signal to remote monitoring station.

K. Failure of AC power shall:
   1. Cause the trouble buzzer at the FACP to sound continuously until silence
   2. Display condition at the FACP.
   3. Display on terminal and printout condition on system printer.
4. Cause automatic transfer to standby battery. All system functions shall be operational during power failure.

L. In addition to the above sequence of operation, the FACP shall perform the following functions:
   1. Identify every addressable device by location, priority, and device type.
   2. Read and display at FACP the sensitivity of addressable smoke and heat detection devices.
   3. Remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
   4. Be capable of supporting non-addressable as well as addressable devices.
   5. Allow individual programmable control of each connected remote or panel-mounted relay.
   6. Provide the user with the field programmability to add or change addressable device types and custom messages on site via the system printer/terminal.
   7. Display up to 127 alarms and/or up to 127 trouble indications, one at a time, as a list on the system printer/terminal.
   8. Change the status of configured circuits (arming or disarming) and change status of relays.
   9. Generate an addressable detector sensitivity report providing a chamber voltage listing (device testing) for each detector. Non-addressable smoke detectors will require manual field-testing and adjustment at each location.

1.5 SUBMITTALS

A. Items specified under this Section are Priority 1. Refer to Section 16010: Basic Electrical Requirements, for specific Priority 1 requirements.

B. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, Listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
   2. Describe system operation, equipment, and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific itch(s) being submitted and the proposed application.
   4. Shop Drawings:
      a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
      b. Point-to-point wiring diagram in block or riser format showing all fire alarm components, conduit and wire types and sizes with cable legend.
      c. Provide 1/4" scale plan of equipment layout in main fire control room.
      d. Include elevations of control panel and remote annunciator panel(s).
   5. Furnish structural calculations for equipment anchorage as described in Section 16010: Basic Electrical Requirements.
   6. Battery standby calculations showing total standby power needed to meet the specified system requirements.
   7. Submit manufacturer’s installation instructions.
   8. Complete bill of materials listing all components. Provide State Fire Marshal listing number for each device.

C. Contractor shall submit approved shop drawings for review by State Fire Marshal and Architect prior to the purchase and installation of equipment.

D. Record Drawings:
1. Furnish record drawings as described in Section 16010: Basic Electrical Requirements, utilizing shop drawing submissions with updated field conditions. These drawings shall include but not be limited to the following:
   a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
   b. Block Diagram/Riser Diagram showing the FACP, system components, and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the engineer has approved the Record Drawings.

1.6 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance
3. Pictorial parts list and part numbers.
4. Schematic drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, terminal, etc.
5. Telephone numbers for the authorized parts and service distributors.
6. Final testing reports.

1.7 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein, shall be new and unused, and of current manufacture.

B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Fire alarm system components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.
C. Handling: Handle in accordance with manufacturer written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

1.9 WARRANTY

A. Units and components offered under this section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

B. The warranty package shall include, but not be limited to the following:
   1. Emergency maintenance service
   2. Service by factory trained service representative of system manufacturer
   3. Replacement of any defective components.

1.10 SYSTEM START-UP

A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the engineer's witnessed test shall begin.

1.11 MAINTENANCE

A. Extra Material:
   1. Provide the following fire alarm system components as extra materials, matching the products installed and packaged for storing.
      b. Detectors: Furnish a quantity equal to 10 percent, for each type of the number installed.
      c. Strobes and Horn/Strobes: Furnish a quantity equal to 10 percent of the number installed.
      d. Horns: Furnish a quantity equal to 10 percent of the number installed.

B. Maintenance Service:
   1. For a period of one year following acceptance the equipment supplier shall have a person(s) familiar with this project attend four quarterly meetings with the Owner's Representative to review system performance, operation and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
   2. During the eleventh month following system acceptance, on a weekend day, the equipment supplier shall perform a complete test of the system, in a manner similar to the acceptance test. A written report shall be submitted to the owner certifying that each initiating device has been tested. A copy of these test firms shall be submitted to the engineer for review and acceptance.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided.
   1. Simplex/Grinnell - No Substitutions

2.2 ADDRESSABLE INITIATING DEVICES

A. Manual pullstations shall conform to the applicable requirements of UL 38. Addressable manual stations shall be connected into addressable initiating circuits. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Control panel shall monitor the station by address and function. The use of a key or wrench shall be required to reset the station. Stations shall have a separate screw terminal for each conductor and be capable of field programming for its "address" location on a initiating circuit.

B. Heat Detectors: Shall conform to the applicable requirements of UL 521. Addressable detectors shall be electronic designed for detection of fire by combination fixed temperature and rate-of-rise principle. Detectors shall be connected into addressable initiating circuits. All electronics shall be contained within detector head and shall plug-in to terminal base, Detector shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by FACP, as well as sensitivity adjustable. Rating for fixed temperature portion shall be 190 degrees F. Detectors shall have screw terminals in base for making all wiring connection.

C. C. Smoke Detectors: Shall conform to the applicable requirements of UL 268:
   1. Ionization detectors: Addressable detectors shall be electronic designed, containing a dual chamber responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be adjustable to compensate for operating conditions. Detectors shall be connected into addressable initiating circuits. All electronics shall be contained within detector head and shall plug-in to terminal base. Detectors shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by FACP, as well as sensitivity adjustable. Detectors shall have screw terminals in base for making all wiring connections.
   2. Duct Smoke Detectors: Addressable detector shall have a duct housing, mounted exterior to the duct, and with perforated sampling tubes. Activation of a detector shall cause shutdown of the associated air handling unit via auxiliary contact base. Detectors shall be rated for the air velocity to be expected.
   3. In-Duct Smoke Detector: Addressable detector shall have external mounted box with relay output, remote test station with LED status indicator and keyed test switch, and sensor head mounted within duct. Activation of detector shall cause associated fire/smoke damper to close via auxiliary relay base.
D. Interface Modules: Addressable interface module shall be connected into addressable initiating circuits. This device shall be used for interfacing normally open or normally closed direct shorting contact devices to an addressable initiating circuit (i.e. waterflow, tamper switches, non-addressable initiating devices, etc.). Module shall be dynamically supervised and individually identified by the FACP.

E. Programmable Relay Modules: Addressable interface module containing a programmable control relay with contacts rated at 2.0 amps at 30VDC, 0.6 amps at 120 VAC.

2.3 NOTIFICATION DEVICES

A. Horns, Strobes and Combination Horn/Strobes:
1. Shall be flush-mounted in all finished areas and surface mounted in all equipment areas.
2. Horn: Wall mounted, 24 volt DC, minimum 92dB sound level at 10 feet, conforming to the applicable requirements of UL 464.
3. Strobe: Wall mounted, 24 volt DC, 15, 30, 75 or 110 candela at a rate of 1 flash per second, white Lexan lens, conforming to UL 1971. Strobe shall have a xenon flash tube.
4. Combination horn/strobes shall operate simultaneously from one power supply.
5. All notification devices shall be addressable.

B. Synchronization Modules: Synchronization modules shall be connected to the notification circuits and shall be used to synchronize the flash rate of strobe devices where more than one strobe can be viewed from a given location in the building. Synchronization shall match Code 3 temporal pattern with a flash rate of 1 Hz, 3 amps at 24 VDC.

2.4 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

A. Under this section, provide connections to the following equipment to activate control sequence of operation.
1. Door Hold-Open/Closure Devices: Provide a pair of wires from a set of dry contacts in the FACP or remote mounted programmable relays to each door hold-open/closure device for power to and release of doors.
2. Roll-down fire doors and shutters: Provide a pair of wires from a set of dry contacts in the FACP or remote mounted programmable relays to each roll-down fire door or shutter for release of door.
3. Fire/Smoke Dampers: Provide a pair of wires from a set of dry contacts in the FACP or remote mounted programmable relays to each fire/smoke damper for automatic closure of dampers. Also, provide a hand-off-auto in FACP for manual control of dampers with LED lights to indicate when each damper is opened or closed. Additional wiring is required to each damper limit switch to monitor open or closed status.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of fire alarm system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
B. Contractor shall coordinate with Simplex prior to submittals and starting work to confirm all addresses and connections. Addresses shown are for design purposes only. Due to record drawings not being 100% accurate, the manufacturer, Simplex, shall assign all final addresses and coordinate exact connection points.

3.2 INSTALLATION

A. General:
1. Install fire alarm system devices in accordance with manufacturers written instructions, as shown on the drawings and as specified herein.
2. Existing system shall remain in service at all times. If system needs to be shut down, coordinate with Owner, notify alarm company, and provide fire watch.

B. Wiring:
1. Refer to Section 16123: Building Wire and Cable.
2. Individual input and output device addressability as well as remote sensitivity measurement, supervision and power shall all be performed on the same pair of wires. Wiring shall be Class A.
3. Each Class A initiating circuit shall consist of a two wire circuit, allowing multiple T-taps, and not requiring any end-of-line device for supervision. Each initiating circuit shall accommodate up to thirty (30) addressable programmable initiating devices. On the initial installation, only 21 devices are to be allowed per circuit to allow for future expansion.
4. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the manufacturer’s current requirements.
5. All wiring shall be installed in a continuous steel conduit system and shall be of the size recommended by the equipment supplier. Refer to Section 16139: Signal Systems Raceway.
6. Wire color-coding shall remain the same throughout the system.
7. No wiring other than that directly associated with fire alarm detection, alarms, or auxiliary fire protection functions (no 120 VAC), shall be permitted in fire alarm conduits.
8. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.
9. All fire alarm junction boxes shall be color-coded and marked per Section 16075: Electrical Identification.
10. Wire nut splices are not allowed.
11. Wires shall be numbered at each connection, termination and junction point. Wire numbering tags shall be Brady Perma-Code, Westline, or equal wire makers. Each group of wires shall be tagged with its destination at each panel, terminal box or junction box.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Electrical contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the fire alarm system.

B. Independent Testing: Electrical contractor shall arrange and pay for the services of an independent testing agency to perform all quality control electrical testing calibration and inspection as required herein. Testing agencies objectives shall be to:
1. Assure fire alarm system installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with manufacturers' recommendations and specifications.
3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Apply label on fire alarm system control panel upon satisfactory completion of tests and results.
5. Verify settings and make final adjustments.

C. At least three weeks prior to any testing, notify the architect so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineer's witnessed test.

D. Prefunctional Testing:
1. Provide testing agency with contract documents and manufacturer's instructions for installation and testing;
2. Visual and Mechanical Inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with manufacturer's instructions.
   c. Compare nameplate information and connections to contract documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers, and doors are secure.
3. Electrical Tests:
   a. The system shall be completely tested prior to formal acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the FACP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
   b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
      1) Smoke detectors and duct smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function. Perform pressure differential test on all duct mounted smoke detectors.
      2) Door Release: Verify that proper alarm activates every held-open door, rolldown doors and shutters, so that the doors close completely to the closed position.
   c. Audible/Visual Notification: Activate by means of an alarm-initiating device that audible and visual devices are clearly audible and/or visual throughout.
   d. Test Report:
      1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
      2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.
E. Functional Performance Testing:
   1. After the approval of the test report, provide a schedule of final testing to be done in the
      presence of the Fire Marshal and Owner's Representative. The schedule must be received
      by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the
      dates and time slots in which the various systems can be tested.
   2. Coordination of the Final Test dates with all parties (General Contractor, Mechanical
      Contractor, Elevator Contractor, Engineer, Owner and others) shall be the sole
      responsibility of the Contractor. If a party is required to be present during any phase of
      testing to activate a device, ensure that the party or a qualified representative of the party
      is present throughout that phase of the testing.

F. In the event that the system fails to function properly during the testing as a result of inadequate
   pretesting or preparation. The contractor shall bear all costs incurred by the necessity for
   retesting, including test equipment, transportation, subsistence and the engineer's hourly rate.

G. Contractor shall replace at no cost to the owner all devices which are found defective or do not
   operate within factory specified tolerances.

H. Contractor shall submit the testing agency's final report for review prior to project closeout and
   final acceptance by the owner; Test report shall indicate test dates, devices tested, results,
   observation, deficiencies and remedies. Test report shall be included in the operation and
   maintenance manuals.

3.4 TRAINING

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Factory authorized service representative shall conduct an 8-hour training seminar for Owner's
   Representative upon completion and acceptance of the system. Instructions shall include safe
   operation, maintenance and testing of equipment with both classroom training and hands-on
   instruction.

C. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION
TrueAlert® Addressable Notification Appliances

Visible Notification Appliances for Wall Mounting

Features:

Individually addressed high intensity visible notification appliance (strobe) provides:

- Supervision of each individual appliance's wiring and connections
- Ability to connect using "T" tapping for Class B/Style 4 circuits to simplify wiring (Class A/Style 6 circuits require in/out wiring)
- Models available with 15, 75, or 110 candela with strobe rating clearly marked on reflector
- Compatibility with ADA requirements (refer to important installation information on page 4)
- In/out wiring accessibility from front of housing providing easy access for installation, inspection and testing
- Regulated circuit design ensuring consistent output
- Magnetic test diagnostics to assist checkout and testing of appliances and wiring
- Rugged, high impact, flame retardant thermoplastic housing available in red or white (covers are available separately to convert color)
- UL listed to Standard 1971

LED indicator and magnetic test feature:

- LED indicator can be selected to display each polling cycle to indicate appliance supervision
- When the host TrueAlert addressable control is in diagnostic mode, the magnetic test pulses the LED to indicate appliance address and is selectable to also briefly flash the strobe to confirm operation

TrueAlert two-wire addressable control of visible (and audible notification) provides:

- Visible appliances connected to the same circuit operated at a synchronized 1 Hz flash rate
- Horns sounded as Temporal or March Time pattern, or on continuously, controlled separately from visible appliances on the same two-wire circuit

TrueAlert Addressable notification appliance design provides flexible, easy, and convenient flush or surface wall mounting:

- Rear of housing does not extend into box and easily mounts to single gang, double gang, or 4-inch square outlet box
- In/out wiring terminals, 18 AWG to 12 AWG
- Optional mounting adapters are available to cover surface mounted electrical boxes and to adapt to Simplex® 2975-9145 boxes

TrueAlert Addressable Strobes are Available in Red with White Lettering and White with Red Lettering

Description

TrueAlert Addressable strobes are individually addressed visible notification appliances that receive power, supervision, and control signals from a TrueAlert Addressable Signaling Line Circuit (SLC) channel. When activated, TrueAlert Addressable strobes flash at a synchronized rate.

TrueAlert addressable operation** allows strobes to be wired onto the same two-wire SLC circuit as horns but with separately controlled operation. Typical applications are audible notification appliances activated as "on-until-silenced" and visible notification appliances activated as "on-until-reset."

TrueAlert Addressable Advantage

Background. Fire alarm control panels typically activate both audible and visible notification upon receipt of an alarm. At the direction of an authorized operator (or by pre-determined program), audible notification appliances may be silenced before the alarm condition is reset (on-until-silenced) while the visible notification appliances are kept activated until the alarm condition is reset (on-until-reset). This operation has traditionally required two different circuits (four-wire operation).

* These products have been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7125-0036:235 for allowable values and conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use - City of New York Department of Buildings - MEAS-93E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Safety Products Westchester.

** TrueAlert addressable notification is protected under U.S. Patent Nos. 6,313,744; 6,426,697; and 6,693,532.
TrueAlert Addressable Advantage (Continued)

TrueAlert addressable operation provides separate audible and visible appliance control functions using a single two-wire circuit that also confirms connection to the individual notification appliance’s electronic circuit. This operation increases circuit supervision integrity by providing supervision that extends beyond the appliance wiring connections.

Opportunities for Reducing Installation and Testing Time. Allowing separate controls to be carried on the same two-wire SLC can significantly reduce installation time and expense for both retrofit and new construction. When Class B (Style 4) wiring is used, wiring can be “T” tapped, allowing even more savings in distance, wire, junction boxes, and overall installation efficiency. The magnetic test feature also can provide improved installation efficiency.

TrueAlert Addressable Control

Compatible controllers include the following:
- 4100U Series TrueAlert Power Supply (refer to data sheet S4100-0031 for additional information)
- TrueAlert Addressable Controller, an intelligent interface panel that connects between the host fire alarm control panel and the TrueAlert addressable notification appliances (refer to data sheet S4009-0003 for additional information.)

TrueAlert Addressable Diagnostics

Polling Indicator. The host TrueAlert addressable control can be selected to pulse each appliance’s LED when that appliance receives a supervision poll.

Magnetic Test. When the host TrueAlert addressable control is selected for diagnostic mode, the TrueAlert addressable appliance magnetic test feature provides a response at the individual appliance being tested.

Silent Appliance Testing. In this test mode, in response to the magnetic test, the appliance LED pulses sequentially to conveniently indicate the appliance’s address.

Operational Appliance Testing. The LED diagnostic test mode can be selected at the TrueAlert addressable control such that after the address is indicated, the strobe will briefly flash to indicate proper operation.

TrueAlert Addressable Wiring Isolator

The 4905-9929 Isolator Module is available for use on TrueAlert Addressable circuits to isolate short circuiting wiring from functioning wiring. (Refer to data sheet S4905-0001 for further information about the TrueAlert Addressable Isolator Module.)

Strobe Selection

Proper selection of visible notification is dependent on occupancy, location, local codes, and proper application of: the National Fire Alarm Code (NFPA 72); ANSI A117.1; the appropriate model building code, BOCA, IBCQ, or SBC, and the application guidelines of the Americans with Disabilities Act (ADA).

Product Selection

TrueAlert Addressable Strobes

<table>
<thead>
<tr>
<th>Model Number</th>
<th>15 cd</th>
<th>75 cd</th>
<th>110 cd</th>
<th>Housing Color</th>
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<tbody>
<tr>
<td>4904-9350</td>
<td>✓</td>
<td></td>
<td></td>
<td>Red with white “FIRE” lettering</td>
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<tr>
<td>4904-9351</td>
<td></td>
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<td></td>
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Mounting Adapters

<table>
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<tr>
<th>Model</th>
<th>Description</th>
<th>Dimensions</th>
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<tbody>
<tr>
<td>4905-9937</td>
<td>Surface mount red adapter skirt</td>
<td>5-3/8&quot; H x 5-1/4&quot; W x 1-5/6&quot; D (136 mm x 133 mm x 41 mm) Total depth with strobe = 3-1/8&quot; (79 mm)</td>
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<tr>
<td>4905-9940</td>
<td>Surface mount white adapter skirt</td>
<td></td>
</tr>
<tr>
<td>4905-9931</td>
<td>Adapter plate, red, for mounting to Simplex 2975-9145 Box (typically for retrofit, may be mounted vertical or horizontal)</td>
<td>8-5/16&quot; x 5-3/4&quot; x 0.060&quot; Thick (211 mm x 146 mm x 1.5 mm)</td>
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<tr>
<td>2975-9145</td>
<td>Red mounting box, requires 4905-9931 adapter plate</td>
<td>7-7/8&quot; x 5-1/8&quot; x 2-3/4&quot; D (200 mm x 130 mm x 70 mm)</td>
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Optional Covers and Guard

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<tr>
<th>Model</th>
<th>Description</th>
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<tr>
<td>4905-9992</td>
<td>Red strobe cover with white “FIRE” lettering</td>
<td>5-1/8&quot; H x 5&quot; W x 1-1/2&quot; D (130 mm x 127 mm x 38 mm)</td>
</tr>
<tr>
<td>4905-9993</td>
<td>White strobe cover with red “FIRE” lettering</td>
<td></td>
</tr>
<tr>
<td>4905-9961</td>
<td>Wire guard with mounting plate, red, compatible with surface or semi-flush mounted boxes</td>
<td>6-1/16&quot; H x 6-1/16&quot; W x 3-1/8&quot; D (164 mm x 154 mm x 79 mm)</td>
</tr>
</tbody>
</table>

* UL listed by Space Age Electronics, Inc.
Mounting is compatible with single gang, double gang, and 4" (102 mm) square boxes, 1-1/2" (38 mm) deep, by others.

