PUBLIC WORKS SHOP PROJECT

PACIFIC, WASHINGTON

Bid Number PW1901

Prepared by:

AHBL, Inc.
22216 North 30th Street, Suite 300
Tacoma. Washington 98403

And

City of Pacific
100 3rd Avenue SE
Pacific, Washington 98047

November 2019
# MILWAUKEE BOULEVARD MINOR WIDENING PROJECT

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</table>
INVITATION TO BID

BID

Notice is hereby given that sealed proposals will be received by the City of Pacific at City Hall, 100 3rd Avenue SE, Pacific, Washington 98047 until 11:00 a.m. local time on December 23, 2019, for the City of Pacific Public Works Shop located at 224 County Line Road SW. Bids received after that date and time, even if mailed earlier, will not be accepted. Any questions may be referred to: Jim Morgan, Public Works Manager, (253) 929-1113.

GENERAL SCOPE OF WORK

There will be a pre-bid conference at 3:00 p.m. on December 16, 2019 at the Public Works Office, 224 County Line Road SW, Pacific, Washington. Prospective bidders are encouraged to attend.

The work to be performed will include all labor, materials, equipment, permits, agency and public notifications, disposal fees, and incidentals necessary to construct 5,000 s.f. public works shop and and miscellaneous site and utility improvements, as shown on the project plans. The following is a partial list of the project elements required:

- Pre-engineered building construction, including mechanical and electrical;
- Perimeter street improvements, including sidewalk and street pavement;
- Site landscaping and irrigation;
- Generator installation with transfer switch; and
- Site grading and paving.

Estimated Bid Range: $700,000 - $1,000,000

PROJECT FUNDING

This project is financed by City funds.

BID FORM

Each Bid must be submitted on the prescribed forms. All Bids must be submitted in a sealed envelope that is marked with the Bid Number PW1901, and the Project: PUBLIC WORKS SHOP PROJECT. The envelope must also show the bidder’s name and address.

BID SECURITY

The Bid must be accompanied by a Bid Bond, certified check or a cashier’s check in an amount not less than five (5) percent of the base bid, not including Washington State Sales Tax. The Bid Bond is a guarantee that the lowest responsive bidder will, within 15 calendar days of the Notice of Award, execute a contract document with the City of Pacific. Should the selected bidder fail to execute the contract documents within the specified time, the Bid Bond shall be subject to forfeit.

ACCEPTANCE OR REJECTION OF BIDS

The City of Pacific reserves the right to reject any or all bids, waive any irregularities or technicalities, and to accept any bid if that action is believed to be in the best interest of the City.
The City of Pacific reserves the right to select any item(s) or reject any or all item(s).

**BID WITHDRAWAL**
All bids shall be valid for a period of 60 calendar days following and including the day of bid opening, and no bids may be withdrawn for 30 days after bid opening without the expressed written consent of the City of Pacific.

**PROJECT SPECIFICATIONS**
Electronic bid documents (plans and specifications) are available at the City of Pacific website for download [http://www.pacificwa.gov/departments/public_works.htm](http://www.pacificwa.gov/departments/public_works.htm)

**SCHEDULE**
The selected bidder must be able to begin Work within ten (10) working days after receiving a Notice to Proceed. All work must be completed within One Hundred Sixty (160) working days including the first day on the site.

**STATE/LOCAL REQUIREMENTS**
State, and local E.E.O., Affirmative Action, Labor Standards, and Prevailing Wage Laws and all other requirements are applicable to all activities related to this project, and must be complied with by all contractors, subcontractors, and lower tier subcontractors.

**AFFIRMATIVE ACTION ON BID**
The City of Pacific is an Equal Opportunity Employer. Women and Minority contractors, King County businesses, and King County lower income residents, whom are qualified to perform all or part of the required services, are encouraged to participate by bidding the project, or by offering their services to other bidders as subcontractors or suppliers.
BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned, ________________, as Principal, and ________________, as Surety, are hereby held and firmly bound unto the City of Pacific, Washington, as Owner in the penal sum of ________________, for the payment of which, well and truly made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

SIGNED this ______________ day of ______________, 20____.

The condition of the above obligation is such that whereas the Principal has submitted to the City of Pacific (Owner) a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing for the: PUBLIC WORKS SHOP PROJECT.

NOW, THEREFORE,

a) If said Bid shall be rejected, or in the alternate,

b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any extension.