Adapter Plate and Wire Guard Installation Reference

4905-9931 Adapter Plate

2675-9145 Box

4905-9961 Optional Wire Guard (shown here for reference only, can be used on other mounting options)

4905-9931 Adapter Plate

TrueAlert Addressable Strobe
Specifications

<table>
<thead>
<tr>
<th>Rated Voltage Range</th>
<th>UL Listed Range</th>
<th>Special Application, 17 to 31 VRMS, see Notes 1 and 2 below</th>
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<tbody>
<tr>
<td>ULC Listed Range</td>
<td>21.25 VRMS to 28.2 VRMS per ULC SS26-M67</td>
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Supervisory Requirements
1 unit load

Flash Rate
1 Hz

Synchronized SLC Loading
Up to 43 TrueAlert addressable synchronized strobes maximum per SLC

| Maximum RMS Current Rating per Strobe Output (see Notes 2 and 3 below) |
|---------------------------|-------------------|---------------------|
|                           | 83 mA             | 205 mA              |
|                           | 75 cd             | 228 mA              |
|                           | 110 cd            |                     |

| Reference RMS Currents at other voltages |
|-----------------------------------------|-----------------|
| 18 VRMS                                 | 78 mA           |
|                                        | 134 mA          |
|                                        | 213 mA          |
| 24 VRMS                                 | 56 mA           |
|                                        | 114 mA          |
|                                        | 160 mA          |

Housing Dimensions (Including lens)
5-1/8" H x 5.5" W x 2-5/8" D (130 mm x 127 mm x 67 mm)

Temperature Range
32° to 122° F (0° to 50° C)

Humidity Range
10% to 93%, non-condensing at 100° F (38° C)

Connections
Terminal blocks for 18 AWG to 12 AWG (0.82 mm² to 3.31 mm²); two wires per terminal for input wiring

NOTES:
1. TrueAlert addressable strobes are required to be connected to a TrueAlert addressable channel where both power and communications are supplied. Refer to TrueAlert Addressable Controller data sheet 54009-0003 for additional information about wiring rules and distance limitations.
2. "Special Application" refers to the operating category under UL Standard 1971, Signaling Devices for the Hearing Impaired, changes effective May 1, 2004. The rated voltage range listed is the absolute operating range. Operation outside of this range may cause permanent damage to the appliance. Please note that 17 VRMS is the lowest operating voltage that is allowed at the last appliance on the TrueAlert signaling line circuit under worst case conditions.
3. The maximum RMS current listed is the device nameplate rating. Strobe designs are constant wattage and the maximum RMS current rating occurs at the lowest allowable operating voltage. (RMS is root mean square and refers to the effective value of a varying current waveform.)

Installation Reference, Mounting Height and Surface Mounting

**IMPORTANT! INSTALLATION MOUNTING HEIGHT REFERENCE**

Electrical box outline

Bottom of lens is either even with, or slightly above bottom of compatible boxes

80° (2.03 m) minimum

NFPA 72 requires that the entire lens be not less than 80° and not greater than 96° above the finished floor.

**Surface Mounting Reference Showing Optional Wire Guard**

Surface mount conduit and box shown for reference

4" (102 mm) square box profile, 1-1/2" (38 mm) deep

Optional 4905-9961 Wire Guard

TrueAlert Addressable strobe

Optional surface mount adapter skirt, 1-1/2" deep: 4905-9937, Red; 4905-9940, White (conduit knockouts are provided on all four sides)
LISTING No. 7125-0026:0235
CATEGORIES: 7125 – FIRE ALARM DEVICES FOR THE HEARING IMPAIRED

LISTEE: Simplex, 100 Simplex Drive, Westminster, MA 01441-0001
Contact: Paul Mattern
Email: pmattern@lycoint.com

Models "TrueAlert non-addressable" 4904-9168, 4904-9171, 4904-9169, 4904-9172, 4904-9170 and 4904-9173 non-synchronized strobe lights.
Models "TrueAlert addressable" 4904-9350, 4904-9351, 4904-9352, 4904-9353, 4904-9354, 4909-9355 synchronized strobe lights.
Models "TrueAlert addressable" 4904-9356, 4904-9357, 4904-9358, 4904-9359, 4904-9360, 4909-9361 synchronized strobe lights.
Models "TrueAlert addressable" 4905-9201, -9202, -9203, -9204, and -9208 synchronized multi-candela strobe lights. Intended for indoor use, wall mounted only. Intended for use with either Model 4209-9401 NAC Extender or with the TrueAlert power supply of Model 4100U fire alarm control panel. "Model 4905-9208 employs two lenses, clear lens for "Fire" and amber for "Non-Fire".
Model 4905-9938 sync control module. Refer to listee's data sheet for detailed product description and operational considerations.

RATING: 4904-9331, -9342, -9350, -9353, -9356, -9359, -9168, -9171: 15cd, 1 Hz.
4904-9332, -9343, -9351, -9354, -9357, -9360, -9169, -9172: 75cd, 1 Hz.
4904-9333, -9344, -9170, -9173, -9352, -9355, -9358, -9361: 110cd, 1 Hz.
Models 4905-9201, -9202, -9203, -9204, -9208*: 15, 30, 75, 110cd, 1 Hz

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction. Intended for indoor use and wall mounting only.

MARKING: Listee's name, model number, electrical rating and UL label.

APPROVAL: Listed as strobe lights suitable for the hearing impaired when used with listee's separately listed fire alarm control units. For "TrueAlert non-addressable" synchronized strobes, Model 4905-9938 sync control module must be used.

NOTE: *Rev 07-01-08 bh

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: July 01, 2010
Listing Expires June 30, 2011

Authorized By: FRANCIS MATEO, Program Coordinator
Fire Engineering Division
**Features**

Individually addressed wall mount audible/visible notification appliances with efficient electronic horn and high intensity xenon strobe provides:

- Supervision of each individual appliance’s wiring and connections
- Ability to connect using “T” tapping for Class B/Style 4 circuits to simplify wiring (Class A/Style 6 circuits require in/out wiring)
- Horns controlled separately from strobes on the same two-wire circuit allowing “on-until-silenced” and “on-until-reset” using a single address
- Compatibility with ADA requirements (refer to important installation information on page 3)
- In/out wiring accessibility from front of housing providing easy access for installation, inspection, and testing
- Magnetic test diagnostics to assist checkout and testing of appliances and wiring
- Rugged, high impact, flame retardant thermoplastic housings available in red or white (covers are available separately to convert color)

**LED indicator and magnetic test feature:**

- LED indicator can be selected to display each polling cycle to indicate appliance supervision
- When the TrueAlert addressable channel controller is in diagnostic mode, the magnetic test pulses the LED to indicate appliance address and is selectable to also briefly flash the strobe to confirm operation

**TrueAlert two-wire addressable control of visible and audible notification activates appliances with:**

- Visible appliances connected to the same circuit operated at a synchronized 1 Hz flash rate
- Horns sounded as Temporal or March Time pattern, or on continuously, controlled separately from visible appliances on the same two-wire circuit
- Horn March Time is available as 60 or 120 beats per minute

**TrueAlert addressable notification appliance design provides flexible, easy, and convenient flush or surface wall box mounting:**

- Rear of housing does not extend into box and easily mounts to single gang, double gang, or 4-inch box
- In/out wiring terminals, 18 AWG to 12 AWG
- Optional mounting adapters are available to cover surface mounted electrical boxes and to adapt to Simplex 2975-9145 boxes

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**Features (Continued)**

**Visible notification appliance (strobe):**

- Xenon strobe available with 15, 75, or 110 candela output (strobe rating is clearly indicated on reflector)
- UL listed to Standard 1971

**Audible notification appliance (horn):**

- Low current electronic horn with harmonically rich output sound for either coded or steady operation
- Controller can be selected for “high” output or a “low” output sound level (~5 dBA difference)
- UL listed to Standard 464

**Description**

TrueAlert addressable audible/visible (AV) notification appliances are individually addressed and receive power, supervision, and control signals from a TrueAlert addressable Signaling Line Circuit (SLC) channel. When activated, the strobes flash at a synchronized rate and the horns sound with synchronized output. (Refer to the specific TrueAlert addressable SLC Control source for additional information.)

**TrueAlert addressable operation** allows strobes to be wired onto the same two-wire SLC circuit as horns but with separately controlled operation. Typical applications are audible notification appliances activated as “on-until-silenced” and visible notification appliances activated as “on-until-reset.”

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* These products have been approved by the California State Fire Marshal (CSFM) pursuant to Section 55144.1 of the California Health and Safety Code. See CSFM Listing 7105-0035228 for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use — City of New York Department of Buildings — MEAS3-63E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Alexander Co. are the property of Tyco Safety Products Westminster.

** TrueAlert addressable notification is protected under U.S. Patent Nos. 6,315,744; 6,425,697; and 6,533,532.
TrueAlert Addressable Advantage

Background. Fire alarm control panels typically activate both audible and visible notification upon receipt of an alarm. At the direction of an authorized operator (or by pre-determined program), audible notification appliances may be silenced before the alarm condition is reset (on-until-silenced) while the visible notification appliances are kept activated until the alarm condition is reset (on-until-reset). This operation has traditionally required two different circuits (four-wire operation).

TrueAlert addressable operation provides separate audible and visible appliance control functions using a single two-wire circuit that also confirms connection to the individual notification appliance’s electronic circuit. This operation increases circuit supervision integrity by providing supervision that extends beyond the appliance wiring connections.

Opportunities for Reducing Installation and Testing Time. Allowing separate controls to be carried on the same two-wire SLC can significantly reduce installation time and expense for both retrofit and new construction. When Class B (Style 4) wiring is used, wiring can be “T” tapped, allowing even more savings in distance, wire, junction boxes, and overall installation efficiency. The magnetic test feature (see next paragraph) also can provide improved installation efficiency.

TrueAlert Addressable Control

TrueAlert addressable notification appliances are controlled by:

- The 4009-9401 TrueAlert Addressable Controller interface panel connected between the host fire alarm control panel and the addressable notification appliances (see data sheet S4009-0003 for further information about the TrueAlert Addressable Controller)
- A TrueAlert Addressable Power Supply in a 4100U fire alarm control panel (see data sheet S4100-0031)

TrueAlert Addressable Diagnostics

Test Features. The TrueAlert Addressable Controller can be selected to pulse each appliance’s LED when that appliance receives a supervision poll. When the Controller is selected for diagnostic mode, the addressable appliance magnetic test feature provides a response at the individual appliance being tested.

Silent Appliance Testing. In this test mode, in response to the magnetic test, the appliance LED pulses sequentially to conveniently indicate the appliance’s address.

Operational Appliance Testing. The LED diagnostic test mode can be selected at the TrueAlert Addressable Controller such that after the address is indicated, the strobe will briefly flash and the horn will briefly sound to indicate proper operation.

Product Selection

TrueAlert Addressable Audible/Visible Notification Appliances

<table>
<thead>
<tr>
<th>Model Number</th>
<th>15 cd</th>
<th>75 cd</th>
<th>110 cd</th>
<th>Housing Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>4903-9450</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4903-9451</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4903-9452</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4903-9453</td>
<td>✓</td>
<td></td>
<td></td>
<td>White with red “FIRE” lettering</td>
</tr>
<tr>
<td>4903-9454</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4903-9455</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Mounting Adapters

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>4905-9937</td>
<td>Surface mount red adapter skirt Use to cover 1-1/2&quot; deep surface mounted boxes</td>
<td>5-3/8&quot; H x 6-1/4&quot; W x 1-5/8&quot; D (136 mm x 133 mm x 41 mm) Total depth with horn = 3-1/8&quot; (79 mm)</td>
</tr>
<tr>
<td>4905-9940</td>
<td>Surface mount white adapter skirt</td>
<td></td>
</tr>
<tr>
<td>4905-9931</td>
<td>Adapter plate, red, for mounting to Simplex 2975-9145 Box (typically for retrofit, may be mounted vertical or horizontal)</td>
<td>8-5/16&quot; x 5-3/4&quot; x 0.060&quot; Thick (211 mm x 146 mm x 1.5 mm)</td>
</tr>
<tr>
<td>2975-9145</td>
<td>Red mounting box, requires 4905-9931 adapter plate</td>
<td>7-7/8&quot; x 5-1/8&quot; x 2-3/4&quot; D (200 mm x 130 mm x 70 mm)</td>
</tr>
</tbody>
</table>

Optional Covers and Guard

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>4905-9994</td>
<td>Red A/V cover with white “FIRE” lettering</td>
<td>For replacement or color conversion</td>
</tr>
<tr>
<td>4905-9995</td>
<td>White A/V cover with red “FIRE” lettering</td>
<td></td>
</tr>
<tr>
<td>4905-9961</td>
<td>Wire guard with mounting plate, red, compatible with surface or semi-flush mounted boxes*</td>
<td>6-1/16&quot; H x 5-1/16&quot; W x 3-1/8&quot; D (154 mm x 154 mm x 78 mm)</td>
</tr>
</tbody>
</table>

* UL listing in process as of document revision date (by Space Age Electronics Inc.).
Mounting is compatible with single gang, double gang, and 4" (102 mm) square boxes, 1-1/2" (38 mm) deep, by others.

Wiring access hole
Wiring terminals

Mounting Holes:
4" square (4)
Single gang (2)
Double gang (3)

Transparent housing and lens assembly
LED indicator
Address setting dipswitch
Removable cover (tool required)
Magnetic test location

IMPORTANT INSTALLATION MOUNTING HEIGHT REFERENCE
Bottom of lens is either even with, or slightly above bottom of compatible boxes.
NFPA 72 requires that the entire lens be not less than 80" and not greater than 96" above the finished floor.

Adapter Plate and Wire Guard Installation Reference

2975-9145 Box Mounting

4905-9931 Adapter Plate
2975-9145 Box

TrueAlert Addressable A/V

4905-9961 Optional Wire Guard
(shown here for reference only, can be used on other mounting options)

Side View, Adapter Skirt and Wire Guard
(Surface mount conduit and box shown for reference)
4" square box profile, 1-1/2" (38 mm) deep

Optional 4905-9961 Wire Guard
Optional surface mount adapter skirt, 1-1/2" deep: 4905-9937, Red; 4905-9940, White (conduit knockouts are provided on all four sides)
The 4905-9929 Isolator Module is available for use on TrueAlert addressable circuits to isolate short-circuited wiring from functioning wiring. (Refer to data sheet S4905-0001 for further information about the TrueAlert addressable isolator module.)

## Specifications

### Electrical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage Range</td>
<td>Special Application, 17 to 31 VRMS, see Notes 1 and 2 below</td>
</tr>
<tr>
<td>Supervisory Requirements</td>
<td>1 unit load</td>
</tr>
<tr>
<td>Strobe Flash Rate</td>
<td>1 Hz</td>
</tr>
<tr>
<td>Synchronized SLC Loading</td>
<td>Up to 43 TrueAlert addressable synchronized strobes maximum per SLC</td>
</tr>
<tr>
<td>Maximum RMS Current Rating per Strobe Output, Horn on &quot;High&quot; Setting (see Notes 2 and 3 below)</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>17 VRMS</td>
</tr>
<tr>
<td>Sound Type</td>
<td>Steady, Coded</td>
</tr>
<tr>
<td>Setting</td>
<td>High, Low</td>
</tr>
<tr>
<td>Output</td>
<td>84.6, 79.1, 60.6, 75.5, 88.3, 81.5, 82.4, 77.2</td>
</tr>
<tr>
<td>Voltage</td>
<td>24 VRMS</td>
</tr>
<tr>
<td>Sound Type</td>
<td>Steady, Coded</td>
</tr>
<tr>
<td>Setting</td>
<td>High, Low</td>
</tr>
<tr>
<td>Output</td>
<td>91, 84, 87, 79, 93, 87, 90, 83</td>
</tr>
</tbody>
</table>

### Horn Output Specifications

Sound Output Characteristics: 2400 to 3700 Hz sweep, modulated at 120 Hz
Horn Sound Output Ratings (dBA) @ 10 ft (3 m)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>17 VRMS</th>
<th>24 VRMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Output</td>
<td>84.6</td>
<td>79.1</td>
</tr>
<tr>
<td>Setting</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Output</td>
<td>79.1</td>
<td>60.6</td>
</tr>
<tr>
<td>Setting</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Output</td>
<td>60.6</td>
<td>75.5</td>
</tr>
<tr>
<td>Setting</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Output</td>
<td>75.5</td>
<td>88.3</td>
</tr>
<tr>
<td>Setting</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Output</td>
<td>88.3</td>
<td>81.5</td>
</tr>
<tr>
<td>Setting</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Output</td>
<td>81.5</td>
<td>82.4</td>
</tr>
<tr>
<td>Setting</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Output</td>
<td>82.4</td>
<td>77.2</td>
</tr>
</tbody>
</table>

### General Specifications

- Housing Dimensions (including lens): 5-1/8" H x 5" W x 2-5/8" D (130 mm x 127 mm x 67 mm)
- Temperature Range: 32° to 122° F (0° to 50° C)
- Humidity Range: 10% to 93%, non-condensing at 100° F (38° C)
- Connections: Terminal blocks for 18 AWG to 12 AWG (0.82 mm² to 3.31 mm²); two wires per terminal for in/out wiring

NOTES:
1. TrueAlert addressable appliances are required to be connected to a TrueAlert addressable channel where both power and communications are supplied. Refer to TrueAlert Addressable Controller data sheet S4009-0003 for additional information about wiring rules and distance limitations.
2. “Special Application” refers to the operating category under UL Standard 1971, *Signaling Devices for the Hearing Impaired*, changes effective May 1, 2004. The rated voltage range listed is the absolute operating range. Operation outside of this range may cause permanent damage to the appliance. Please note that 17 VRMS is the lowest operating voltage that is allowed at the last appliance on the TrueAlert signaling line circuit under worst case conditions. “Low” horn setting draws approximately 5 mA less current at each voltage listed.
3. Currents are with horn on steady. The maximum RMS current listed is the device nameplate rating. Strobe designs are constant wattage and the maximum RMS current rating occurs at the lowest allowable operating voltage. (RMS is root mean square and refers to the effective value of a varying current waveform.) Coded horn values are typical of the output measured with a Temporal or March Time pattern and with a sound level meter reading on a “test” setting. Under the same test conditions, coded horn output “peak” sound level readings are typically 4 dBA higher. Anechoic horn output ratings are typically more representative of actual installed sound output.

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LISTING No. 7125-0026:0229

CATEGORY: 7125 – FIRE ALARM DEVICES FOR THE HEARING IMPAIRED

LISTEE: Simplex, 100 Simplex Drive, Westminster, MA 01441-0001
Contact: Paul Mattem
Email: pmattem@tycoint.com


RATING: Electrical: 24 VDC
Candela: -9417, -9428, -9425, -9431, -9450, -9453, -9459: 15cd
-9418, -9429, -9426, -9432, -9451, -9454, -9460: 75 cd
-9419, -9430, -9427, -9433, -9452, -9455, -9461: 110 cd
*Models 4906-9227, -9228, -9229, -9230: 15, 30, 75 110cd

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number, electrical rating and UL label.

APPROVAL: Listed as electronic horn/strobes for use with separately listed electrically compatible fire alarm control units. All "TrueAlert non-addressable" synchronized models are used in conjunction with Model 4905-9938 (CSFM Listing No. 7125-0026:235) sync control module. For indoor use only.

This unit can generate a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002.

NOTE:

*Rev. 07-18-2007 jw

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: July 01, 2010
Listing Expires June 30, 2011

Authorized By: FRANCIS MATEO, Program Coordinator

Fire Engineering Division
TrueAlarm® Analog Sensing

Addressable Duct Sensor Housings with TrueAlarm Photoelectric Sensor; Available with Multiple Relay Control

Features:
Compact air duct sensor housing with clear cover to monitor for the presence of smoke**
Includes factory installed TrueAlarm photoelectric smoke sensor and features:
- Individual sensor information processed by the host control panel to determine sensor status
- Digital transmission of analog sensor values via MAPNET II® or IDNet™, 2-wire communications
- Programmable sensitivity, consistent accuracy, environmental compensation, status testing, and monitoring of sensor dirt accumulation

Model 4998-9755:
- Basic duct sensor housing (no relay output) powered by MAPNET II/IDNet communications

Model 4998-9756:
- Duct sensor housing with supervised output for multiple remote relays; requires separate 24 VDC; includes one relay
- Relay output is under panel control
- At the panel, relay output can be activated manually or in response to a separate alarm or other input

General features:
- UL listed to Standard 268A
- Clear cover allows visual inspection
- Test ports provide functional smoke testing access with cover in place
- Mounts to rectangular ducts or round ducts; minimum size is 8" (203 mm) square or 1.8" (457 mm) diameter
- Magnetic test feature for alarm initiation at housing
- Optional weatherproof enclosure is available separately (refer to data sheet 4998-0032)

Diagnostic LEDs (on interface board):
- Red Alarm/Trouble LED for sensor status and communications polling display
- Yellow LED for open or shorted trouble indication of supervised relay control (4998-9756 only)

Sampling tubes (ordered separately):
- Available in multiple lengths to match duct size
- Installed and serviced with housing in place

Remote module options (ordered separately):
- Remote red status/alarm LED (2098-9808)
- Remote test station with LED (2098-9806)
- PAM-SD remote relays (refer to page 2 for details)

Introduction

Operation. Simplex® compact air duct smoke sensor housings provide TrueAlarm operation for the detection of smoke in air conditioning or ventilating ducts. Sampling tubes are installed into the duct allowing air to be directed to the smoke sensor mounted in the housing.