IN WITNESS WHEREOF: The Principal and the Surety have herewith set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

(Principal)

(SEAL)

(Surety)

By: ______________________

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.
STATEMENT OF QUALIFICATIONS

Similar Project Completed:

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Address</th>
<th>Date Completed</th>
<th>Type of Improvement</th>
<th>Value of Contract</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Similar Projects Under Contract:

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Address</th>
<th>Date Completed</th>
<th>Type of Improvement</th>
<th>Value of Contract</th>
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<tbody>
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</tr>
</tbody>
</table>

Proposed Equipment to be used on Project:

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<tr>
<th>Name</th>
<th>Make</th>
<th>Size</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

Firm: _____________________________

Name: ___________________________

Signature: _______________________
LETTER OF SUBCONTRACTOR

(To be Submitted Prior to Contract Award Date)

We, the undersigned, intend to employ the following subcontractors in order to fully perform the work outlined in these specifications.

We intend to employ the firm of:

<table>
<thead>
<tr>
<th>Trade</th>
<th>Subcontractor Name/Address</th>
<th>Washington Contractor’s Registration No.</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

And represent and warrant that the work will be performed by said subcontractors in a good and workmanlike manner and under our direct supervision. We further represent and warrant that the work to be performed by them constitutes approximately ______________ percent of the total dollar value of said Contract.

Firm: ________________________________
Name: ______________________________
Address: ___________________________
Telephone: _________________________
CERTIFICATION OF EQUAL EMPLOYMENT OPPORTUNITY REPORT

Certification with regard to Performance of Previous Contracts or Subcontracts subject to the Equal Opportunity Clause and the filing of Required Reports.

The bidder _____________________, proposed subcontractor _____________________, hereby certifies that he/she has ____, has not ____ participated in a previous contract or subcontract subject to the equal opportunity clause, as required by Executive Orders 10925, 11114, or 11246, and that he/she has ____, has not ____, filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance, a Federal Government Contracting or administering agency, or the former President’s Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements.

(Company)

By:

(Title)

Date: __________________________

NOTE: The above certification is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-1.7 [b][1]), and must be submitted by bidders and proposed subcontractors which are exempt from the equal opportunity clause are set forth in 41 CFR 60-1.5. Generally only contracts or subcontracts of $10,000 or under are exempt.

Currently, Standard for 100 (EEO-1) is the only report required by the Executive Order or their implementing regulations.

Proposed prime contractors and subcontractors who have participated in a previous contract or subcontract subject to the Executive Orders and have not filed the required reports should not that 41 CFR 60-1.7(b) (1) prevents the award of contracts and subcontracts unless such contractor submits a report covering the delinquent period or such other period specified by the Federal Highway Administration or by the Director, Office of Federal Contract Compliance, U.S. Department of Labor.
NON-COLLUSION AFFIDAVIT CERTIFICATE

STATE OF WASHINGTON )

)ss.
County of ____________)

__________________________________________, being first duly sworn, on his/her oath says that the bid above submitted is a genuine and not a collusive bid, or made in the interest or on behalf of any person not therein named; and he/she further says that the said bidder has not directly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham bid, or any other person or corporation to refrain from bidding; and that said bidder has not in any manner sought by collusion to secure to his/herself an advantage over any other bidder or bidders.

__________________________________________

(Contractor)

Subscribed and sworn to before me this _________ day of ________________, 20___.

__________________________________________

Notary Public in and for the State of Washington, residing at ________________________.

City of Pacific
Bid Proposal
Public Works Shop Project

November 2019
II-5
Project No. PW1901
PROPOSAL

PUBLIC WORKS SHOP PROJECT

City of Pacific
100 3rd Avenue SE
Pacific, Washington  98047

Gentlemen:

1. The undersigned hereby certifies that he has examined the location and construction detail work as outlined on the Plans and Specifications for the City of Pacific Public Works Shop Project is familiar with the local conditions at the location of the work to be done, and has read and thoroughly understands the Plans and Specifications and the Contract governing the work and the method by which payment will be made for said work in accordance with said Plans, Specifications, and Contract at the following scheduled unit prices. All items shall be filled out showing unit prices and total amount of each item.