TrueAlarm Sensor/Operation

Digital Communication of Analog Sensing. Analog information from the sensor is digitally communicated to the control panel where it is analyzed. Sensor input is stored and tracked as an average value with an alarm or abnormal condition being determined by comparing the sensor's present value against its average.

Intelligent Data Evaluation. Monitoring each photoelectric sensor's average value provides a software filtering process that compensates for environmental factors (dust, dirt, etc.) and component aging, providing an accurate reference for evaluating new activity. The result is a significant reduction in the probability of false or nuisance alarms caused by shifts in sensitivity, either up or down.

** Please note that smoke detection in air ducts is intended to provide notification of the presence of smoke in the duct. It is not intended to, and will not, replace smoke detection requirements for open areas or other non-duct applications.

† TrueAlarm sensors and MAPNET II and IDNet communications are protected by one or more of the following U.S. Patents: 5,155,458; 5,173,885; 5,543,777; 5,469,014; 5,943,777; 5,710,641; D382,807; D398,302; D398,379; 4,765,025.

S4098-0039-4 10/2003
TrueAlarm Sensor Operation (Continued)

Control Panel Selection. Peak activity per sensor is stored to assist in evaluating specific locations. The alarm set point for each sensor is determined at the control panel, selectable as the individual application requires.

Sensor Status LED. Each sensor housing’s red status LED (located on the electrical interface board) pulses to indicate communications with the panel. If the control panel determines that a sensor is in alarm, or that it is dirty or has some other type of trouble, the details are annunciated at the control panel and that sensor housing’s status LED will be turned on steadily. During a system alarm, the control panel will control the LEDs such that an LED indicating a trouble will return to pulsing to help identify any alarmed sensors. (Remote Status/Alarm LEDs track the operation of the sensor housing LED.)

Photoelectric Sensing

Typically duct sensor applications require less sensitive settings (such as 2.5% per foot obscuration) due to the ducts being a relative dirty environment. However, the standard seven levels of TrueAlarm sensor sensitivity are available for each individual sensor, ranging from 0.2% to 3.7% per foot of smoke obscuration. Sensitivity is selected and monitored at the fire alarm control panel.

Fire Alarm Control Panel Features

- Individual smoke sensitivity selection
- Sensitivity monitoring that satisfies NFPA 72 sensitivity testing requirements
- Peak value logging allows accurate analysis for sensitivity selection
- Automatic, once per minute individual sensor calibration check verifies sensor integrity
- Automatic environmental compensation
- Smoke sensitivity is displayed in percent per foot
- Ability to display and print detailed sensor information in plain English language
- Relays of model 4098-9756 are under panel control for ON, OFF, or override

Duct Sensor Selection Chart

<table>
<thead>
<tr>
<th>Duct Smoke Sensor Housing with Photoelectric Sensor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9755</td>
</tr>
<tr>
<td>4098-9756</td>
</tr>
</tbody>
</table>

Remote LED Indicator and Test Station, Select One if Required

| 2098-9803 | Red LED status indicator |
| 2098-9806 | Test Station with keyswitch and red LED status indicator (turning switch to “TEST” initiates alarm for system testing) |

Epoxyl Encapsulated Remote Relay (wiring is 18 AWG (0.82 mm²) color coded wire leads)

| PAM-SD | Relay; single Form C (10 A @ 120 VAC); refer to pages 3 and 4 for additional relay information; order separately from Air Products & Controls Ltd.; one included with 4098-9756 |

Sampling Tube Selection Chart: Ordered Separately Per Duct Width; Select One

<table>
<thead>
<tr>
<th>Duct Width</th>
<th>Tube Required</th>
<th>Min. Suggested Cut Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” (305 mm)</td>
<td>2098-9796</td>
<td>1/2 in. (12.7 mm) longer than duct width</td>
</tr>
<tr>
<td>13” to 23” (330 mm to 584 mm)</td>
<td>2098-9804</td>
<td>1/2 in. (12.7 mm) longer than duct width</td>
</tr>
<tr>
<td>24” to 46” (610 mm to 1168 mm)</td>
<td>2098-9797</td>
<td>2 in. (51 mm) longer than duct width</td>
</tr>
<tr>
<td>46” to 71” (1188 mm to 1803 mm)</td>
<td>2098-9798</td>
<td>2 in. (51 mm) longer than duct width</td>
</tr>
<tr>
<td>71” to 95” (1803 mm to 2413 mm)</td>
<td>2098-9799</td>
<td>2 in. (51 mm) longer than duct width</td>
</tr>
</tbody>
</table>

*Each duct housing includes an internally mounted model 4098-9714 TrueAlarm photoelectric sensor and an exhaust tube. A correctly sized sampling tube (ordered per application) is required, refer to chart below.
NOTE: Refer to Installation Instructions 574-776 for additional detail and maintenance information.
Preferred Duct Sensor Locations:
1. A minimum of six duct widths downstream from bends or inlets to avoid air turbulence.
2. On the downstream side of filters to detect fires in the filters.
3. In return ducts, ahead of mixing areas.
4. Upstream of air humidifier and cooling coil.
5. With accessibility for test and service.
6. For additional information, refer to NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

Locations to Avoid:
1. Where dampers closed for comfort control would interfere with airflow.
2. Next to outside air inlets (unless the intent is to monitor smoke entry from that area).
3. In return air damper branch ducts and mixing areas where airflow may be restricted.

Outdoor Applications Note:
For outdoor applications, refer to data sheet S4098-0032 for information on weatherproof enclosure 4098-9845.
MAPNET II® and IDNet™ Addressable Devices
Device Communications Compatibility Chart

### Devices Compatible with MAPNET II, 4010 IDNet, 4100U, and 4008 IDNet Communications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9101</td>
<td>Class B IDC ZAM</td>
<td>4098-9791 Sensor Base with connections for remote LED or relay; and supervised remote relay</td>
</tr>
<tr>
<td>4098-9106</td>
<td>Class A IDC ZAM</td>
<td>4098-9792 Standard Sensor Base</td>
</tr>
<tr>
<td>4098-9759</td>
<td>In-Duct Sensor Housing without relay</td>
<td>4098-9794 Sounder Base</td>
</tr>
<tr>
<td>4098-9761</td>
<td>In-Duct Sensor Housing with relay</td>
<td>4099-9001 Addressable Station, Standard</td>
</tr>
<tr>
<td>4098-9755</td>
<td>Duct Sensor Housing without relay</td>
<td>4099-9002 Addressable Station, Breakglass</td>
</tr>
<tr>
<td>4098-9756</td>
<td>Duct Sensor Housing with relay</td>
<td>4099-9003 Addressable Station, Push</td>
</tr>
<tr>
<td>4098-9789</td>
<td>Sensor Base with connections for remote LED or unmonitored relay</td>
<td>UL, ULC, FM, CSFM, MEA</td>
</tr>
</tbody>
</table>

### Devices with Special Considerations

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9001</td>
<td>Supervised IAM; 4090-9051 is encapsulated and w/o LED</td>
<td>MAPNET II provides Class B monitoring of N.O. contacts IDNet from 4008, 4010, or 4100U also provides &quot;T&quot; sense</td>
</tr>
<tr>
<td>4099-9401</td>
<td>TrueAlert® Addressable Controller</td>
<td>4010 IDNet (4100 and 4103 control using RJU)</td>
</tr>
<tr>
<td>4098-9754**</td>
<td>Photo/Heat Multi-Sensor, one address for photo, heat, and TrueSense® operation (4100U only)</td>
<td>MAPNET II, 4101 IDNet, and 4008 IDNet; two consecutive addresses; does not provide TrueSense® operation; see below for 4010 U applications of 4098-9754</td>
</tr>
<tr>
<td>4099-9012</td>
<td>Addressable Releasing Station, Push</td>
<td>Use with MAPNET II or IDNet Releasing panels only</td>
</tr>
<tr>
<td>4190-9050</td>
<td>4-20 mA AMZ, revision 2.01 firmware</td>
<td>MAPNET II or 4100U IDNet Operation (MAPNET II requires one unit load, IDNet requires two unit loads); MEA is not applicable for this product</td>
</tr>
<tr>
<td>4190-9051</td>
<td>TrueAlarm LaserCOMPACT</td>
<td>MAPNET II or 4100U IDNet Operation</td>
</tr>
<tr>
<td>4098-9754**</td>
<td>Photo/Heat Multi-Sensor, one address for photo, heat, and TrueSense® operation (4100U only)</td>
<td>For 4100U IDNet only; use with standard sensor bases, requires only one address</td>
</tr>
</tbody>
</table>

### Devices Compatible with 4010 IDNet or 4100U IDNet Communications Only (except as noted)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4090-9201</td>
<td>4008 IDNet.NAC Extender (409G A); requires 4100U rev. 11 software</td>
<td>4099-9002 Relay IAM (also for use with 4008)</td>
</tr>
<tr>
<td>4098-9031</td>
<td>Class B IDNet Fiber Optic Transmitter (not MEA approved)</td>
<td>4098-9793 Isolator Base</td>
</tr>
<tr>
<td>4090-9105</td>
<td>Class A IDNet Fiber Optic Transmitter (not MEA approved)</td>
<td>4098-9605* Suppression Release Peripheral (SRP) without enclosure (uses 2975-6227) [ULC is not applicable]</td>
</tr>
<tr>
<td>4090-9107</td>
<td>IDNet Repeater (not MEA approved)</td>
<td>4090-9809* SRP with Enclosure</td>
</tr>
</tbody>
</table>

### Devices Compatible with 4100U IDNet Communications Only (except as noted)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4090-9111</td>
<td>IDNet Communications Isolator (also compatible with 4008 IDNet)</td>
<td>4090-9115* Relay IAM with T-Sense Input</td>
</tr>
<tr>
<td>4090-9117</td>
<td>Addressable Power Isolator</td>
<td>4090-9119* Relay IAM with unmonitored input</td>
</tr>
<tr>
<td>4090-9121</td>
<td>Security Monitor IAM, two unit loads</td>
<td>4090-9120* B-PL Module, 4 T-Sense Inputs, 2 relays</td>
</tr>
</tbody>
</table>

### Devices Compatible with MAPNET II Communications Only

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2190-9153 &amp; -9154</td>
<td>Monitor ZAM, Style D, IDC</td>
<td>2190-9161 &amp; -9162 Signal ZAM, Style Y NAC</td>
</tr>
<tr>
<td>2190-9155 &amp; -9156</td>
<td>Monitor ZAM, Style B, IDC</td>
<td>2190-9163 &amp; -9164 Control Relay ZAM, DPDT Contacts</td>
</tr>
<tr>
<td>2190-9157 &amp; -9158</td>
<td>4-Wire Detector ZAM, IDC</td>
<td>2190-9173 2-Point I/O Module</td>
</tr>
<tr>
<td>2190-9159 &amp; -9160</td>
<td>Signal ZAM, Style Z NAC</td>
<td>UL, ULC, FM, CSFM, MEA</td>
</tr>
</tbody>
</table>

### Devices Compatible with 4010 IDNet Communications or 4100U with 4100-3106 IDNet Expansion Module

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9757</td>
<td>QuickConnect2 Sensor (uses 4098-9788 multi-purpose base)</td>
<td>UL, ULC, FM, CSFM, MEA</td>
</tr>
</tbody>
</table>

### Devices Compatible with 4008 Panel IDNet Communications Only

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Compatibility Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4090-9007</td>
<td>IDNet Signal IAM</td>
<td>UL, ULC</td>
</tr>
</tbody>
</table>

* Requires 4010 Revision 3.01 software or higher; or 4100U Revision 11.05 software or higher.

** Requires 4100U Revision 11.0 software or higher.

Note: Listings are as of document revision date, refer to individual product data sheets for more information.
MAPNET II Communications

What does it mean?

MAPNET is an acronym for Multi-Application Peripheral NETwork. MAPNET II was introduced as an improved version of MAPNET (I) in 1991. The improvements included electrical design changes that impacted both the transmit and receive circuits and provided better electrical transient immunity and overall improved performance.

Where is it used?

Availability includes system models 4020/4100/4120 and 4100U, and with 2120 Systems using the CDT (Communicating Device Transponder). All MAPNET II transceiver control modules communicate only with MAPNET II compatible addressable devices. (However, some addressable devices can automatically adapt to communicate with either MAPNET II or IDNet communication protocols.)

What does it do?

MAPNET II is an addressable communications protocol that provides power and half-duplex communications over a single pair of wires for up to 127 addressable devices. (Half-duplex communications are bi-directional, but occur in one direction at a time.) Information can include status (normal, trouble, alarm, abnormal, etc.) and commands such as turn on or off a relay, reset a ZAM, or activate a sounder base. Additionally, TrueAlarm® analog sensor information is communicated via MAPNET II communications (or IDNet communications).

How does it work?

The control panel sends out polling commands for status monitoring or individual device commands. This occurs by imposing voltage variations on a steady DC level. When the polling stops, the DC level is held high and each responding device answers its unique address by switching a resistor onto the DC circuit causing data to be readable at the panel. The steady DC level provides power for the MAPNET II communications receiver circuit and, for some low power devices, such as basic smoke/heat sensors and IAMs, can power the entire device — meaning only a single wire pair is required.

IDNet Communications

What does it mean?

IDNet is an acronym for Individual Device Network. The IDNet design is the next generation of addressable device communications, improving upon the basic MAPNET II communications protocol.

Where is it used?

IDNet communications are provided by the Simplex® 4010, 4100U, and 4008 Fire Alarm Control Panels. In addition to MAPNET II/IDNet addressable devices, IDNet communications also control unique devices such as the IDNet Isolator base, the 4009 IDNet NAC Extender, and the Security IAM. Newer versions of 4100U software (revision 11 and higher) also communicate with multi-point relays and the multi-sensor. However, each of these three panels provides slightly different IDNet device compatibility.

What does it do?

The operation is similar to MAPNET II but there are significant differences. The IDNet protocol and hardware enhancements support up to 250 addressable devices on a single wire pair and can support additional device types and different operations. (The 4008 Fire Alarm Control Panel provides up to 200 addressable device support.)

How does it work?

Basic operation is similar to that of MAPNET II but with an expanded capability that requires a different control panel to decode the additional device types and operations available with IDNet communications.

What is the difference between 4010 IDNet and 4100U IDNet?

The basic communications protocol of IDNet is similar, just as RS-232 or RS-485 is similar. However, even though the IDNet communications protocol is similar, not all control panels can recognize all addressable devices. As a higher end panel, 4100U IDNet has been designed with higher end performance. For compatibility reasons, there is a distinction between 4010 or 4100U IDNet.

What is the difference between 4010 IDNet and 4008 IDNet?

The 4008 Addressable panel provides a unique set of features. It is for smaller applications and only two photoelectric sensitivity levels are supported. However, it is capable of controlling the 4090-9116 IDNet Communications Isolator, and it is compatible with the new 4090-9007 IDNet Signal IAM.

* MAPNET II and IDNet addressable communications designs are protected by U.S. Patent No. 4,786,626. Other applicable patents are detailed on individual product data sheets.

Please note that listings and approvals shown on page 1 that are under Simplex Time Recorder Co. are the property of Tyco Safety Products Westminster.

Tyco, Simplex, the Simplex logo, MAPNET II, IDNet, TycoTime, TrueSense, and TrueAlarm are trademarks of Tyco International Services AG or its affiliates in the U.S. and/or other countries.

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LISTING No. 3240-0026:0220
CATEGORY: 3240 — DUCT SMOKE DETECTOR HOUSING/BASE
LISTEE: Simplex, 100 Simplex Drive, Westminster, MA 01441-0001
Contact: Paul Mattern
Email: pmattern@tycoint.com

DESIGN: Model 4098-9750, -9751, -9752, -9753 and -9681 duct detector units. Models 4098-9752, -9753 and -9681 consist of a thermal plastic enclosure, electrical component, a listed smoke detector 4098-9714 (CSFM Listing No. 7272-0026:216) or 4098-9601 (CSFM Listing No. 7272-0026-219), a detector base and a sampling and exhaust tube. Model 4098-9601 detector head is intended for use only with Model 4098-9681 duct detector unit. Models 4098-9750 and -9751 consist of a steel box, an extension nipple, electrical components (mounted inside the box), a listed smoke detector Model 4098-9714 (CSFM Listing No. 7272-0026:216) and a detector base. Refer to listee's data sheet for additional detailed system description and operational considerations.

RATING:

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model designation, air velocity rating and UL label.

APPROVAL: Listed as a duct detector unit for use with separately listed compatible fire alarm control units. Intended for use with Models 4098-9791, -9792, -9682, -9683 or -9788 detector base. For indoor use only.

NOTE:

*Rev. 06-13-2003

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: July 01, 2010
Listing Expires: June 30, 2011

Authorized By: FRANCIS MATEO, Program Coordinator
Fire Engineering Division
**TrueAlarm® Analog Sensing**

**Features:**

TrueAlarm® analog sensing provides digital transmission of analog sensor values via MAPNET II® or IDNet™, two-wire communications**

Fire alarm control panel provides:
- Individual sensitivity selection for each sensor
- Sensitivity monitoring that satisfies NFPA 72® sensitivity testing requirements
- Peak value logging allowing accurate analysis for sensitivity selection
- Automatic, once per minute individual sensor calibration check that verifies sensor integrity
- Automatic environmental compensation
- Display of sensitivity directly in percent per foot
- Multi-stage alarm operation
- Ability to display and print detailed sensor information in plain English language

Photoelectric smoke sensors:
- Seven levels of sensitivity from 0.2% to 3.7%

Heat sensors:
- Fixed temperature sensing
- Rate-of-rise temperature sensing
- Utility temperature sensing

Ionization smoke sensors:
- Three levels of sensitivity; 0.5%, 0.9% and 1.3%

For use with Simplex®:
- 4010, 4020, 4100, 4100U, and 4120 Series control panels
- Universal Transponders and 2120 TrueAlarm® CDTs equipped for MAPNET II operation

Magnetic test feature

Functional and architecturally styled chamber enclosure:
- Louvered design enhances smoke capture by directing flow to chamber
- Entrance areas are minimally visible when ceiling mounted

Optional accessories include remote LED alarm indicator and output relays

UL listed to Standard 268

**Description**

Digital Communication of Analog Sensing.

TrueAlarm analog sensors provide an analog measurement that is digitally communicated to the host control panel using Simplex addressable communications. At the control panel, the data is analyzed and an average value is determined and stored. An alarm or other abnormal condition is determined by comparing the sensor's present value against its average value and time.

Intelligent Data Evaluation. Monitoring each sensor's average value provides a continuously shifting reference point. This software filtering process compensates for environmental factors (dust, dirt, etc.) and component aging, providing an accurate reference for evaluating new activity. With this filtering, there is a significant reduction in the probability of false or nuisance alarms caused by shifts in sensitivity, either up or down.

Control Panel Selection. Peak activity per sensor is stored to assist in evaluating specific locations. The alarm set point for each TrueAlarm sensor is determined at the host control panel, selectable as more or less sensitive as the individual application requires.

Timed/Multi-Stage Selection. Sensor alarm set points can be programmed for timed automatic sensitivity selection (such as more sensitive at night, less sensitive during day). Control panel programming can also provide multi-stage operation per sensor. For example, a 0.2% level may cause a warning to prompt investigation while a 2.5% level may initiate an alarm.

Sensor Alarm and Trouble LED Indication. Each sensor base's LED pulses to indicate communications with the panel. If the control panel determines that a sensor is in alarm, or that it is dirty or has some other type of trouble, the details are annunciated at the control panel and that sensor base's LED will be turned on steadily. During a system alarm, the control panel will control the LEDs such that an LED indicating a trouble will return to pulsing to help identify the alarmed sensors.

**TrueAlarm analog sensing are protected by one or more of the following U.S. Patents:**

5,185,468; 5,173,683; 5,400,814; 5,543,777; 5,710,548; D391,407; D396,305; D392,673.

MAPNET II and IDNet addressable communications designs are protected by U.S. Patent No. 4,789,826.

S4089-0016-9 9/2003
TrueAlarm Sensor Bases and Accessories

Sensor Base Features
Base mounted address selection:
- Address remains with its programmed location
- Accessible from front (dipswitch under sensor)
Automatic identification provides default sensitivity when substituting sensor types
- Integral red LED for power-on (pulsing), or alarm or trouble (steady on)
- Locking anti-tamper design
- Magnetically operated functional test
Mounts on standard outlet box

Sensor Bases
4098-9792, Standard sensor base
4098-9789, Sensor base with wired connections for:
- 2098-9808 Remote LED alarm indicator or 4098-9822 relay (unsupervised)
4098-9791, Sensor base with supervised relay driver output (not compatible with 2120 CDT):
- Relay operation is programmable and can be manually operated from control panel
- Use with remote mount 2098-9737 relay
- Also includes wired connections for remote LED alarm indicator or 4098-9822 relay

Sensor Base Options
2098-9737, Remote or local mount supervised relay:
- Dpdt contacts for resistive/suppressed loads, power limited rating of 3 A @ 28 VDC; non-power limited rating of 3 A @ 120 VAC (requires external 24 VDC coil power)

4098-9822, LED Annunciation Relay:
- Activates when base LED is on steadily, indicating local alarm or trouble
- Dpdt contacts for resistive/suppressed loads, power limited rating of 2 A @ 28 VDC; non-power limited rating of 1/2 A @ 120 VAC, (requires external 24 VDC coil power)
4098-9832, Adapter plate:
- Required for surface or semi-flush mounting to 4" square electrical box and for surface mounting to 4" octagonal box
- Can be used for cosmetic retrofitting to existing 6-3/8" diameter base product
2098-9808, Remote red LED Alarm Indicator:
- Mounts on single gang box (shown in illustration to right)

Description
TrueAlarm sensor bases contain integral addressable electronics that constantly monitor the status of the detachable photoelectric, ionization, or heat sensors. Each sensor's output is digitized and transmitted to the system fire alarm control panel every four seconds.

Since TrueAlarm sensors use the same base, different sensor types can be easily interchanged to meet specific location requirements. This feature also allows intentional sensor substitution during building construction. When conditions are temporarily dusty, instead of covering the smoke sensors (causing them to be disabled), heat sensors may be installed without reprogramming the control panel. Although the control panel will indicate an incorrect sensor type, the heat sensor will operate at a default sensitivity providing heat detection for building protection at that location.

Mounting Reference

Electrical Box Requirements (boxes are by others):
- Without relay: 4" octagonal or 4" square, 1-1/2" deep
- With relay: 4" octagonal or 4" square, 1-1/2" deep, with 1-1/2" extension ring

Surface Mount Reference

Flush Mount Reference, mount even with final surface, or with up to 1/4" (6.4 mm) maximum recesses

Relay Size: 2-1/2" X 1-1/2" X 1" (3.75 cubic inches)
(64 mm X 38 mm X 25.4 mm)

NOTE: Review total wire count, wire size, and accessories being wired to determine required box volume.

TrueAlarm Bases
4098-9769, 9791, & 9752
**TrueAlarm Sensors**

**Features**

- Sealed against rear air flow entry
- Interchangeable mounting
- EMI/RFI shielded electronics

**Heat sensors:**
- Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation
- Spacing distance between heat sensors:

<table>
<thead>
<tr>
<th>Fixed Temp. Setting</th>
<th>UL Spacing</th>
<th>FM Spacing, Either Fixed Temperature Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>155°F (68°C)</td>
<td>60 ft (18.3 m)</td>
<td>15 ft x 15 ft (4.6 m) fixed temperature only;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 ft x 30 ft (9.2 m) fixed temperature with rate-of-rise</td>
</tr>
</tbody>
</table>

**Smoke Sensors:**
- Photoelectric or ionization technology sensing
- 360° smoke entry for optimum response

---

**4098-9733 Heat Sensor**

TrueAlarm heat sensors are self-restoring and provide rate compensated, fixed temperature sensing, selectable with or without rate-of-rise temperature sensing. Due to its small thermal mass, the sensor accurately and quickly measures the local temperature for analysis at the fire alarm control panel.

Rate-of-rise temperature detection is selectable at the control panel for either 25°F (3.9°C) or 20°F (11.1°C) per minute. Fixed temperature sensing is independent of rate-of-rise sensing and programmable to operate at 155°F (68°C) or 155°F (68°C). In a slow developing fire, the temperature may not increase rapidly enough to operate the rate-of-rise feature. However, an alarm will be initiated when the temperature reaches its rated fixed temperature setting.

TrueAlarm heat sensors can be programmed as a utility device to monitor for temperature extremes in the range from 32°F to 155°F (0°C to 68°C). This feature can provide freeze warnings or alert to HVAC system problems. (Refer to specific panels for availability.)

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**4098-9714 Photoelectric Sensor**

TrueAlarm photoelectric sensors use a stable, pulsed infrared LED light source and a silicon photodiode receiver to provide consistent and accurate low power smoke sensing. Seven levels of sensitivity are available for each individual sensor, ranging from 0.2% to 3.7% per foot of smoke obscuration. Sensitivity is selected and monitored at the fire alarm control panel.

The sensor head design provides 360° smoke entry for optimum response to smoke from any direction. A built-in screen keeps insects from entering the smoke chamber. Due to its photoelectric operation, air velocity is not normally a factor, except for impact on area smoke flow.

---

**4098-9717 Ionization Sensor**

TrueAlarm ionization sensors use a single radioactive source with an outer sampling ionization chamber and an inner reference ionization chamber to provide stable operation under fluctuations in environmental conditions such as temperature and humidity. Smoke and invisible combustion gases can freely penetrate the outer chamber. With both chambers ionized by a small radioactive source (Am-241 (Americium)), a very small current flows in the circuit. The presence of particles of combustion will cause a change in the voltage ratio between chambers. This difference is measured by the electronics in the sensor base and digitally transmitted back to the control panel for processing.

Three levels of sensitivity are available for each ionization sensor: 0.5, 0.9, and 1.3% per foot of smoke obscuration.

---

**Application Reference**

Sensor locations should be determined only after careful consideration of the physical layout and contents of the area to be protected. Refer to NFPA 72, the National Fire Alarm Code®. On smooth ceilings, smoke sensor spacing of 30 ft (9.1 m) may be used as a guide. For detailed application information, refer to 4098 Detectors, Sensors, and Bases Application Manual (ST4-705).
## TrueAlarm Analog Sensing Product Selection Chart

### TrueAlarm Sensor Bases

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Compatibility</th>
<th>Mounting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9792 (C)</td>
<td>Standard Sensor Base, no options</td>
<td>Sensors 4098-9714, -9733, &amp; -9717</td>
<td>4&quot; octagonal or 4&quot; square box, 1-1/2&quot; min. depth; or single gang box, 2&quot; min. depth</td>
</tr>
<tr>
<td>4098-9789 (C)</td>
<td>Sensor Base with connections for Remote LED Alarm Indicator or Unsupervised Relay</td>
<td>Sensors 4098-9714, -9733, &amp; -9717</td>
<td>4&quot; octagonal or 4&quot; square box</td>
</tr>
<tr>
<td>4098-9791 (C)</td>
<td>Sensor Base with connections for Supervised Remote Relay and connections for Remote Alarm Indicator or Unsupervised Relay</td>
<td>2096-9808 remote LED alarm indicator or 4098-9822 relay</td>
<td>Note: Box depth requirements depend on total wire count and wire size; refer to accessories list below for reference.</td>
</tr>
</tbody>
</table>

### TrueAlarm Sensors

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Compatibility</th>
<th>Mounting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4098-9714 (C)</td>
<td>Photocell Smoke Sensor</td>
<td>Bases 4098-9792, 4098-9789, and 4098-9791</td>
<td>Refer to base requirements</td>
</tr>
<tr>
<td>4098-9717 (C)</td>
<td>Ionization Smoke Sensor</td>
<td>Bases 4098-9792, 4098-9789, and 4098-9791</td>
<td>Refer to base requirements</td>
</tr>
<tr>
<td>4098-9733 (C)</td>
<td>Heat Sensor</td>
<td>Bases 4098-9792, 4098-9789, and 4098-9791</td>
<td>Refer to base requirements</td>
</tr>
</tbody>
</table>

### TrueAlarm Sensor/Base Accessories

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Compatibility</th>
<th>Mounting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2096-9737</td>
<td>Supervised Relay, mounts remote or in base electrical box</td>
<td>Bases 4098-9789 and 4098-9791</td>
<td>Remote Mounting requires 4&quot; octagonal or 4&quot; square box, 1-1/2&quot; minimum depth or 2-1/8&quot; deep with 1-1/2&quot; extension ring</td>
</tr>
<tr>
<td>2096-9808</td>
<td>Remote Red LED Alarm Indicator on single gang stainless steel plate</td>
<td>Bases 4098-9789 and 4098-9791</td>
<td>Single gang box, 1-1/2&quot; minimum depth</td>
</tr>
<tr>
<td>4098-9822 (C)</td>
<td>Relay, tracks base LED status (unsupervised, mounts only in base electrical box)</td>
<td>Bases 4098-9792, -9789, &amp; -9791</td>
<td>4&quot; octagonal box, 2-1/8&quot; deep with 1-1/2&quot; extension ring</td>
</tr>
<tr>
<td>4098-9832</td>
<td>Adapter Plate</td>
<td>Bases 4098-9792, -9789, &amp; -9791</td>
<td>Required for surface or semi-flush mounted 4&quot; square box and for surfaces mounted 4&quot; octagonal box</td>
</tr>
</tbody>
</table>

*Refer to data sheet S4098-0028 for Scour By Cable Information. Refer to Installation Instructions 574-707 and Application Manual 574-709 for additional information. ULC listed model numbers are designated by (C) and require a "C" suffix such as 4098-9792C.*

### Specifications

**General Operational Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications and Sensor Supervisory Power</td>
<td>MAPNET II or IDNel, auto-select, 24-40 VDC w/data, 400 μA typical, 1 address per base</td>
</tr>
<tr>
<td>Communications Connections</td>
<td>Screw terminals for in/out wiring, 18 to 14 AWG (0.82 mm² to 2.06 mm²)</td>
</tr>
<tr>
<td>Remote LED Alarm Indicator Current</td>
<td>1 mA typical, no impact to alarm current</td>
</tr>
<tr>
<td>Remote LED Alarm Indicator and Relay Connections</td>
<td>Color coded wire leads, 18 AWG (0.82 mm²)</td>
</tr>
<tr>
<td>UL Listed Temperature Range</td>
<td>32° to 100° F (0° to 38° C)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>32° to 122° F (0° to 50° C)</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>10 to 99% RH</td>
</tr>
<tr>
<td>Smoke Sensor</td>
<td>4098-9714, Photocell Sensor</td>
</tr>
<tr>
<td>Smoke Ambient Rate</td>
<td>Air velocity = 0-2000 ft/min (0-610 m/min)</td>
</tr>
<tr>
<td>Smoke Housing Color</td>
<td>Frost White</td>
</tr>
<tr>
<td>4098-9791 Base, Supervised Relay, 2096-9808, 4098-9822</td>
<td>18-32 VDC (nominal 24 VDC)</td>
</tr>
<tr>
<td>Externally Supplied Relay Coil Voltage</td>
<td>16-24 VDC (nominal 24 VDC)</td>
</tr>
<tr>
<td>Supervisory Current</td>
<td>13 mA from separate 24 VDC supply</td>
</tr>
<tr>
<td>Alarm Current</td>
<td>270 μA, from 24 VDC supply</td>
</tr>
<tr>
<td>Alarm Current</td>
<td>270 μA, from 24 VDC supply</td>
</tr>
</tbody>
</table>

Tyco, Simplex, the Simplex logo, TrueAlarm, MAPNETII and IDNel are trademarks of Tyco International Services AG or its affiliates in the U.S. and/or other countries. NFPA 72 and National Fire Alarm Code are registered trademarks of the National Fire Protection Association (NFPA).
LISTING No. 7272-0026:0218

CATEGORY: 7272 – PHOTOELECTRIC SMOKE DETECTOR

LISTEE: Simplex, 100 Simplex Drive, Westminster, MA 01441-0001
Contact: Paul Mattef
Email: pmattec@tycoinc.com


Models 4098-9714, -9714TSP and -9714TTP are listed for use with Models 4098-9750, -9751, -9752 and -9753 duct detector units (CSFM Listing No. 3240-0026:220) and Models 4098-9755, -9755TSP and -9755TTP duct detector units (CSFM Listing No. 3240-0026:241).

Models 4098-9754, -9754TSP, -9754TTP: *GSA4098-9754 analog photoelectric type smoke detectors employ an integral supplemental heat sensor (1350 F fixed temperature and 1200 F rate of rise). This heat sensor is intended for use as a supplemental device to the smoke detector and is not intended for use in lieu of required heat detectors.

Refer to listee's printed data sheet for additional detailed product description and operational considerations.

RATING:

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction. Model 4088-9714 with Model 4098-9751 is suitable for installations inside air ducts with air velocities between 0-2000 fpm.

MARKING: Listee's name, model number, electrical rating, and UL label.

APPROVAL: Listed as photoelectric smoke detectors for use with listee's separately listed Models 4100, 4010, 4020, 4120 and *4008 series fire alarm control units. Refer to listee's Installation Instruction Manual for details.

NOTE:

*Rev. 03-03-2005

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: July 01, 2010
Listing Expires: June 30, 2011

Authorized By: FRANCIS MATEO, Program Coordinator
Fire Engineering Division
Features

IDNet addressable interface modules** for use with Simplex® models 4010 and 4100U fire alarm control panels.

4090-9002, Individual Addressable Relay Module (Relay IAM):
- A single addressable point provides control and status tracking of a Form “C” contact
- Low power latching relay design allows IDNet communications to supply both data and module power

Compact, sealed construction:
- Enclosed design minimizes dust infiltration
- Mounts in standard 4” square electrical box
- Screw terminals for wiring connections
- Visible LED flashes to indicate communications
- Optional covers are available to allow LED to be viewed after installation

UL listed to Standard 864

Description

IDNet Relay IAMs allow fire alarm control panels to control a remotely located Form “C” contact using IDNet addressable communications for both data and module power. Typical applications would be for switching local power for control functions such as elevator capture, or control of HVAC components, pressurization fans, dampers, etc. Relay status is also communicated requiring only one device address.

Product Selection

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4090-9002</td>
<td>Relay IAM</td>
</tr>
</tbody>
</table>

Optional Trim Plates

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4090-9801</td>
<td>Trim plate with LED viewing window, includes mounting screws; galvanized steel For semi-flush mounted box</td>
</tr>
<tr>
<td>4090-9802</td>
<td>For surface mounted box</td>
</tr>
</tbody>
</table>

Specifications

(Refer to Installation Instructions 574-184 for additional information.)

<table>
<thead>
<tr>
<th>Communications</th>
<th>4010 or 4100U IDNet, 1 address per device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay IAM Power</td>
<td>Supplied by IDNet communications</td>
</tr>
<tr>
<td>Type</td>
<td>Form C, SPDT</td>
</tr>
<tr>
<td>Contact Ratings</td>
<td></td>
</tr>
<tr>
<td>Power-Limited</td>
<td>2 A @ 24 VDC, for transient suppressed loads</td>
</tr>
<tr>
<td>Nonpower-Limited</td>
<td>1 A @ 24 VDC for inductive loads</td>
</tr>
<tr>
<td>Nonpower-Limited</td>
<td>1/2 A @ 120 VAC, for transient suppressed loads</td>
</tr>
<tr>
<td>Wire Connections</td>
<td>Screw terminals for input wiring, 18 to 14 AWG wire (0.02 to 2.06 mm²)</td>
</tr>
<tr>
<td>IDNet Wiring Reference</td>
<td>Up to 10,000 ft (3048 m) total wiring distance (including T-Taps)</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Compatible with Simplex 2081-0044 \n</td>
</tr>
<tr>
<td>Dimensions</td>
<td>4-1/8” H x 4-1/8” W x 1-3/8” D \n</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Black thermoplastic</td>
</tr>
<tr>
<td>Mounting Plate Material</td>
<td>Sheet metal, galvanized</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>32° to 120° F (0° to 45° C) \n</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>Up to 95% RH at 100° F (38° C)</td>
</tr>
</tbody>
</table>

* This product has been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7200-0026:223 for all allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use – City of New York Department of Buildings – MEA636-63E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Safety Products West kneeler.

** IDNet addressable communications are protected by U.S. Patent No. 4,785,025.
Relay IAM Mounting Information

Address setting under resealable label

4" (102 mm) square box, 2-1/8" (54 mm) minimum depth, RACO 232 or equal (supplied by others)

Double gang blank cover plate and mounting screws, for use when LED is not required to be externally viewed (supplied by others)

Mounting Reference, Double Gang Blank Cover Plate

4-9/16" (116 mm)
4-5/16" (109 mm)

4090-9801, Trim plate for semi-flush mounted box

4090-9802, Trim plate for surface mounted box

Optional Trim Plates for Visible LED

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Tyco Safety Products Westminster • Westminster, MA • 01441-0001 • USA
www.tycoesafetyproducts-usa-wm.com
© 2004 Tyco Safety Products Westminster. All rights reserved. All specifications and other information shown were current as of document revision date and are subject to change without notice.
The PAM Series Relays are encapsulated multi-voltage devices with "flying" leads that offer versatile, reliable performance in a convenient package. Several of the versions contain a red LED which indicates when the relay coil is energized. The PAM Series Relays are packaged with a self-tapping screw and a piece of double sided tape for easy installation almost anywhere. The relays are also packaged with wire-nuts to aid installation.

PAM Relays are ideal for applications where remote relays are required for control or status feedback. They are suitable for use with HVAC, Temperature Control, Fire Alarm, Security, Energy Management, Lighting Control Systems and Building Automation Systems.

**PRODUCT DESCRIPTION**

**PAM-1**
The PAM-1 Relay provides 10.0 A form "C" contacts. The relay may be energized by one of three input voltages: 24VDC, 24VAC, or 120VAC. The input voltages are polarity-sensitive and diode-protected. PAM-1 Relays contain a red LED which indicates when the relay coil is energized.

**PAM-2**
The PAM-2 Relay provides 7.0 A form "C" contacts. The relay may be energized by one of two input voltages: 12VDC or 24VDC. The input voltages are polarity-sensitive and diode-protected. PAM-2 Relays contain a red LED which indicates when the relay coil is energized.

**PAM-4**
The PAM-4 Relay provides 10.0 A form "C" contacts. The relay may be energized across a wide voltage range from 9VDC to 40VDC, making it ideal for 12VDC and 24VDC EOL circuits. The 15mV operating current is constant across the operating range. The input voltages are polarity-sensitive and diode-protected.

**PAM-SD**
The PAM-SD Relay provides 7.0 A form "C" contacts. The relay may be energized by an input voltage between 20VDC to 32VDC, making it ideal for 24VDC NAC circuits. The input voltages are polarity-sensitive and diode-protected. The PAM-SD provides an additional set of wires for redundant input voltage (circuit supervision pass through).

Air Products and Controls Inc.
1749 E. Highwood
Pontiac, MI 48340
(248) 332-3900 Phone
(888) 332-2241 Toll free
(248) 332-8807 Fax
www.ap-c.com

Distributed By:
### PRODUCT SPECIFICATIONS

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>PAM-1</th>
<th>PAM-2</th>
<th>PAM-4</th>
<th>PAM-SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>COIL VOLTAGE</td>
<td>24VAC/24VDC/120VAC</td>
<td>12VDC/24VDC</td>
<td>9 to 40VDC</td>
<td>20 to 32VDC</td>
</tr>
<tr>
<td>POLARIZED</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ENERGIZED LED INDICATOR</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CURRENT REQUIREMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@12VDC</td>
<td>15mA</td>
<td>15mA</td>
<td>15mA</td>
<td>15mA</td>
</tr>
<tr>
<td>@24VDC</td>
<td>50mA</td>
<td>15mA</td>
<td>15mA</td>
<td>15mA</td>
</tr>
<tr>
<td>@120VAC</td>
<td>30mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTACT CONFIGURATION</td>
<td>(1) SPDT dry form &quot;C&quot;</td>
<td>(1) SPDT dry form &quot;C&quot;</td>
<td>(1) SPDT dry form &quot;C&quot;</td>
<td>(1) SPDT dry form &quot;C&quot;</td>
</tr>
<tr>
<td>CONTACT RATINGS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(contact rating/ power factor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@5VDC</td>
<td>250μA / .35 PF</td>
<td>250μA / .35 PF</td>
<td>250μA</td>
<td>250μA / .35 PF</td>
</tr>
<tr>
<td>@24VDC</td>
<td>7A / .35 PF</td>
<td>7A / .35 PF</td>
<td>7A</td>
<td>7A / .35 PF</td>
</tr>
<tr>
<td>@120VAC</td>
<td>10A</td>
<td>7A / .35 PF</td>
<td>10A</td>
<td>7A / .35 PF</td>
</tr>
<tr>
<td>WIRE LEADS</td>
<td>6 &quot;flying&quot; leads</td>
<td>5 &quot;flying&quot; leads</td>
<td>7 &quot;flying&quot; leads</td>
<td>7 &quot;flying&quot; leads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMBIENT TEMPERATURE</td>
<td>32°F to 120°F</td>
<td>32°F to 120°F</td>
<td>32°F to 120°F</td>
<td>32°F to 120°F</td>
</tr>
<tr>
<td>(@ 100% RH, condensing)</td>
<td>(0°C to 49°C)</td>
<td>(0°C to 49°C)</td>
<td>(0°C to 49°C)</td>
<td>(0°C to 49°C)</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td>100% potting (sealed) with &quot;flying&quot; leads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOUNTING</td>
<td>Pre-drilled mounting screw holes and self tapping screw provided. Double sided tape provided.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>1.50&quot; (38mm)</td>
<td>1.50&quot; (38mm)</td>
<td>1.50&quot; (38mm)</td>
<td>1.50&quot; (38mm)</td>
</tr>
<tr>
<td>W</td>
<td>1.20&quot; (25mm)</td>
<td>1.00&quot; (25mm)</td>
<td>1.00&quot; (25mm)</td>
<td>1.00&quot; (25mm)</td>
</tr>
<tr>
<td>D</td>
<td>0.90&quot; (23mm)</td>
<td>0.90&quot; (23mm)</td>
<td>0.80&quot; (20mm)</td>
<td>0.80&quot; (20mm)</td>
</tr>
<tr>
<td>LISTINGS AND APPROVALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UL:</td>
<td>U0XX7.3S403</td>
<td>U0XX7.3S403</td>
<td>U0XX7.3S403</td>
<td>U0XX7.3S403</td>
</tr>
</tbody>
</table>

*UOXX=Control Unit Accessories, System; 7=also Certified for Canada

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**NOTICE:** The information contained in this document is intended only as a summary and is subject to change without notice. The products described have specific instructional/installation documentation, which covers various technical, approval, code, limitation and liability information. Copies of this documentation along with any general product warning and limitation documents, which also contain important information, are provided with the product and are also available from Air Products and Controls Inc. The information contained in all of these documents should be considered before specifying or using the products. Any example applications shown are subject to the most current enforced local codes, standards, approvals, certifications, and/or the authority having jurisdiction. All of these references, as well as the specific manufacturer of any shown or mentioned related equipment, should be consulted prior to any implementation. For further information or assistance concerning the products, contact Air Products and Controls Inc. Air Products and Controls Inc. reserves the right to change any and all documentation without notice.