2. The Contract amount shall be the unit price of each item. Correct extensions based on unit prices bid and the approximate quantities shown are for the comparison for bid only and payments for unit priced items will be based on actual quantities measured in accordance with the requirements of the Contract Specifications. Limits of lump sum priced items will be as described in the Contract Drawings and Specifications.

The undersigned has checked the above amounts and understands that the Owner will not be responsible for any errors or omissions on the part of the undersigned in making up this proposal.

In order for the Owner to consider a proposal, all items on the proposal must be filled in completely.

3. It is agreed that this proposal may not be withdrawn within a period of thirty (30) days after the date set for the opening thereof.

4. In accordance with the Specifications, the undersigned further agrees to so plan the work and to prosecute it with such diligence that said work shall be commenced within ten (10) calendar days after notice to proceed. All work on this project shall be completed 160 working days.

______________________________  ________________________________
(Contractor's License No.)    (Contractor's UBI No.)

By:

______________________________
(Authorized Official)

______________________________
(Address)

Receipt of the following Addenda to the Plans and/or Specifications is hereto acknowledged:

<table>
<thead>
<tr>
<th>Addendum No.</th>
<th>Addendum Receipt Date</th>
<th>Signed Acknowledgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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</table>
## CONTRACT BID
### SCHEDULE OF PRICES

**SCADA / TELEMETRY UPGRADE PROJECT**

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>ESTIMATED QUANTITY</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>PERIMETER ROAD IMPROVEMENTS</strong></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>Lump Sum</td>
<td>Mobilization</td>
<td>Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>2</td>
<td>Force Account</td>
<td>Minor Change</td>
<td>Estimated</td>
<td>$</td>
</tr>
<tr>
<td>3</td>
<td>Lump Sum</td>
<td>Roadway Surveying</td>
<td>Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>4</td>
<td>1 Lump Sum</td>
<td>Spill Prevention Control and Countermeasures (SPCC)</td>
<td>Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>5</td>
<td>10 Each</td>
<td>Potholing</td>
<td>Per Each</td>
<td>$</td>
</tr>
<tr>
<td>6</td>
<td>3 Each</td>
<td>Adjust Manhole to Grade</td>
<td>Per Each</td>
<td>$</td>
</tr>
<tr>
<td>7</td>
<td>4 Each</td>
<td>Adjust Catch Basin to Grade</td>
<td>Per Each</td>
<td>$</td>
</tr>
<tr>
<td>8</td>
<td>3 Each</td>
<td>Adjust Existing Valve to Grade</td>
<td>Per Each</td>
<td>$</td>
</tr>
<tr>
<td>9</td>
<td>1 Lump Sum</td>
<td>Stormwater Pollution Prevention Plan (SWPPP)</td>
<td>Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>10</td>
<td>100 Days</td>
<td>ESC Lead</td>
<td>Per Day</td>
<td>$</td>
</tr>
<tr>
<td>11</td>
<td>5 Each</td>
<td>Inlet Protection</td>
<td>Per Each</td>
<td>$</td>
</tr>
<tr>
<td>12</td>
<td>24 Hours</td>
<td>Street Cleaning</td>
<td>Per Hour</td>
<td>$</td>
</tr>
<tr>
<td>ITEM NO.</td>
<td>ESTIMATED QUANTITY</td>
<td>DESCRIPTION OF ITEM</td>
<td>UNIT PRICE</td>
<td>AMOUNT</td>
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<tr>
<td>13</td>
<td>375 Linear Feet</td>
<td>Cement Concrete Traffic Curb</td>
<td>$ Per Linear Foot</td>
<td>$</td>
</tr>
<tr>
<td>14</td>
<td>75 Square Yards</td>
<td>Cement Concrete Driveway Approach, Type 1</td>
<td>$ Per Square Yard</td>
<td>$</td>
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<tr>
<td>15</td>
<td>1 Each</td>
<td>Cement Concrete Curb Ramp Type Perpendicular</td>
<td>$ Per Each</td>
<td>$</td>
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<tr>
<td>16</td>
<td>120 Square Yards</td>
<td>Cement Concrete Sidewalk</td>
<td>$ Per Square Yard</td>
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<tr>
<td>17</td>
<td>10 Square Feet</td>
<td>Detectable Warning Surface</td>
<td>$ Per Square Foot</td>
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Sub-Total A (Bid Items 1-17) $ 20,000.00