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LISTING No. 7300-0026:0223
CATEGORY: 7300 – MISC. DEVICE/CONTROL UNIT ACCESSORIES
LISTEE: Simplex, 100 Simplex Drive, Westminster, MA 01441-0001
        Contact: Paul Mattern
        Email: pmattern@tycoint.com
DESIGN: Models* 4090-9001, -9001TSP, -9001TT, and -9051 Supervised IAM Monitor Module;
        4090-9002, -9002TSP, and -9002TT IAM Relay Module; 4090-9101, -9101TSP, and -9101TT
        Class "A" ZAM Initiating Module; 4090-9101, -9101TSP, and -9101TT
        Class "B" ZAM Initiating Module; and 2190-9173 Two-Point I/O Module. Refer to listee’s
data sheet for additional detailed product description and operational considerations.
RATING: 24 VDC
        30 VDC for Models 4090-9002 series
INSTALLATION: In accordance with listee’s printed installation instructions, applicable codes and ordinances
        and in a manner acceptable to the authority having jurisdiction.
MARKING: Listee’s name, model number, electrical rating, and UL label.
APPROVAL: Listed as control unit accessories for use with separately listed compatible fire alarm
        control units. For indoor use only. Refer to listee’s Installation Instruction Manual for details.
NOTE:

*Receiv. 03-29-2005 Jw

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed
the test results and/or other data but does not make an independent verification of any claims. This listing is not an
endorsement or recommendation of the item listed. This listing should not be used to verify correct operational
requirements or installation criteria. Refer to listee’s data sheet, Installation Instructions and/or other suitable
information sources.

Date Issued: July 01, 2010
Listing Expires: June 30, 2011

Authorized By: FRANCIS MATEO, Program Coordinator

Fire Engineering Division
LISTING SERVICE

LISTING No. 7300-1004:0101
CATEGORY: 7300 – MISC. DEVICE/CONTROL UNIT ACCESSORIES
LISTEE: AIR PRODUCTS AND CONTROLS INC, 1749 E HIGHWOOD, PONTIAC, MI 48340
Contact: Richard Steele (248) 332-3900 Fax (248) 332-8807
Email: rsteele@ap-c.com


RATING: In accordance with listee’s printed installation instruction, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

INSTALLATION: Listee’s name, electrical rating and UL label.

APPROVAL: Listed as relay modules for use with separately listed compatible fire alarm control units. Refer to manufacturer’s Installation Manual for details.

NOTE:

*Rev. 03-01-2006 jw

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee’s data sheet, Installation instructions and/or other suitable information sources.

Date Issued: July 01, 2010
Listing Expires: June 30, 2011
Authorized By: FRANCIS MATEO, Program Coordinator
Fire Engineering Division
SECTION 16630 - CLOCK SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this division, including but not limited to:
1. Indicating clocks connected to existing system

B. Related Work: Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 SYSTEM DESCRIPTION

A. Provide indicating clocks and all associated conduit, wire, boxes, supports, etc.

B. Prior to start of work coordinate and verify with Simplex that system has capacity for additional clocks. Provide signal boosters if required.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and rating indicating compliance with all listed standards.
2. Describe system operation, equipment, dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Shop Drawings:
   a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
   b. Point-to-point wiring diagram in block or riser format showing all clock components, conduit and wire types and sizes with cable legend.
   c. Provide available clock hand and dial styles for selection by Architect.
5. Submit manufacturer's installation instructions.
6. Complete bill of material listing all components.
7. Warranty.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance
3. Pictorial parts list and parts numbers
4. Schematic drawings of wiring system, including all clocks, boosters/power supplies, and master controller
5. Telephone numbers for the authorized parts and service distributors
6. Final testing reports

1.5 QUALITY ASSURANCE
A. All materials, equipment, and parts comprising the units specified herein shall be new, unused, and of current manufacturer.
B. Only products and applications listed in this section may be used on the project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING
A. Delivery: Clock system components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to owner.
B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and truffle. Provide heat where required to prevent condensation.
C. Handling: Handle in accordance with manufacturer’s written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Products shall match existing system; verify in field prior to submittal. Simplex
B. Substitutions: None allowed

2.2 CLOCKS
A. Clocks shall be Simplex.
1. 6334-9125, 2.5 inch, red LED, 120 volts
2. 6334-9802 gang box adapter
3. 6334-9803 adapter harness, 120 VAC
4. Provide signal booster if required.
2.3 DIGITAL INDICATING CLOCKS

A. Direct read digital indicating clock with 2 inch high numerical liquid crystal display.

B. Clocks shall operate at 120 VAC.

C. Clocks shall be capable of synchronization via master clock controller.

D. Furnish flush back box for semi-flush mounting of clock.

E. Provide 4 hours of battery backup for clock memory and time setting switch to reset time after extended power failure.

F. Submit options of color combination to architect for selection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine site conditions for acceptance of clock system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install clock system in accordance with manufacturer’s written instructions, as shown on the drawings and specified herein.

B. Coordinate final clock locations with the architect prior to rough-in.

C. For wiring requirements refer to Section 16123: Building Wire and Cable.

D. Do not permit final installation of clocks until building is secured and any work that could damage clocks is completed.

E. All wiring shall be installed in a continuous steel conduit system and shall be sized as recommended by equipment supplier. Refer to Section 16139: Signal Systems Raceways.

3.3 FIELD QUALITY CONTROL

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Manufacturers Field Service: Electrical contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the clock system.
C. At least three weeks prior to any testing, notify the architect so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the engineer's witnessed test.

D. Prefunctional Testing:
   1. Visual and Mechanical Inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with manufacturer's instructions.
      c. Check tightness of all control and power connections.
      d. Compare nameplate information and connections to contract documents.
      e. Check that all covers, barriers, and doors are secure.
   2. Electrical Tests:
      a. Test system master clock controller, clock booster panels, clacks and system wiring to verify proper operation and correction of the entire clock system.
   3. Test Report:
      a. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
      b. Submit two typed copies of the test report on 8-1/2 x 11 inch paper in a neatly bound folder for approval. Failure to comply with this will result in a delay of final testing and acceptance.

E. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the engineer’s hourly rate.

F. Contractor shall replace at no cost to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the testing agency's final report for review prior to project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.4 CLEANING

A. Upon completion of project prior to final acceptance, the contractor shall thoroughly clean all clock surfaces. Remove paint splatters and other sport, dirt, and debris.

3.5 TRAINING

A. Refer to Specification Section 16080: Electrical Commissioning.

B. Factory authorized service representative shall conduct a 2-hour training seminar for Owner Representatives upon completion and acceptance of the system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.
C. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION
SECTION 16700 – TELECOMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for Sections numbering 167xx, and is intended to supplement, not supersede, the requirements of Division 1 and General Conditions.

B. Related Items
   1. General: Consult other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.
   2. Section 16710 - Telecommunications Horizontal Cabling
   3. Section 16719 - Telecommunications Testing
   4. General and Supplementary Conditions: Drawings and general provisions of Contract and Division 1 of the Specifications, apply to 167xx series Sections.

1.2 REFERENCES

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
   5. Uniform Mechanical Code (UMC).
   6. National, State, Local and other binding building and fire codes.
   7. FCC Regulations:
      b. Part 68 – Connection of Terminal Equipment to the Telephone Network

C. Standards: Equipment and materials furnished under this Section shall conform to the following standards where applicable:
      a. Part 1: General Requirements
      b. Part 2: Balanced Twisted-Pair Cabling Components
      c. Part 2, Addendum 1: Transmission Performance Specifications For 4-Pair 100 Ohm Category 6 Cable
      d. Part 3: Optical Fiber Cabling Components Standard
   3. ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces, including the following addenda:
      a. TIA/EIA-569-A-1 Surface Raceways
b. TIA/EIA-569-A-2 Furniture Pathways and Spaces
 c. TIA/EIA-569-A-3 Access Floors
 d. TIA/EIA-569-A-4 Poke-Thru Fittings
 e. TIA/EIA-569-A-6 Multi-Tenant Pathways and Spaces
 f. TIA/EIA-569-A-7 Cable Trays and Wirelines

5. ANSI/IEEE-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   a. TIA/EIA-758-1 Addendum No. 1
7. EIA testing standards.
8. ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems
9. ANSI/ICEA S-83-596-1994 Fiber Optic Premises Distribution Cable
10. ANSI/ICEA S-87-640-1999 Fiber Optic Outside Plant Communications Cable
11. ANSI/ICEA S-90-661-2002 Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems
12. ICEA S-104-696-2001 Standard For Indoor-Outdoor Optical Cable

D. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

E. Make a copy of each document readily available during the course of construction for reference by field personnel.

1.3 DEFINITIONS
A. The Definitions of Division 1 shall apply to the 167xx sections.

B. In addition to those Definitions of Division 1, the following list of terms as used in this specification shall be defined as follows and shall apply to the 167xx sections:
   2. “Connect”: To install required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
   3. “Cabling”: A system comprised of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].
   4. “Identifier”: A unique code assigned to an element of the communications infrastructure that links it to its corresponding record.

1.4 SYSTEM DESCRIPTION
A. In circumstances where the Specifications and Drawings conflict, the Drawings shall govern quantity and the Specifications shall govern quality.

1.5 SUBMITTALS
A. General:
   1. Issue required submittals in accordance with Conditions of the Contract, and Division 1 Submittal Procedures Section.
2. Obtain Engineer’s approval of submittals prior to the release of materials and equipment purchase order and prior to installation.

B. Product Data
   1. Format:
      a. Minimum Format: Provide each product data submittal in an 8-1/2 x 11 inch folder. Preferred Format: Provide each product data submittal in a 3-ring binder with front cover and spine clear pockets for insertion of the submittal information.
      b. Clearly label the cover and the spine of each submittal with the following information:
         1) Client Name.
         2) Project Name and Address.
         3) Project Submittal Number.
         4) Submittal Name (e.g., “Product Data Submittal For Telecommunications Equipment Rooms”).
         5) Specification Section Number (e.g., “Section 16705”).
         6) Date of Submittal. Format: <month> <day>, <year> (e.g., “January 1, 2010”).
         7) Contractor Name.
      c. Include a Table Of Contents at the beginning of the submittal that lists materials by article and paragraph number (e.g., “2.02-A Equipment Racks”).
      d. Include tabbed separators for improved navigation through the submittal.
   2. Content:
      a. Cover Letter: Product data submittals shall include a cover letter stating that the submittal is in full compliance with the requirements of the Contract Documents. Cover letter shall list all the items and data submitted, and shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
      b. Product Information: Product Data submittal shall consist of manufacturer’s technical data, product literature, “catalog cuts”, data sheets, specifications, and block wiring diagrams (if necessary). This data shall clearly describe the product’s characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded. At a minimum, include products listed in the specifications numbering 167xx. Also include relevant products that will be installed, which are not listed in the specifications.
      c. Seismic Calculations: If required, include in the product data submittal the manufacturer’s anchorage calculations for floor mounted fully loaded equipment racks/frames/cabinets such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 “Earthquake Regulations” of the “Uniform Building Code” for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer registered in the State of California shall prepare calculations and shall wet stamp and sign them. Forward calculations to the City of Berkeley for review and approval.
      d. Resubmittals: Resubmittals shall include a cover letter that lists the action taken and revisions made to each product submittal in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

C. Submittal Description: Shop Drawings
   1. Format:
      a. Prepare shop drawings using AutoCAD Release 14 or later.
      b. Use the same size drawing sheet as the drawings of the Contract Documents, and use the project title block.
      c. Text: minimum of 3/32" high when plotted at full size.
      d. Use identical symbols as those in the drawings.
e. Screen background information.
f. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.
g. Label each sheet in the shop drawings set with the Specification Section Number (e.g., "16710").
h. Scaling:
   1) Scale floor plans at 1/8"=1'-0".
   2) Scale enlarged room plans at 1/4"=1'-0".
   3) Scale wall elevations at 1/2"=1'-0".
   4) Scale rack elevations at 1"=1'-0".

2. Content:
a. Submit detailed shop drawings if the proposed installation differs from the Contract Documents or the design intent.
b. Cover Letter: Accompany each shop drawing submittal with a cover letter stating that the shop drawings have been thoroughly reviewed by the Contractor and are in full compliance with the requirements of the Contract Documents. Cover letters shall include a drawing index, and shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
c. Drawing Information: Shop drawing submittals shall consist of floor plans, enlarged room plans, wall and rack elevations, installation details, and other aspects of the system that differ from the Contract Documents or the design intent. Use the same scales as the Drawings (e.g., 1/4" = 1'-0" for enlarged room plans).
d. Seismic Calculations: As part of the shop drawings submittal, the manufacturer shall provide anchorage calculations for floor mounted fully loaded distribution frames such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer registered in the State of California shall prepare Structural Calculations, and shall wet stamp and sign them. Forward calculations to the City of Berkeley for review and approval.
e. Resubmittals: Accompany resubmittals with a cover letter that lists the revisions made to each drawing in response to Submittal Review Comments. Resubmittals will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

D. Submittal Description: Record Drawings

1. Quantity & Media:
a. Furnish four full-size sets of drawings on bond or “eco-bond” medium.
b. Furnish one full-size set of record drawings on reproducible media (e.g., vellum).
c. Furnish one CD-ROM of drawing electronic files.

2. Format:
a. Prepare record drawings using AutoCAD Release 14 or later.
b. Use the same size drawing sheet as the drawings of the Contract Documents, and use the project title block.
c. Text: minimum of 3/32" high when plotted at full size.
d. Use symbols identical to the symbols shown on the Drawings.
e. Screen background information.
f. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.

3. Content:
a. Record Drawings shall fully represent actual installed conditions and shall incorporate revisions made during the course of construction.
b. Floor plans shall show:
   1) Locations and identifiers of outlets.
2) Size, quantity, location, and routes of pathways (such as cable trays, conduits, J- 
hangers, and other cable support devices).
c. Enlarged room floor plans scaled at 1/2"=1'-0" showing exact placement of equipment 
cabinets/frames, rack bays, and other equipment. Enlarged room overhead plans scaled at 
1/2"=1'-0" showing exact placement of overhead cable support devices (e.g., cable tray, 
cable runway, conduit sleeves, etc.).
d. Wall elevations scaled at 1"=1'-0" showing exact placement of termination hardware (e.g., 
termination/crossconnect blocks).
e. Installation details.

E. Submittal Description: Operation and Maintenance (O & M) Manuals
1. Format:
a. Furnish each O & M Manual in a white, 3-ring binder with front cover and spine clear 
pockets for insertion of the project information.
b. Clearly label the cover of each O & M Manual with the following information:
   1) Client Name.
   2) Project Name and Address.
   3) Manual Name (e.g., “Operation And Maintenance Manual for Communications 
       Cabling System”).
   4) Date of Submittal. Format: <month> <day>, <year> (e.g., “January 1, 2000”).
   5) Contractor Name.
c. Include a Table Of Contents at the beginning that lists the contents.
d. Include tabbed separators for improved navigation through the manual.
2. Content:
a. 11"x17" prints of As-Built Drawings, as described above.
b. Manufacturer's original catalog information sheets for each component provided under 
   applicable Section.
c. Warranty certificate from the manufacturer and the Contractor.
d. Manufacturer’s instructions for system or component use.
e. Instructions for maintenance and warranty issues.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications
1. Five continuous years, minimum, design and manufacture of the materials and equipment 
specified herein.
2. Manufacturer(s) of products and equipment specified herein shall demonstrate that they have a 
quality assurance program in place to assure that the specifications are met. The program shall 
include, as a minimum, provisions for:
a. Incoming inspection of raw materials
b. In-process inspection and final inspection of the cable product
c. Calibration procedures of test equipment to be used in the qualifications of the product
d. Recall procedures in the event that out of calibration equipment is identified.
3. Conformance to certain government standards on quality assurance may be required for some 
applications within these specifications.

B. Contractor Qualifications
1. A current, active, and valid and C7 or C10 California State Contractors License.
2. Five continuous years, minimum, experience
3. Five, minimum, completed projects similar to scope and cost.
4. Evidence of technicians qualified for the work.
5. A Panduit Certified Installer (PCI), Belden Registered Installation Contractor (BRIC), and 
capable of providing an extended warranty for an Integrity Cabling Solution. Provide satisfactory 
evidence of certification in the form or a current letter or certificate from the manufacturer as part 
of the bid submission.
C. Materials
   1. Provide new materials and equipment without defects.
   2. Furnish only specified products and equipment, or products and equipment that have been approved in writing.

D. Regulatory Requirements
   1. Work and materials shall conform to the latest rules of National Board of Fire Underwriters wherever such standards have been established and shall conform to the regulations of the State Fire Marshal, OSHA and the codes of the governing local municipalities. Nothing in these specifications is to be construed to permit work not conforming to the most stringent of the applicable codes.
   2. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
   3. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this series of Sections, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Drawings and Specifications. The Contract Documents address the minimum requirements for construction.

E. Project Management And Coordination Services
   1. Provide a project manager for the duration of the project to coordinate this Work with other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.
   2. Review of Shop Drawings Prepared by Other Subcontractors:
      a. Obtain copies of shop drawings for equipment provided by others that require telecommunication service connections or interface with Division 16 work.
      b. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 16 contract documents. Document discrepancies or deviations as follows:
         c. Prepare memo summarizing the discrepancy.
         d. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
         e. Prepare and maintain a shop drawing review log indicating the following information:
            1) Shop drawing number and brief description of the system/material.
            2) Date of your review.
            3) Indication if follow-up coordination is required.

F. Drawings
   1. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.
   2. Accuracy: Drawings for the Work within this Division are essentially diagrammatic within the constraints of the symbology applied.
   3. The Drawings do not fully represent the entire installation for the Telecommunications Cabling System. Drawings indicate the general route for the cables and the location of outlets. Conduits, sleeves, hangers, etc. – for the most part – are not shown.
   4. Complete the details necessary for point-to-point design. This allows the Contractor to achieve desired results applying their own procedures and methods. Submit shop drawings for review prior to installation.

G. Role of the Engineer
   1. During the construction phase of the project, the Engineer will work with the Contractor to provide interpretation and clarification of project contract documents, reply to (and ‘process’) relevant Requests for Information (RFIs), and act as an interface between the Contractor and the Owner.
   2. The Owner has retained the Engineer’s services to observe the Work for general compliance with the Contract Documents and to ensure that the installation meets the design intent of the system.
3. In summary, the Engineer will perform the following specific services during the construction phase:
   a. Review product submittals and shop drawings for general compliance with the contract drawings and specifications.
   b. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
   c. Interpret field problems for Owner, and translate into understandable language.
   d. Review the testing procedures to confirm compliance with industry-accepted practices.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery
   1. Do not deliver products to the site until protected storage space is available.
   2. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
   3. Deliver materials in manufacturer's original, unopened, undamaged packaging and containers with identification labels (name of the manufacturer, product name and number, type, grade, UL classification, etc.) intact.
   4. Replace equipment damaged during shipping at no cost to the Owner.

C. Storage and Protection
   1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
   2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
   3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
   4. Storage outdoors covered by waterproof material is not acceptable.
   5. Provide heat where required to prevent condensation or temperature related damage.

D. Handling
   1. Handle in accordance with manufacturer's written instructions.
   2. Damaged equipment shall not be installed.
   3. Replace damaged equipment at no cost to the Owner.
   4. Handle with care to prevent internal component damage, breakage, denting, and scoring.

1.8 SCHEDULING

A. Unless otherwise specified, the construction schedules of the 167xx series Sections may be combined.

B. Obtain approval from General Contractor for telecommunications cabling work prior to mobilization.

1.9 WARRANTY

A. Service must be rendered within 24 hours of system failure notification. Note deviations or improvements to this service at the time of bid.
B. Provide a 25-year manufacturer's warranty for the fiber optic and twisted pair cabling systems from the date of acceptance.

C. Manufacturers of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department or stocking distributor shall be located close enough to the job site area to supply replacement parts within a 24-hour period.

D. Warrant installed hardware, under normal use and service, to be free from defects and faulty workmanship during the warranty period. Keep the system in operating condition at no additional material or labor costs to the Owner during the warranty period.

E. The manufacturers shall demonstrate that a quality assurance program is in place to assure that the specifications are met. The program shall include, as a minimum, provisions for:
   1. Incoming inspection of raw materials
   2. In-process inspection and final inspection of the product
   3. Calibration procedures of test equipment to be used in the qualifications of the product
   4. Recall procedures in the event that out of calibration equipment is identified.

F. Conformance to certain government standards on quality assurance may be required for some applications outlined in these specifications.

1.10 SPECIAL REQUIREMENTS

A. LEED Certification
   1. One of this Project’s goals is to achieve LEED certification – inclusive of renewable building materials and environmentally friendly construction process, among other aspects. Though not all measures taken on behalf of the telecommunications cabling system installer will gain LEED points, the goal of an environmentally friendly construction process still applies.
   2. The telecommunications cabling system installer is expected to implement procedures that will reduce the amount of packaging material waste. For example, the telecommunications cabling system installer could purchase connectors in bulk packaging. As well, manufacturers can be selected based on their use of recycled materials.
   3. Because the products are not “hard spec’ed” (or equal applies to most products), the telecommunications cabling system installer must submit the product information. In this submittal, the telecommunications cabling system installer shall include statements of how the Project’s goal of an environmentally friendly construction is being upheld on their behalf.

PART 2 - PRODUCTS

2.1 General

A. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.

B. Product numbers listed in the 167xx series sections are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Engineer through the General Contractor in writing prior to ordering the material and performing installation work.
2.2 Substitutions

A. Requests for substitutions shall conform to the general requirements and procedure outlined in General Requirements.

B. Where items are noted as "or equal", a product of equivalent design, construction and performance will be considered. Include in the Product Data submittal: catalog cuts, product information, and pertinent test data required to substantiate that the product is in fact equivalent to that specified.

C. Only one substitution will be considered for each product specified. Do not use substitution material, processes or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

D. Substitutions shall be equivalent, in the opinion of the Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from provisions of the Specifications.

E. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equivalent" follows the manufacturers' names and model number(s).

F. Whenever material, process or equipment is specified in accordance with a TIA/EIA specification, an ANSI specification, UL rating or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance at no additional cost.

G. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Project Conditions: Verify existing conditions, which have been previously provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Pathways: Verify that pathways and supporting devices, which have been previously provided under other sections, are properly installed, and that temporary supports, devices, etc., have been removed.

C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, "True Tape" the conduits to verify cable distances.
3.2 FIELD QUALITY CONTROL

A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule.

B. Project Management: Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute meeting agenda prior to and meeting notes after meetings in a format acceptable to the General Contractor.

C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the General Contractor. Issue schedule to General Contractor for approval. Prepare and issue updated schedules whenever there are modifications.

D. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

3.3 INSTALLATION

A. Complete work in conformance to applicable federal, state and local codes, and telephone standards.

B. Coordinate the entire installation with the General Contractor, and their subcontractors, to meet the construction schedule. Include coordination meetings as required to fulfill this requirement.

C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

D. Manufacturer's Instructions:
   1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
   2. Maintain jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

E. Adjusting:
   1. Make changes and revisions to the system to optimize operation for final use.
   2. Make changes to the system such that defects in workmanship are corrected and cables and the associated termination hardware pass the minimum test requirements.

F. Protection
   1. Protect installed products and finish surfaces from damage during construction.

3.4 REPAIR/RESTORATION

A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.

B. Punch List:
   1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
   2. Provide punch list to Engineer for review prior to performing punch walk with the Engineer.

C. Re-Installation:
1. Make changes to adjust the system to optimum operation for final use. Make changes to the system such that defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.
2. Repair defects prior to system acceptance.

3.5 CLEANING
A. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.
B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.
C. Repair or replace damaged installed products.
D. Legally dispose of debris.
E. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

3.6 DEMONSTRATION
A. On completion of the acceptance test, schedule a time convenient with the Owner, or owner's representatives, for instruction in the configuration, operation, and maintenance of the system.
B. Provide 2 hours, minimum, of on-site training by a factory-trained representative. Document dates and times of training, and submit a “sign in” sheet for individuals trained, as part of the close out documentation.

3.7 CERTIFICATION
A. Provide to Owner a written form of acceptance for signature. Corrections must be completed before Owner will give acceptance.

END OF SECTION
SECTION 16710 – TELECOMMUNICATIONS HORIZONTAL CABLEING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Horizontal Cabling.

B. Related Sections
   1. Comply with the Related Sections paragraph of Section 16700.

C. Products Furnished and Installed Under Other Sections:
   1. Cable distribution system (horizontal pathways).
   2. Conduits for building distribution.
   3. Conduit stubs & device (back) boxes for wall mounted outlets.
   4. Sleeves, unless shown on Drawings.

1.2 REFERENCES

A. Comply with the References requirements of Section 16700.

1.3 DEFINITIONS

A. Refer to Section 16700 for Definitions.

B. In addition, the following terms used in this Section shall be defined as follows:
   1. "CAT3": Category 3 [UTP]
   2. "CAT5E": Category 5 Enhanced [UTP]
   3. "CAT6": Category 6 [UTP]
   4. "Channel": End to end transmission path; e.g., the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full crossconnection is implemented, the crossconnect termination/connecting apparatus and equipment cord.
   5. "CMP": Communications Media Plenum, plenum rating; synonymous with "MPP"
   6. "CMR": Communications Media Riser, non-plenum riser rating; synonymous with "MPR"
   7. "MM": Multimode [fiber type]
   8. "SM": Singlemode [fiber type]
   9. "FEP": Fluorinated Ethylene Propylene
   10. "Permanent Link": Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords; e.g., the ‘permanent’ portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
   11. "PVC": PolyVinyl Chloride
   12. "UTP": Unshielded Twisted Pair

1.4 SYSTEM DESCRIPTION

A. Work Provided Under Other Sections
   1. Telecommunications Pathways (Primary & Secondary Horizontal Pathways, Conduits, etc.)
1) Refer to the Drawings for size (capacity) and route information for pathway system components.

b. The horizontal pathway system components (linear ring system, cable hangers) throughout the ceiling space to the device location (e.g. from the conduits exiting the MDF/IDFs to the device pathway) are covered under another section.

c. The device pathways – conduit stubs and device boxes – at the wall and in-floor outlets are covered under another section.

B. Base Bid Work
1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working communications Horizontal Cabling System installation described in these specifications. Consider horizontal cabling as shown on Drawings as base bid work, unless otherwise noted. This includes terminations at both ends.
2. In general, the base bid work includes:
   a. Submittals.
   b. Horizontal cables, terminations, and outlets.
   c. Cable management.
   d. Patch cords and cross-connects.
   e. Cable identification tags and system labeling.
   f. Record Documents.
   g. Warranty.

1.5 SUBMITTALS

A. Comply with the Submittals article of Section 16700 for procedural, quantity, and format requirements.

B. Submittal Requirements at Start Of Construction:
1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
2. Sample Submittal, consisting of the following components:
   a. Type “A” Outlet Sample – A fully configured outlet including faceplate, modular jacks, and label.
   b. Type “W” Outlet Sample – A fully configured outlet including faceplate, modular jacks, and label.
   c. Cable Label Sample.
3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 167xx series Sections.
4. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.

C. Submittal Requirements at Closeout:
1. As-Built Drawings.
2. Crossconnection records/cut sheets.
3. O & M Manuals.

1.6 QUALITY ASSURANCE

A. Comply with the Quality Assurance requirements of Section 16700.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with the Delivery, Storage and Handling requirements of Section 16700
1.8 WARRANTY

A. Comply with the Warranty requirements of Section 16700.

1.9 SEQUENCING

A. At the combination service outlets (telecom and electrical), install coverplate only after Electrical Contact has completed their work and has given notice that the work is complete.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Comply with the Substitutions requirements of Section 16700.

2.2 HORIZONTAL CABLE – PLENUM RATED

A. CAT6 UTP 4-Pair Cable
   1. Application: Suitable for indoor installation, within ceiling space.
   2. Conductors:
      a. Insulated Conductors: 23 AWG solid copper, fully insulated with a flame retardant thermoplastic material (material = PVC, or equivalent).
   3. Cable Sheath:
      a. The cable shall have a seamless outer jacket (material = LS-PVC, or equivalent) applied to and completely cover the internal components (twisted pairs). The cable shall be unshielded.
      b. Flame Rating: NEC (Article 800) rated as CMP, and UL listed as such.
   4. Electrical Performance: Meet or exceed TIA/EIA-568-B.2-1 and ISO/IEC 11801 requirements for CAT6 UTP cabling.
   5. Manufacturer: Belden, or equal:
      a. #2413 005; CAT6 4 pair UTP cable, CMP – Green

2.3 PATCH CORDS AND CROSSCONNECT WIRE

A. Modular Patch Cords – Type: Data CAT6
   1. Modular patch cords shall be suitable for indoor installation within a telecom room or workstation environment. Cords shall be assembled from a single, continuous length of cordage, homogenous in nature, and shall be terminated at both ends via 8 position modular plugs. Splices are not permitted anywhere.
   2. Cordage
      a. Insulated Conductors: 24 AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
      b. Twisted Pairs: Two insulated conductors “twisted” into a “pair” (twisted pair), and individually color coded.
      c. Sheath shall be unshielded, and shall be flame-retardant polyvinyl chloride (PVC) jacketed.
      d. Flame Rating: NEC CM (or higher) rated, and UL listed as such.
3. Electrical Performance: Comply with TIA/EIA-568-B for CAT6 UTP patch cords and Channel requirements (minimum).

4. Manufacturer: Belden, or equal:
   a. #601106003; CAT6 4 pair UTP patch cord, 3 ft. length, Blue

5. No allowance for furnishing or installing cords for use at the workstations (from the outlet to the end user equipment) will be required for this contract. The Owner will provide these cords.

B. Voice Crossconnect Wire
   1. Suitable for indoor installation within a 110-based crossconnect system. Each and every crossconnect wire shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.
   2. Factory splices of insulated conductors are expressly prohibited.
   3. Conductors:
      a. Insulated Conductors: Conductors shall be 24 AWG solid copper. Conductors shall be fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
      b. Twisted Pairs: Two insulated conductors shall be “twisted” into a “pair” (twisted pair). Twisted pairs shall be individually color coded.
   4. Manufacturer: SYSTIMAX, or equal:
      a. #CCW-F 1/24 S1000 (105 597 231); crossconnect wire, 1 pair, Whi-Red / Red-Whi
      b. #CCW-F 1/24 S1000 (105 597 264); crossconnect wire, 1 pair, Whi-Blu / Blu-Whi

2.4 TERMINATION EQUIPMENT

A. Modular Patch Panel, IDF Rooms
   1. Application: Modular patch panels shall be suitable for installation within a telecommunication facility for the termination of the horizontal CAT6 cables.
   2. Modular patch panels shall be horizontally oriented for a rack mounted configuration.
   3. Modular patch panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment/equipment field.
   4. Modular patch panels shall be a 'discrete port' type panel. Each port shall be a CAT6 modular jack (reference “Modular Connectors – CAT6 Cabling” following). Modular patch panels shall have 48 ports.
   5. Modular patch panels shall come equipped with integrated labeling.
   6. Manufacturer: Panduit Mini-Com series, or equal:
      a. Panduit #CPPL48WLY; 48 port patch panel (does not include connectors).

2.5 CONNECTORS

A. Modular Connectors – CAT6 Cabling
   1. CAT6 UTP 4-pair cables shall be terminated at the workstation via 8 position modular connectors. Each connector shall be CAT6 rated.
   2. Jacks shall be T568A wired.
   3. Manufacturer: Panduit Mini-Com series, or equal:
      a. C6688TGGR; CAT6 8-position jack “Mini-Com” series “TX6 Plus, Green

2.6 WORKSTATION OUTLETS

A. Frame – Flush Decora Type
   1. Frame shall be fully compatible with standard single gang opening, and shall be GFCI/Decora style.
   2. Color: white.
3. Refer to Drawings (sheet T0.02) for port counts per device type.
4. Manufacturer: Panduit, or equal:
   a. #CFG1WH, GFCI/Decora frame, 1 port.
   b. #CFG2WH, GFCI/Decora frame, 2 port.
   c. #CFG4WH, GFCI/Decora frame, 4 port.

B. Coverplate – Flush Decora Type
1. Coverplate shall be fully compatible with standard single gang opening and the Decora frame, and shall be GFCI/Decora style.
2. Coverplate shall include required accessories, such as icons, blank inserts, labels and label windows
4. Refer to Drawings (sheet T0.02) for gang size per device type.
5. Manufacturer: Panduit, or equal:
   a. #CPGWH, one-gang Decora coverplate
   b. #CPGWH-2G, two-gang Decora coverplate

C. Faceplate –Wall Phone Type
1. Wall phone faceplates shall come equipped with 1 modular jack and two mounting studs.
2. Manufacturer: Panduit, or equal:
   a. #KWP6FY; wall phone faceplate, stainless steel, with CAT5 jack

D. Bezel Adapters for “Poke-Thru” and Floor Box Devices
1. Adapters shall be fully compatible with both the “poke-thru” type floor outlets and the specified connectors / connector accessories.
2. Manufacturer: Panduit, or equal:
   a. #CH02MEI-X; bezel adapter, 2 port, accepts Mini-Com connectors

2.7 LABELS

A. General: Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.

B. Horizontal Cable Labels
1. Labels shall be adhesive backed and have a self-laminating feature.
2. Labels shall fit the horizontal cables listed above (i.e., shall fully wrap around the cable’s jacket).
3. Printable Area shall be 2" x 0.5", minimum, in size, and shall be white in color.
   a. LJS17-Y3-1; laser/ink jet labels for cable diameters 0.16"-0.32", white

C. Modular Patch Panels
1. Labels shall be adhesive backed.
2. Labels shall fit above the port without overlap to the next port or to the port itself.
3. Printable Area shall be 0.61" x 0.33", minimum, in size, and shall be white in color.
   a. #CPPLF-5; laser labels for modular patch panels, white

D. Coverplate & Faceplate Labels
1. Labels shall be suitable for coverplates and faceplates listed above.
2. Labels shall be adhesive backed.
3. Labels shall fit above the port without overlap to the next port or to the port itself.
4. Printable Area shall be 0.61" x 0.33", minimum, in size, and shall be white in color.
5. Manufacturer: Panduit.
   a. #CPPLF-5; laser labels for modular patch panels, white
2.8 MISCELLANEOUS COMPONENTS

A. Velcro Cable Ties
   1. Width: .75".
   2. Color: Velcro cable ties shall be the same color as the cable to which it is being applied.
   3. Manufacturers: Panduit
      a. #HLS-15R-0 Black, 15' roll, cut to length.
      b. #HLS-75R-0 Black, 75' roll, cut to length.

2.9 HORIZONTAL MANAGEMENT PANEL

A. Application: Suitable for installation into equipment rack for horizontal cord management. The horizontal management panel shall match (and fully integrate with) the vertical management sections.

B. The horizontal management panel shall be single-sided.

C. Size: 2U high by 19" mounting wide.

D. Color: black (guides and cover).

E. Manufacturer:
   1. CPI
      a. #30130-719; horizontal management panel, single sided, 2U, black

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the General Execution requirements of Section 16700.

3.2 INSTALLATION

A. Horizontal Cable
   1. General
      a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
   2. Installation
      a. Install cables into pathways designated for telecom cables.
      b. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
      c. Maintain pulling tension within manufacturer's limits.
      d. Protect cable during installation. Replace cable if damaged during installation.
      e. Place cables with no kinks, twists, or impact damage to the sheath.
   3. Routing
      a. Maintain maximum cable length of 90 meters from the termination in the IDF to the termination at the user's faceplate.
      b. When routing horizontally within telecom rooms, utilize the overhead cable support. When routing vertically within telecom rooms, utilize the wall mounted vertical cable support; support every 24 inches on center using cable ties.
      c. Place and suspend cables in a manner to protect them from physical interference or damage.
d. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
e. Route horizontal cables at 90-degree angles, allowing for bending radius, along corridors for ease of access. Do not route through an adjacent space if a corridor borders at least one wall of the room.
f. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. In the telecommunications rooms, place the slack in the overhead cable support. At the workstation, place cable in ceiling space supported from a cable hanger.
g. Provide six inches (minimum) of sheathed cable slack behind each workstation outlet faceplate. The slack cable shall be coiled inside in the device box, the raceway, or within the wall, per the cabling manufacturer’s installation standards.
h. At the equipment bay in the telecommunications room, divide horizontal cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination.

4. Termination
   a. Properly strain relieve cables at termination points per manufacturer’s instructions.
   b. Terminate twisted pairs at both ends on the specified connecting hardware.
   c. Perform terminations in accordance with manufacturer’s instructions and TIA/EIA-568-B standard installation practices.
   d. Perform post-installation testing as described in the Communication Testing specification.

B. Outlet Faceplates
   1. Mount faceplates plumb, square, and at the same level as adjacent device faceplates.
   2. Patch gaps around faceplates so that faceplate covers the entire opening.

C. Outlet Modular Connectors
   1. Terminate pairs of the voice and data cables onto the connector. Terminations shall conform to manufacturer’s latest wiring requirements for connector.
   2. Replace terminations and connectors not passing the required media test.

D. Rack Mounted Patch Panels
   1. Provide modular patch panels in a quantity to allow termination of horizontal cables served from respective IDF. Install into rack bays as shown on Drawings.
   2. Mount the modular patch panels in association with the horizontal management panels such that a management panel is mounted above and below given modular patch panel. The ‘middle’ management panels will be shared between the modular patch panels above and below given management panel. The result will be an “N + 1” configuration.
   3. Assemble and install according to the manufacturer’s instructions.

E. Data Patching and Voice Crossconnects/Patching
   1. Refer to Drawings (sheet T-102) for data patching requirements.
   2. Utilize the horizontal and vertical management components to properly route the modular patch cords, fiber patch cords, crossconnect wire, and pigtails patches.
   3. Crossconnect Colors:
      a. For digital handsets, provide: White-Blue / Blue-White
      b. For analog handsets, provide: White-Red / Red-White
   4. Splices in modular patch cords & pigtails and crossconnect wire are prohibited.

3.3 LABELING

A. General Requirements
   1. Labeling, identifier assignment, and label colors shall conform to TIA/EIA-606-A Administration Standard and as approved by Owner’s Representative before installation.
   2. Labels shall be permanent with machine-generated text; hand written labels will not be accepted.

B. Label Formats

Murakami/Nelson
TEECOM Design Group
Project No. 0802C
TELECOMMUNICATIONS HORIZONTAL CABLEING
16710 - 7
1. Horizontal Cable Labels  
   a. Text Attributes: Black, 1/8” high, minimum, or #12 font size.  
   b. Install labels on both ends of cables no more than 4” from the edge of the cable jacket.  
      Install labels such that they are visible by a technician from a normal stance.

2. Modular Patch Panel Labels  
   a. Use modular panel labels included in the product packaging. Request approval by the  
      Engineer for other labels.
   b. Use a label color for the respective field type, per TIA/EIA-606.
   c. Text Attributes: Black, 3/32” high, minimum, or #10 font size.

3. Outlet Labels  
   a. Use outlet labels included in the product packaging. Request approval by the Engineer for  
      other labels.
   b. Label Background: White.
   c. Text Attributes: Black, 1/8” high, minimum, or #12 font size.
   d. Install label in the top label window. The bottom label window shall be left blank.