PUBLIC WORKS SHOP AND ASSOCIATED IMPROVEMENTS

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Lump Sum Mobilization</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>102</td>
<td>Lump Sum Minor Change</td>
<td>$ Estimated</td>
<td>$ 20,000.00</td>
</tr>
<tr>
<td>103</td>
<td>Lump Sum Pre-Engineered Shop Building</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>104</td>
<td>Lump Sum Shop Building Electrical System</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>105</td>
<td>Lump Sum Shop Building Mechanical System</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>106</td>
<td>Lump Sum Shop Building Plumbing System</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>107</td>
<td>Lump Sum Site Electrical, including Generator</td>
<td>$ Per Lump Sum</td>
<td>$</td>
</tr>
<tr>
<td>108</td>
<td>Lump Sum Site Irrigation</td>
<td>$</td>
<td>$</td>
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City of Pacific
Bid Proposal
Public Works Shop Project
November 2019
Project No. PW1901
<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUANTITY</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td></td>
<td>Site Planting</td>
<td>Per Lump Sum</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>350 Linear Feet</td>
<td>Chain Link Fence Type</td>
<td>Per Linear Foot</td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>1 Each</td>
<td>Double 10 Ft Chain Link Gate</td>
<td>Per Each</td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>1 Each</td>
<td>Double 12 Ft Chain Link Gate</td>
<td>Per Each</td>
<td></td>
</tr>
<tr>
<td>113</td>
<td>1 Each</td>
<td>Single Chain Link Sliding Gate</td>
<td>Per Each</td>
<td></td>
</tr>
<tr>
<td>114</td>
<td>4,575 Square Yard</td>
<td>Geo Fabric</td>
<td>Per Square Yard</td>
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</tr>
<tr>
<td>115</td>
<td>1,285 Tons</td>
<td>Crushed Surfacing Top Course</td>
<td>Per Ton</td>
<td></td>
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<tr>
<td>116</td>
<td>1,130 Tons</td>
<td>HMA Cl. 1/2 In. PG 64-2</td>
<td>Per Ton</td>
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</tr>
<tr>
<td>117</td>
<td>Lump Sum</td>
<td>Record Drawings</td>
<td>Per Lump Sum</td>
<td>2,000.00</td>
</tr>
</tbody>
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Sub-Total (Bid Items 101-117) $ 
Washington State Sales Tax (10.00%) $ 
Sub-Total B $ 
TOTAL A + B $ 

ADDITIVE ONE PUBLIC WORKS OFFICE DECK REPLACEMENT

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUANTITY</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT PRICE</th>
<th>AMOUNT</th>
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</thead>
<tbody>
<tr>
<td>201</td>
<td></td>
<td>Deck Replacement</td>
<td>Per Lump Sum</td>
<td></td>
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</table>

Washington State Sales Tax (10.00%) $ 
Sub-Total C $ 
TOTAL A+B+C $ 

Owner reserves the right to reject any or all bids. The basis of award shall be as stated in the Instructions to Bidders.
CITY OF PACIFIC

PROJECT NUMBER: PW1901

THIS AGREEMENT is entered into between the City of Pacific (the “City”) and __________________ of ______, Washington, (the “Contractor”), for the project known as Public Works Shop Project (the “Project”), Contract Number PW1901.

PROJECT DESCRIPTION. This Project provides for the construction of a new Public Works Shop; site improvements; mechanical and electrical construction; and landscape and irrigation improvements at the City of Pacific public works facilities at 224 County Line Road.

IN CONSIDERATION OF THE TERMS AND CONDITIONS CONTAINED HEREIN, THE PARTIES AGREE AS FOLLOWS:

CITY RESPONSIBILITIES. The City agrees to engage the Contractor to perform all work necessary to complete the Project according to the Project plans and specifications under the terms and conditions contained in this Agreement. The City agrees to pay the Contractor according to the Project plans and specifications and the schedule of unit or itemized prices outlined in the Contractor’s bid proposal at the time, in the manner and upon the conditions provided for in this agreement. The contract bid amount is $____________, which includes any applicable sales or use tax.

CONTRACTOR RESPONSIBILITIES. The Contractor shall perform all work and furnish and bear the expense of all tools, materials, equipment and labor as may be required for the transfer of materials and for construction and completion of the Project, except as is otherwise designated in the Project plans and specifications. The Contractor agrees to perform any necessary alterations in or additions to the work as required by the City. The Contractor shall complete the Project in accordance with and as described in the Project plans and specifications, and the edition of the Washington State Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Specifications) referenced in the Project specifications. Contractor binds himself, his heirs, executors, administrators, successors and assigns.