C. Identifier Assignment  
   1. General: Separate label fields of the identifier with a hyphen.
   2. Horizontal Cables  
      a. First field: the originating MDF/IDF room identity; for example: “VA2.1”.
      b. Second field: the destination room number; for example: “266”.
      c. Third field: a unique sequential outlet number; for example: “01” (1st outlet in the room).
      d. Fourth field: a unique port number; for example: “1” (1st port of the outlet).
      e. Fifth field: the cable type; for example: “CAT6”.
      f. Example: “VA2.1-266-01-1-CAT6”

3. Outlets  
   a. First field: the originating MDF/IDF room identity; for example: “VA2.1”.
   b. Second field: the destination room number; for example: “266”.
   c. Third field: a unique sequential outlet number; for example: “01” (1st outlet in the room).
   d. Example: “VA2.1-266-01”

4. Individual Ports at the Outlets  
   a. First field: a unique sequential number; for example: “1”.

5. Individual Ports at the Modular Patch Panels  
   a. First field: the End User Room Number; for example: “266”.
   b. Second field: unique sequential outlet number; for example: “01” (1st outlet in the room).
   c. Third field: outlet port number; for example: “1” (1st port of the outlet).
   d. Example: “266-01-1”

3.4 FINAL INSPECTION  
   A. Inspect installed products and work in conjunction with the Owner or Owner’s Representative. Develop  
      a punchlist for items needing correction.
   B. Issue punchlist to Engineer for review prior to performing punchlist with the Engineer.
   C. Repair defects prior to system acceptance.
   D. Inspect installed products and work in conjunction with the Engineer for sign off.
SECTION 16719 – TELECOMMUNICATIONS TESTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section Includes: Testing of Telecommunications Backbone and Horizontal Cabling subsystems.

B. Related Sections
   1. Consult all other Sections and Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to completely test a complete and operable system.
   2. Section 16700 – Basic Telecommunications Requirements
   3. Section 16710 – Telecommunications Horizontal Cabling

C. Products Furnished and Installed Under Other Sections:
   1. Telecommunications Cabling

1.2 REFERENCES

A. Comply with Section 16700 References requirements.

B. Additional references to those listed in Section 16700.
   1. TIA/EIA-526-14 ("OFSTP-14") Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
   2. TIA/EIA-526-7 ("OFSTP-7") Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant
   3. TIA/EIA-455-171 Attenuation By Substitution Measurement – For Short-Length Multimode Graded-Index And Single-Mode Optical Fiber Cable Assemblies (a.k.a., FOTP-171)

1.3 DEFINITIONS

A. Refer to Definitions of Sections 16700 AND 16710.

B. In addition, the following list of terms as used in this specification shall be defined as follows:
   1. "Adapter" (associated with fiber connectivity): Shall mean a connecting device joining 2 fiber connectors, either like or unlike.
   2. "Channel": Shall mean a testing configuration which includes the Permanent Link and the line cord (at the workstation), the equipment cord, and, if a full crossconnection is implemented, a patch cord and the crossconnect termination/connecting apparatus.
   3. "Connect": Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
   4. "Cord": Shall mean a length of cordage having connectors at each end. The term “Cord” shall be synonymous with the term “Jumper”. The cord may be:
      a. Unshielded twisted pair
      b. Fiber (multimode or singlemode), jacketed & buffered
   5. "Launch Cord": Shall mean the cord certified for use in fiber optic characterization testing, as described in this section.
   6. "OTDR": Shall mean Optical Time Domain Reflectometer.
7. "Passive Link Segment": Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
8. "Permanent Link": Shall mean the 'permanent' portion of the Horizontal cabling to each outlet with the test cords de-embedded from the measurements; this includes cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
9. "System Cord": Shall mean the cord used in the operating electrical or optical circuit.
10. "Test Cord": Shall mean the cord certified for use in testing, as described in this section.

1.4 SYSTEM DESCRIPTION

A. Work Provided Under Other Sections
   1. Refer to Section 16710 for a more complete System Description.
   2. Horizontal Cabling
      a. The Horizontal Cabling, in general, consists of multiple 4-pair Category 6 UTP cables to each outlet. Refer to the Drawings for specific requirements.

B. Base Bid Work
   1. Testing of a completed Telecommunications Cabling System, including:
      a. Procedures Submittals.
      b. Equipment Submittals.
   2. Testing Requirements:
      a. Fiber optic passive link segment(s):
         Table 16719-1.1: Tests For Fiber Optic Passive Link Segments
         | Subsystem | Type       | Test          | Direction | Wavelength        |
         |------------|------------|---------------|-----------|-------------------|
         | Backbone   | Multimode  | Characterization | Both      | 850nm,1300nm      |
         | Backbone   | Singlemode | Characterization | Both      | 1310nm,1550nm     |
         | Backbone   | Multimode  | Passive Link Ins. Loss | One      | 850nm, 1300nm     |
         | Backbone   | Singlemode | Passive Link Ins. Loss | One      | 1310nm, 1550nm    |

   b. Multipair/UTP cabling:
      Table 16719-1.2: Tests For Multipair/UTP Cabling
      | Subsystem | Type | Test         | Configuration | Notes               |
      |------------|------|--------------|----------------|---------------------|
      | Backbone   | Riser| Wire map & length |                | -                   |
      | Horizontal | CAT6| Category 6    | Permanent Link | Per TIA/EIA-568-B.2-1 |

   c. Record Documents, including test reports.

1.5 SUBMITTALS

A. Refer to Submittals of to Section 16700 for procedural, quantity, and format requirements.

B. Preconstruction Submittal Requirements:
   2. Product Submittal, including cut sheets of testing equipment to be used (note all software/firmware versions as applicable) and certificate of last calibration.
   3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 167xx series Sections.

C. Submittal Requirements at Closeout:
   1. Record Documents.

D. Submittal Description: Record Documents
1. Test Reports: Record documents submittal shall include test reports showing the following information:
   a. A title page which includes:
      1) Client Name
      2) Project Name
      3) Project Address
      4) General Contractor name / Telecommunications Installer name
      5) Date of Submittal
   b. Individual tabs which break down the test results by building, and then by telecommunications room.
   c. All Backbone Fiber Optic “Post Installation” Passive Link Attenuation test results (utilize the forms provided in Part 4 of this specification for documentation of test results if the tester used does not have data storage capabilities) and Fiber Optic OTDR test results.
   d. All Backbone UTP test results.
   e. All Horizontal cable test results, per cable

2. Furnish all test results on CD-ROM in their native data format and an exported Microsoft Excel compatible format.
   a. Include all necessary software to allow viewing and printing of individual test results.
   b. CD shall be labeled with the project name, contractor name, and date of submission.

1.6 QUALITY ASSURANCE

   A. Comply with the Quality Assurance requirements of Section 16700.

1.7 WARRANTY

   A. Warrant the validity of the test results. Under no circumstances shall any cable’s test results be substituted for another’s. If a single instance of falsification is confirmed, the Contractor shall be liable for a complete retest of the cabling system at no additional cost to the Owner. This includes the retaining the services of a neutral party to observe all retesting.

PART 2 - PRODUCTS

2.1 GENERAL

   A. The manufacturer may change the product numbers listed in this Section at any time, as well as software and firmware versions. In the event this Section contains an invalid product number or conflicts with the written description, or specifies an out-of-date software and/or firmware version, notify the Engineer in writing prior to issuing submittals or field testing.

2.2 FIBER OPTIC LIGHT SOURCE

   A. All connection interfaces shall be factory installed. No field-configurable adapters will be allowed at the light source.

   B. Wavelengths output shall be continuous.

   C. LED-based light source for multimode fiber testing shall have a:
      1. Center wavelength of 850nm ± 30nm and 1300nm ± 20nm.
      2. Spectral width (FWHM) 30nm - 60nm at 850nm and 100nm - 140nm at 1300nm.
3. Minimum output power level of ≥14dBm.

D. VCSEL-based light source for multimode fiber testing shall have a:
   1. Center wavelength of 850nm ± 30nm and 1300nm ± 20nm.
   2. Spectral width (FWHM) 30nm - 60nm at 850nm and 100nm - 140nm at 1300nm.
   3. Minimum output power level of ≥14dBm.

E. LASER-based light source for singlemode fiber testing shall have a:
   1. Center wavelength of 1310nm ± 20nm and 1550nm ± 20nm.
   2. Spectral width (FWHM) of ≤5nm at 1310nm and ≤5nm at 1550nm.
   3. Minimum output power level of ≥3dBm.

F. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures (ref. PART 3 - EXECUTION).

G. Equipment shall be factory-calibrated within 12 months of testing date.

H. Equipment:
   1. Agilent Technologies' WireScope 350 test set
      a. #450-1070 Fiber SmartProbe testing adapter, multimode 850nm.
      b. #450-1080 Fiber SmartProbe testing adapter, multimode 1300nm.
      c. #450-2020 Fiber SmartProbe testing adapter, singlemode 1300nm.
      d. ScopeData management software (version 5.20 or higher).
   2. Comms Cable Systems
      a. #OS-301 light source
      b. #OS-302 light source
      c. #OS-100D light source
   3. Fluke Networks’ DSP-4300 test set
      a. #DSP-4300; “CableAnalyzer” test kit, loaded with firmware version 3.0.4.
      b. #DSP-FTA420S; ‘Multimode’ fiber testing adapter, LED-based (850nm, 1300nm).
      c. #DSP-FTA430S; ‘Singlemode’ fiber testing adapter, LASER-based (1310nm, 1550nm).
      d. #DSP-FTA440S; ‘Gigabit’ fiber testing adapter, VCSEL-based (multimode @ 850nm and singlemode @ 1310nm).
      e. LinkWare; "LinkWare" management software (latest version).
   4. Laser Precision #5150 test set

2.3 FIBER OPTIC POWER METER

A. The power meter for both multimode and singlemode testing must be capable of measuring relative or absolute power, and must be independent of modal distributions.

B. All power meters used must be calibrated and traceable to the National Bureau of Standards.

C. All power meters used shall have the following performance:
   1. Dynamic range of 0dBm to -40dBm, minimum.
   2. Accuracy of ±0.2dB.

D. Equipment shall be factory-calibrated within 12 months of testing date.

E. Equipment:
   1. Agilent Technologies' WireScope 350 test set
      a. #450-1070 Fiber SmartProbe testing adapter, multimode 850nm.
      b. #450-1080 Fiber SmartProbe testing adapter, multimode 1300nm.
2.4 FIBER OPTIC MANDREL

A. For jacketed (3.0 mm) fiber, mandrel diameter shall be 22 mm for 50/125 um fiber. For unjacketed buffered (0.9 mm) fiber, mandrel diameter shall be 25 mm for 50/125 um fiber.

B. Equipment: Fluke Networks
   1. #NF-MANDREL-50; red mandrel for jacketed 50/125 um fiber

2.5 FIBER OPTIC OTDR

A. Multimode Source Module:
<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Dynamic Range</th>
<th>Attenuation Deadzone</th>
<th>Reflective Deadzone</th>
<th>Loss Resolution</th>
<th>Distance Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>850nm</td>
<td>24dB</td>
<td>6.5mt</td>
<td>3.0mt</td>
<td>0.001dB</td>
<td>0.1mt</td>
</tr>
<tr>
<td>1300nm</td>
<td>27dB</td>
<td>7.0mt</td>
<td>3.0mt</td>
<td>0.001dB</td>
<td>0.1mt</td>
</tr>
</tbody>
</table>

B. Singlemode Source Module:
<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Dynamic Range</th>
<th>Attenuation Deadzone</th>
<th>Reflective Deadzone</th>
<th>Loss Resolution</th>
<th>Distance Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1310nm</td>
<td>40dB</td>
<td>6.0mt</td>
<td>3.5mt</td>
<td>0.001dB</td>
<td>0.1mt</td>
</tr>
<tr>
<td>1550nm</td>
<td>28dB</td>
<td>12.0mt</td>
<td>3.5mt</td>
<td>0.001dB</td>
<td>0.1mt</td>
</tr>
</tbody>
</table>

C. Equipment, including main unit and source modules, shall be factory-calibrated within 12 months of testing date.

D. Equipment:
   1. Agilent Technologies #8147, for multimode & singlemode systems
   2. Corning Cable Systems,
      a. 2001HR, for multimode & singlemode systems
      b. 340 OTDR Plus Multitester II
      c. MiniOTDR+, for multimode & singlemode systems
   3. Tektronix,
      a. TFP2A FiberMaster
      b. TFS3031 TekRanger2

2.6 FIBER OPTIC TEST CORDS

A. Multimode Fiber Optic Test Cord
   1. The fiber of the multimode test cord(s) shall have the core diameter and numerical aperture nominally equal to that of the multimode fiber optic passive link.
   2. The length of test cords used for insertion loss testing shall be between 1m and 5m.
   3. The connectors of the test cords shall be compatible with the connector types of the light source and the power meter.
      a. The connector of the test cords shall be that which the light source accepts.
4. The connectors shall exhibit \( \leq 0.5 \text{dB} \) loss per connection @ both 850nm and 1300nm, as measured per FOTP-171 D2.

B. Singlemode Fiber Optic Test Cord
   1. The fiber of the singlemode test cord(s) shall have the mode field diameter nominally equal to that of the singlemode fiber optic passive link.
   2. The length of test cords used for insertion loss testing shall be between 1m and 5m.
   3. The connectors of the test cords shall be compatible with the connector types of the light source and the power meter.
      a. The connector of the test cords shall be that which the light source accepts.
   4. The connectors shall exhibit \( \leq 0.5 \text{dB} \) loss per connection @ both 1300nm and 1550nm, as measured per FOTP-171 D3.
   5. All singlemode connectors shall inhibit Fresnel reflections (i.e., have a “PC” finish).

2.7 CATEGORY 6 HORIZONTAL CABLE TESTER

A. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy.

B. Test Standards (minimum): TIA Category 6 (per TIA/EIA-568B.2 Addendum 1); ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-T, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5

C. Areas of Test Measurement (minimum): Wire Map; Length; Insertion Loss; Near End Crosstalk (NEXT) loss, at both master unit and remote unit; Power Sum NEXT (PSNEXT) loss, at both master unit and remote unit; Equal Level Far End Crosstalk (ELFEXT), at both master unit and remote unit; Power Sum ELFEXT, at both master unit and remote unit; Return Loss (RL), at both master unit and remote unit; Propagation Delay and Delay Skew; Attenuation-to-Crosstalk Ratio (ACR), at both master unit and remote unit; Power Sum ACR (PSACR), at both master unit and remote unit; Characteristic Impedance; DC Loop Resistance.

D. Equipment: Agilent Technologies
   1. #N2600A-100: “WireScope 350” test kit (main unit, remote unit, CAT6 permanent link probe, CAT6 channel probe, accessories), loaded with firmware version 3.1.1.
   2. “ScopeData Pro” reporting and documentation software latest version.

E. Equipment: Fluke Networks
   1. #DTX-1200 or #DTX-1800; “DTX CableAnalyzer” test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with latest version of firmware.
   2. #DSP-4300; “CableAnalyzer” test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with firmware version 3.0.4.
   3. “LinkWare” reporting and documentation software (version 1.1, or higher)

2.8 BACKBONE UTP CABLING TESTERS

A. Wire Map (continuity, opens, shorts, crossed pairs, split pairs) tester, or equal:
   1. Siemon #MT-5000 test unit, with 25-pair adapter.

B. Length tester, or equal:
   1. Harris #TS-90 test unit

PART 3 - EXECUTION
3.1 SCHEDULING

A. Prepare a schedule for testing activities based on the schedule developed in Section 16710. Update testing schedule when changes in the cabling construction schedule occur.

B. Schedule both the Engineer of Record and a representative of the test equipment manufacturer for a demonstration of testing methods. Execute a demonstration of testing methods with aforementioned parties prior to 'production' testing activities. Test reports and acceptance testing will not be accepted without proof of methods demonstration.

3.2 FIELD QUALITY CONTROL

A. Complete testing as delineated below prior to system acceptance.

B. Permanently record all test results and presented in a format acceptable to the Owner or Engineer before system acceptance.

C. Remove and replace with new, at no cost to the Owner, any cables or conductors (copper or glass) failing to meet the indicated standards. The Owner will not accept the installation until testing has indicated a 100% availability of all cables and conductors or the Owner has approved any deviation from this requirement.

D. Calibrate test sets and associated equipment per the manufacturers printed instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.

3.3 "PRE-INSTALLATION" CONTINUITY TESTING PROCEDURES

A. Ensure fiber continuity of all fiber strands of all cables prior to installation.

B. Reports from "pre-installation" continuity testing are not required to be submitted at project close out.

3.4 BACKBONE FIBER OPTIC CHARACTERIZATION TESTING

A. Test fiber optic passive links per "Base Bid Requirements" in Part 1 of this Section.

B. Precautions
   1. Adhere to the equipment manufacturer's instructions during testing activities.
   2. Prior to any testing activity or any measurements taken, complete the following activities:
      a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for however long it takes to bring the test equipment to reach room temp).
      b. Clean all launch cords and system cords (if applicable) connectors and all adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
   3. Do not power off OTDR's light source during testing activity.
   4. Do not remove launch cord from the OTDR's light source at any time (unless the testing is complete or the equipment is being put away for the evening, or during trouble shooting).
   5. Do not bend the launch cord smaller than 20 times the cord diameter during testing activities (this may induce loss into the cord reducing the accuracy of the measurement).
   6. Fully charge power source before each day's testing activity, if applicable.

C. "Post-Installation" Characterization Testing Procedures
1. Equipment settings / measurement parameters:
   a. Index of Refraction: match cable-under-test fiber parameters; default settings as follows:
      Multimode   Corning 50/125 Infinicon    1.483 @ 850nm    1.483 @ 1300nm
                  SYSTIMAX 50/125         1.483 @ 850nm    1.478 @ 1300nm
      Singlemode   SYSTIMAX            1.466 @ 1310nm   1.467 @ 1550nm
                  Corning SMF-28          1.4675 @ 1310nm   1.4681 @ 1550nm
   b. Pulse Width: multimode: 20ns; singlemode: 50 ns.
      Multimode 50/125    4 ns for cable lengths up to 500 meters
                  20 ns for cable lengths from 250 meters to 2,000 meters
      Singlemode    10 ns for cable lengths up to 2,000 meters
                  50 ns for cable lengths from 2,000 meters to 20 kilometers
   c. Backscatter:
      1) Multimode: -67dB @ 850nm, -74dB @ 1300nm;
      2) Singlemode: -74dB @ 1310nm and 1550nm
   d. Event Threshold: 0.05dB for both multimode and singlemode
   e. Reflection Threshold:
      1) Multimode: -45dB
      2) Singlemode: -60dB
   f. Fiber Break/End-Of-Fiber: 3dB for both multimode and singlemode

2. Waveform: The waveform shall be real-time/normal density.

3. Obtain measurements using a ‘launch’ cord connected to the test instrument and the cable-under-
test.
   a. The fiber of the launch cord shall match the fiber of the cable-under-test in physical and
      performance parameters (such as type, core/cladding size, index of refraction, refractive
      profile). The fiber of the launch cord should match the fiber of the cable-under-test in
      manufacturer and product.
   b. The length of the launch cord shall be between 25 meters and 100 meters.

4. Review the results of each test and bring to the attention of the Engineer all fibers that do not meet
   the manufacturer’s allowed loss for splices and connectors, or fibers that do not meet the length of
   the overall cable length.

D. Record Documents:
1. Test reports shall match the cable and fiber IDs as labeled in the field – i.e., the ID on the cable
   label/fiber port label shall be the same as what is associated with the electronic and printed test
   record.
2. The units for distance measurements (i.e., the “X” axis of the graph) shown on the print of the test
   measurements shall be feet.
3. For the traces, the x- and y-axis scales of a given cabling link shall be identical. Preferably, all
   reports shall be printed with identical scales on both x- and y-axis.
4. The launch cord must be shown in the trace of the printed test report.
5. Measurements shall carry a precision through one significant decimal place (minimum).
6. Each test report shall contain the following information (not necessarily in this order):
   a. Project name,
   b. General Contractor name / Telecommunications Installer name
   c. Cable identifier, fiber number, and fiber type (e.g., “multimode”)
   d. Measurement direction,
   e. Date measurement was obtained,
   f. Operator (name an company),
   g. Test equipment model and serial number(s),
   h. Set up parameters (minimum - pulse width, refractive index, event threshold.)
   i. Wavelength,
   j. OTDR trace,
   k. Length of fiber,
   l. Overall link loss.
7. For each passive cabling link, include either a schematic graphic or narrative accurately describing
   the test set up as a preface to the test reports. In other words, show the launch cord with length,
expected events with distances, etc. This information will eliminate many questions the Engineer
will have while reviewing the reports.

3.5 BACKBONE FIBER OPTIC PASSIVE LINK INSERTION LOSS TESTING

A. Test fiber optic passive links per “Base Bid Requirements” in Part 1 of this Section.

B. Launch Conditions:
   1. For passive link insertion loss testing for multimode fibers, the modal launch condition from the
      light source shall be characterized as Category 1 per OFSTP-14.
   2. For passive link insertion loss testing of singlemode fibers:
      a. Use the launch conditions, as described in FOTP-78.
      b. Employ a method to remove high-order propagating modes, as described in FOTP-77.

C. Test Methods:
   1. The passive link insertion loss testing of multimode fibers shall be performed according to “Test
      Method B: One Jumper Reference”, per OFSTP-14, for ‘permanent’ links, and shall be performed
      according to “Test Method C: Three Jumper Reference”, per OFSTP-14, for ‘channel’ links.
   2. The passive link insertion loss testing of singlemode fibers shall be performed according to “Test

D. Precautions
   1. Adhere to the equipment manufacturer’s instructions during testing activities.
   2. Prior to any testing activity or any measurements taken:
      a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if
         necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or
         for however long it takes to bring the test equipment to reach room temp).
      b. Power on the light source and power meter for at least 5 minutes.
      c. Clean all test cords & system cords (if applicable) connectors and all adapters with a lint-
         free wipe and 90% (or higher) isopropyl alcohol.
   3. Do not power off light source or the power meter during testing activity.
   4. Do not remove Test Cord #1 from the light source at any time (unless the testing is complete or
      the equipment is being put away for the evening).
   5. Do not bend the test cords smaller than 20 times the cord diameter (this may induce loss into the
      cord reducing the accuracy of the measurement).
   6. Fully charge power sources before each day’s testing activity.

E. Passive Link Insertion Loss Testing Procedures
   1. Test Equipment Set Up
      a. Follow the test equipment manufacturer’s initial adjustment and set up instructions.
      b. If the power meter has a Relative Power Measurement Mode, select this mode.
      c. If the meter can display power levels in dBm, select this unit of measurement to simplify
         subsequent calculations.
      d. Set the light source and power meter to the same wavelength.
   2. Test Cord Performance Verification
      a. Connect Test Cord #1 between the light source and the power meter.
      b. The value displayed on the power meter is the reference power (\(P_{ref}\)) measurement. If the
         power meter has a relative power measurement mode, enter this reference power measurement
         (\(P_{ref}\)) value into the meter. If it does not, hand-write \(P_{ref}\) onto the record
         documents for future reference.
      c. Disconnect Test Cord #1 from the power meter. Do not disconnect Test Cord #1 from the
         light source.
      d. Connect the ‘open’ end of Test Cord #1 to an adapter (of matching connector type). Connect
         one end of Test Cord #2 to the adapter and the other end of Test Cord #2 to the
         power meter.
e. The value displayed on the power meter is the power measurement \( P_{\text{sum}} \). If the power meter is in Relative Power Measurement Mode, the meter reading represents the test cord #2 connection attenuation. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the connection attenuation:

\[
\text{Connection Attenuation (dB)} = \left| \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right) \right|
\]

1) If \( P_{\text{sum}} \) and \( P_{\text{ref}} \) are in the same logarithmic units (dBm, dBu, etc): Connection Attenuation (dB) = \( \left| \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right) \right| \)

2) If \( P_{\text{sum}} \) and \( P_{\text{ref}} \) are in watts: Connection Attenuation (dB) = \( \left| 10 \times \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right) \right| \)

3) The measured connection attenuation must be less than or equal to the value found in Table 3 (below).

f. Flip the ends of Test Cord #2 so that the end connected to the power meter is now connected to the adapter, and the end connected to the adapter is now connected to the power meter.

g. The meter reading is the reversed Power Measurement (\( P_{\text{sum}} \)). Perform the proper calculations if not using Relative Power Measurement Mode.

h. Verify that both connection attenuation measurements are less than or equal to the value found in the following table:

<table>
<thead>
<tr>
<th>Multimode (50/125)</th>
<th>ST or SC Cord</th>
<th>0.50 dB Max</th>
<th>0.20 dB Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singlemode</td>
<td>0.55 dB Max</td>
<td>0.30 dB Max</td>
<td></td>
</tr>
</tbody>
</table>

i. If both measurements are found to be less than or equal to the values found in Table 1, test cord #1 is acceptable for testing purposes. Unacceptable attenuation measurements may be attributable to test cord # or test cord #2. Examine each cord with a portable microscope and clean, polish, or replace if necessary.

j. Repeat this test procedure from the beginning reversing the test cords in order to verify the performance of test cord #2.

3. Determine the Launch Category of the Light Source

a. The launch category of a light source can be determined by measuring its Coupled Power Ratio (CPR). The CPR is a measurement of the modal power distribution launched into a multimode fiber. A light source that launches a higher percentage of its power into the higher order modes of a multimode fiber produces a more over-filled condition and is classified as a lower Category than a light source that launches more of its power into just the lower order modes producing an under-filled condition. Under-filled conditions result in lower link attenuation, while over-filled conditions produce higher attenuation. Therefore, adjusting the acceptable link attenuation to compensate for a light source's launch characteristics increases the accuracy of the test procedure.

b. Provide two test cords, one multimode (Test Cord #1) and one singlemode (Test Cord #2). Both cords shall be directly terminated on connectors that are compatible with the light source and power meter.

1) The fiber of the multimode test cord shall have the core diameter and numerical aperture nominally equal to those of the permanent link.

2) The fiber of the singlemode test cord shall contain Class 1Va singlemode fiber, with a mode field diameter of 5.0 \( \mu \text{m} \) \( \pm 0.5 \mu \text{m} \) for 850nm tests and 9.0 \( \mu \text{m} \) \( \pm 1.0 \mu \text{m} \) for 1300nm tests.

c. Connect test cord #1 between the light source and the power meter. Avoid placing bends in the cord that are less than 4 inches in diameter.

d. The meter reading is the Reference Power Measurement (\( P_{\text{ref}} \)). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement (\( P_{\text{ref}} \)) value into the meter. If it does not, hand-write \( P_{\text{ref}} \) for future reference.

e. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.

f. Connect test cord #2 between the power meter and test cord #1, using an appropriate adapter between the test cords.

1) Test cord #2, the singlemode cord, shall include a high order mode filter. This can be accomplished by twice wrapping the cord around a 1.2" diameter (30-mm) mandrel.
The meter reading is the Power Measurement ($P_{\text{sum}}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the CPR. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the CPR:

1) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in the same logarithmic units (dBm, dBu, etc): CPR (dB) = $\left| P_{\text{sum}} - P_{\text{ref}} \right|

2) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in watts: CPR (dB) = $10 \times \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right)$

**Coupled Power Ratio (CPR) in dB, for 50/125μm Fiber:**

<table>
<thead>
<tr>
<th></th>
<th>Cat-1 Overfilled</th>
<th>Cat-2</th>
<th>Cat-3</th>
<th>Cat-4</th>
<th>Cat-5 Underfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>850nm source</td>
<td>20 – 24</td>
<td>16 – 19.9</td>
<td>11 – 15.9</td>
<td>7 – 10.9</td>
<td>0 – 5.9</td>
</tr>
<tr>
<td>1300nm source</td>
<td>16 – 21</td>
<td>12 – 15.9</td>
<td>8 – 11.9</td>
<td>4 – 7.9</td>
<td>0 – 3.9</td>
</tr>
</tbody>
</table>

4. **Multimode Insertion Loss Measurement**
   a. After setting up the test equipment, verifying the performance of the test cords, and determining the light source’s CPR, the insertion loss of the passive link segments can be measured.
   b. Connect test cord #1 between the light source and the power meter.
   c. The meter reading is the Reference Power Measurement ($P_{\text{ref}}$). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ($P_{\text{ref}}$) value into the meter. If it does not, hand-write $P_{\text{ref}}$ for future reference and to be included in the Record Documents.
   d. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
   e. Connect test cord #1 to the passive link segment ‘input’.
   f. At the opposite end of the passive link segment, connect test cord #2 to the link segment ‘input’ and the power meter.
   g. The meter reading is the Power Measurement ($P_{\text{sum}}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the insertion loss:
      1) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in the same logarithmic units (dBm, dBu, etc): Link Segment Attenuation (dB) = $\left| P_{\text{sum}} - P_{\text{ref}} \right|
      2) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in watts: Link Segment Attenuation (dB) = $10 \times \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right)\]
   h. Record $P_{\text{sum}}$ for inclusion into the Record Documents. Refer to Records (ref. PART 3: EXECUTION) for all of the information to record.

5. **Singlemode Insertion Loss Measurement**
   a. After setting up the test equipment and verifying the performance of the test cords, the insertion loss of the passive link segments can be measured.
   b. Connect test cord #1 between the light source and the power meter.
   c. The meter reading is the Reference Power Measurement ($P_{\text{ref}}$). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ($P_{\text{ref}}$) value into the meter. If it does not, hand-write $P_{\text{ref}}$ for future reference and to be included in the Record Documents.
   d. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
   e. Connect test cord #1 to the passive link segment ‘input’.
   f. At the opposite end of the passive link segment, connect test cord #2 to the link segment ‘input’ and the power meter.
   g. The meter reading is the Power Measurement ($P_{\text{sum}}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the insertion loss:
      1) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in the same logarithmic units (dBm, dBu, etc): Link Segment Attenuation (dB) = $\left| P_{\text{sum}} - P_{\text{ref}} \right|
2) If $P_{\text{sum}}$ and $P_{\text{ref}}$ are in watts: Link Segment Attenuation (dB) = \( 10 \times \log_{10} \left( \frac{P_{\text{sum}}}{P_{\text{ref}}} \right) \)

h. Record $P_{\text{sum}}$ for inclusion into the Record Documents. Refer to Records (ref. PART 3: EXECUTION) for all of the information to record.

6. Acceptable Measurement Values
   a. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
   b. The general insertion loss equation for any link segment is as follows:
      1) Insertion loss = \(<\text{cable loss}> + <\text{connection loss}> + <\text{splice loss}> + <\text{CPR adjustment}>\).
      2) Note: A connection is defined as the joint made by two mating fibers terminated with rematable connectors (e.g., ST, SC, etc).
   c. 50/125\(\mu\)m Multimode Insertion Loss Coefficients
      1) Cable Loss = Cable Length (km) x (3.0 dB/km @ 850-nm or 1.08 dB/km @ 1300-nm).
      2) Connection Loss (ST or SC Connectors) = (Connections x 0.4 dB) + 0.42 dB.
      3) Connection Loss (Other mini-connectors) = (Connections x 0.2 dB) + 0.24 dB
      4) Splice Loss = Splices x (0.05 dB for fusion or 0.10 dB for mechanical).
      5) CPR Adjustment = See following table:

<table>
<thead>
<tr>
<th>Links with ST or SC Connectors</th>
<th>Cat-1</th>
<th>Cat-2</th>
<th>Cat-3</th>
<th>Cat-4</th>
<th>Cat-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Links with mini-connectors</td>
<td>+0.50</td>
<td>0.00</td>
<td>-0.25</td>
<td>-0.50</td>
<td>-0.75</td>
</tr>
<tr>
<td></td>
<td>+0.25</td>
<td>0.00</td>
<td>-0.10</td>
<td>-0.20</td>
<td>-0.30</td>
</tr>
</tbody>
</table>

d. Singlemode Insertion Loss Coefficients
   1) Cable Loss = Cable Length (km) x (0.50 dB/km @ 1310-nm or 0.50 dB/km @ 1550-nm)
   2) Connection Loss (ST or SC Connectors) = (Connections x 0.44 dB) + 0.42 dB
   3) Connection Loss (Other mini-connectors) = (Connections x 0.24 dB) + 0.24 dB
   4) Splice Loss = Splices x (0.07 dB for fusion or 0.15 dB for mechanical)
   5) CPR Adjustment = Not applicable for singlemode.

F. Record Documents:
   1. All cable and fiber IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/fiber port label shall be the same as what is entered into the stored test result in the power meter.
   2. Measurements shall carry a precision through one significant decimal place (minimum).
   3. Each test report shall contain the following information (not necessarily in this order):
      a. Project name and address
      b. General Contractor name / Telecommunications Installer name.
      c. Operator's name(s),
      d. Date of measurement,
      e. Test equipment - manufacturer, model, and serial number,
      f. Cable identifier, fiber and fiber type,
      g. Measurement direction,
      h. Wavelength, and
      i. Measured loss values.

3.6 BACKBONE TWISTED PAIR CABLELING TESTING REQUIREMENTS AND PROCEDURES

A. Testing Requirements
   1. Test backbone multipair cabling per "Base Bid Requirements" in Part 1 of this Section.
   2. The installation will be accepted when testing has indicated a 100% availability of all terminated pairs or the Owner has approved any deviation from this requirement.
B. Testing Procedures
   1. Test wire map and continuity for all pairs.
   2. Test length for 2% of pairs of each cable. None of the pairs tested for length shall be of the same 25-pair binder group.

C. Record Documents:
   1. All cable and pair IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/termination label shall be the same as what appears on the test reports.
   2. Measurements shall carry a precision through no significant decimal place.
   3. Each test report shall contain the following information (not necessarily in this order):
      a. Project name and address,
      b. General Contractor name / Telecommunications Installer name,
      c. Operator's name(s),
      d. Date of measurement,
      e. Test equipment - manufacturer, model, and serial number,
      f. Cable identifier and pair numbers,
      g. Overall test result, and
      h. Measured values of minimum requirements.

3.7 HORIZNATIONAL CATEGORY 6 TESTING PROCEDURES

A. Precautions
   1. Adhere to the equipment manufacturer’s instructions during all testing.
   2. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
   3. Fully charge power sources before each day’s testing activity

B. Test Equipment Set Up
   1. Set up the tester to perform a full Category 6 test, as a Permanent Link configuration.
   2. If the tester has the capability, set the cable type as product specific setting. If not, set as generic Category 6.
   3. Set the tester to save the full test results (all test points, graphs, etc.).
   4. Save the test results with the associated cable link identifier to match that as specified in Section 16710.
   5. Calibrate the test set per the manufacturer's instructions.

C. Acceptable Test Result Measurements
   1. Links which report a Fail, Fail* or Pass* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
   2. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
   3. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
   4. Minimum measurement requirements:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire Map</td>
<td>All pairs of the cabling link shall be continuous and terminated correctly at both ends. No exceptions shall be accepted.</td>
</tr>
<tr>
<td>Length</td>
<td>The maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration shall be 94 meters, including test cords.</td>
</tr>
<tr>
<td>Insertion Loss</td>
<td>The acceptable insertion loss measurements for any Category 6 cabling link shall be no greater than that as listed in TIA/EIA-568B.2 Adden-</td>
</tr>
</tbody>
</table>
### Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss</td>
<td>The acceptable worst pair-to-pair NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
<tr>
<td>Power Sum NEXT Loss</td>
<td>The acceptable power sum PS-NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
<tr>
<td>Worst Pair-to-Pair ELFEXT and FEXT Loss</td>
<td>The acceptable worst pair-to-pair ELFEXT and loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
<tr>
<td>Power Sum ELFEXT and FEXT Loss</td>
<td>The acceptable PS-ELFEXT and loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
<tr>
<td>Return Loss</td>
<td>The acceptable return loss measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
<tr>
<td>Propagation Delay and Delay Skew</td>
<td>The acceptable propagation delay and delay skew measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.</td>
</tr>
</tbody>
</table>

### D. Record Documents

1. For each Horizontal Category 6 test measurement, record the following information:
   a. Project name and address,
   b. General Contractor name / Telecommunications Installer name,
   c. Operator's name(s),
   d. Date of measurement,
   e. Ambient temperature,
   f. Test equipment - manufacturer, model, and serial number,
   g. Cable identifier,
   h. Overall test result, and
   i. Measured values of minimum requirements.

END OF SECTION
FRAMING NOTES

1. This is a schematic drawing and does not include details such as wall sections, roof details, electrical, plumbing, or other systems. The final construction details will be provided through separate drawings.

2. The framing system is designed to support the weight of the structure and to resist lateral forces due to wind and seismic activity.

3. All connections should be made with appropriate fasteners and adhesives to ensure structural integrity.

FINISH AND MATERIAL SCHEDULE

ROOM NO. | ROOM NAME | FLOOR | BASE | WALLS | CEILING | REMARKS
--- | --- | --- | --- | --- | --- | ---
1 | Classroom | 1st | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System
2 | Classroom | 1st | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System
3 | Conference Room | 2nd | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System
4 | Office | 2nd | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System
5 | Storage | 2nd | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System
6 | Storage | 2nd | Office | Insulated Metal Panel | Insulated Metal Panel | Demountable Partition System

GENERAL FINISH NOTES:

1. All finishes are subject to change and will be determined by the interior designer.

2. Final material selections will be made after the construction drawings are reviewed by the owners.

TACTILE SIGNAGE

GENERAL SIGNAGE NOTES:

1. All signage must comply with the Americans with Disabilities Act (ADA) requirements.

2. Signs must be visible from a distance of 15 feet and have a contrast ratio of at least 4:1.

3. All signage must be maintained in good condition.

4. The signs must be mounted in accordance with the manufacturer's instructions.
### FOURTH FLOOR BATTERY CALCULATION (EXISTING PANEL)

<table>
<thead>
<tr>
<th>Description</th>
<th>Calculation</th>
<th>Duration</th>
<th>Load</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Power</td>
<td>1.5 kW</td>
<td>5 hours</td>
<td>Load</td>
<td>Load</td>
</tr>
</tbody>
</table>

### FIFTH FLOOR & ROOF BATTERY CALCULATION (EXISTING PANEL)

<table>
<thead>
<tr>
<th>Description</th>
<th>Calculation</th>
<th>Duration</th>
<th>Load</th>
<th>Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Power</td>
<td>2.0 kW</td>
<td>6 hours</td>
<td>Load</td>
<td>Load</td>
</tr>
</tbody>
</table>

### FOURTH & FIFTH FLOOR BATTERY AND VOLTAGE DROP CALCULATIONS

**GENERAL NOTES:**
1. Compatibility with existing building systems
2. Load analysis based on current and future scenarios
3. Detailed simulations for efficiency and reliability

---

**Table Data:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Quantity</th>
<th>Power</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>Type B-800</td>
<td>1</td>
<td>1.5 kW</td>
<td>95%</td>
</tr>
<tr>
<td>Inverter</td>
<td>Model X-32</td>
<td>2</td>
<td>3.0 kW</td>
<td>97%</td>
</tr>
</tbody>
</table>

---

**Diagram Details:**

- Electrical network layout
- Battery charger connections
- Circuit protection system

---

**Notes:**

- All calculations performed by certified engineers
- Compliance with local electrical codes and regulations
- Regular maintenance schedule

---

**References:**

- Technical manual of the equipment used
- Standard industrial practice manual
- Local utility company guidelines
### TELECOMMUNICATIONS OUTLET SCHEDULE

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Location</th>
<th>Outlet Description</th>
<th>Quantity</th>
<th>Outlet Box Type</th>
<th>Min. Conduit Size</th>
<th>Outlets</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Outlet, Wall Mount</td>
<td>&quot;W&quot;</td>
<td>E</td>
<td>2&quot; Square, Deep, Two Gang</td>
<td>E1</td>
<td>Stainless Steel</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Regular Outlet, Wall Mount, 4 Post</td>
<td>&quot;W&quot;</td>
<td>E</td>
<td>2&quot; Square, Deep, Two Gang</td>
<td>E1</td>
<td>Stainless Steel</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Regular Outlet, Surface Mount</td>
<td>&quot;R&quot;</td>
<td>E</td>
<td>2&quot; Square, Deep, Two Gang</td>
<td>E1</td>
<td>Stainless Steel</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indoor Jack</td>
<td>&quot;I&quot;</td>
<td>N</td>
<td>2&quot; Square, Deep, Two Gang</td>
<td>E1</td>
<td>Stainless Steel</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wall Switch</td>
<td>&quot;W&quot;</td>
<td>E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pull Box</td>
<td>&quot;P&quot;</td>
<td>E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CAT 5 Indoor Outlet, Wall Mount</td>
<td>&quot;I&quot;</td>
<td>E</td>
<td>CAT 5 Jack, E</td>
<td>E1</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
</tr>
<tr>
<td>CAT 5 Indoor Outlet, Surface Mount</td>
<td>&quot;R&quot;</td>
<td>E</td>
<td>CAT 5 Jack, E</td>
<td>E1</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
</tr>
<tr>
<td>CAT 5 Indoor Outlet, Pull Box</td>
<td>&quot;P&quot;</td>
<td>E</td>
<td>CAT 5 Jack, E</td>
<td>E1</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
<td>CAT 5</td>
</tr>
</tbody>
</table>

### ELECTRONIC OUTLET SCHEDULE

- **TELECOMMUNICATIONS COMMENTS**
  - 1. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.
  - 2. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.
  - 3. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.
  - 4. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.
  - 5. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.
  - 6. PROVIDE 2-PORT DECON POLE WITH SECION 2-GANG CONCRETE.

- **ELECTRONIC OUTLET SCHEDULE**
  - 1. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.
  - 2. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.
  - 3. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.
  - 4. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.
  - 5. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.
  - 6. PROVIDE CAT 5 JACKS FROM WALL MOUNT WALL TO DECON.