PROJECT TIMELINE. Work on the Project shall begin on the date provided in the Notice to Proceed and shall be completed in the number of 160 Working days outlined in the Project specifications.

LIQUIDATED DAMAGES. If the Project is not completed within the allotted working days, the Contractor agrees to pay to the City liquidated damages in the amount calculated per the WSDOT Specifications for each day the Project remains incomplete after expiration of the Project timeline.

DOCUMENTS INCORPORATED BY REFERENCE. The documents incorporated by reference, as if fully set forth in this Agreement, include the Project plans and specifications, the Contractor’s bid proposal, and the edition of the Washington State Standard Specifications for Road, Bridge, and Municipal Construction referenced in the Project Specifications.

INDEMNIFICATION. The Contractor agrees to indemnify, defend, and hold harmless the City and its officers and employees, from any claims, suits, actions, damages or liability whatsoever which may result from or arise out of the Contractor's work under this Agreement. This provision shall not apply to those claims or damages that are determined to have been caused by the sole negligence of the City, its officers, or employees.

EFFECTIVE DATE. The parties to this Agreement have caused it to be fully executed on the date of the last authorizing signature below.

________________________________________
CONTRACTOR
I certify by signing below that I am a duly authorized signatory for the Contractor:

________________________________________
Mayor Date

________________________________________
Approved as to form:

________________________________________
City Attorney Date

City of Pacific
Public Works Contract
Public Works Shop Project

III-1

Project Number: PW1901
Date: June 2019
BONDS

PUBLIC WORKS PAYMENT BOND

To: The City of Pacific

Bond No. ______________

The City of Pacific (City) has awarded to __________________ (Principal), a contract for the construction of the project designated as Public Works Shop Project (Contract), and said Principal is required under the terms of that Contract to furnish a payment bond in accord with Title 39.08 Revised Code of Washington (RCW) and (where applicable) 60.28 RCW.

The Principal, and ___________________________________ (Surety), a corporation organized under the laws of the State of __________________ and licensed to do business in the State of Washington as surety and named in the current list of “Surety Companies Acceptable in Federal Bonds” as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the City, in the sum of ______________ US Dollars ($_____________), Total Contract Amount, subject to the provisions herein.

This statutory payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW Titles 39.08, and 39.12 including all workers, laborers, mechanics, subcontractors, and materialmen, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, except as provided herein, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties’ duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and authentic power of attorney for the officer executing on behalf of the surety.

PRINCIPAL

Principal Signature Date

Printed Name

Title

Name, address, and telephone of local office/agent of Surety Company is:

____________________________________________________________________________

SURETY

Surety Signature Date

Printed Name

Title

City of Pacific
Public Works Contract
Public Works Shop Project

III-1

Project Number: PW1901
Date: June 2019
PERFORMANCE BOND

To: The City of Pacific
Bond No. ______________

The City of Pacific (City) has awarded to ___________________ (Principal), a contract for the construction of the project designated as Public Works Sho__ Project (Contract), and said Principal is required to furnish a bond for performance of all obligations under the Contract.

The Principal, and ___________________ (Surety), a corporation, organized under the laws of the State of ___________________ and licensed to do business in the State of Washington as surety and named in the current list of “Surety Companies Acceptable in Federal Bonds” as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the ***, in the sum of ___________________ US Dollars ($_______) Total Contract Amount, subject to the provisions herein.

This statutory performance bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform and complete all of the Principal’s obligations, conditions, and duties under the Contract and in addition shall indemnify, defend, and protect the City against any claim of direct or indirect loss resulting from the failure of the Principal (or any of the employees, Subcontractors, or lower tier subcontractors of the Principal) to faithfully perform all obligations, conditions, and duties under the Contract; or resulting from the failure of the Principal (or Subcontractors or lower tier subcontractors of the Principal) to pay all laborers, mechanics, Subcontractors, lower tier subcontractors, material person, or any other person who provides supplies or provisions for carrying out the Work; or to fulfill all the terms and conditions of all duly authorized modifications, additions, and changes to said Contract that may hereafter be made, at the time and in the manner therein specified; and if such obligations, conditions, and duties have not been fulfilled, this bond shall remain in full force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties’ duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and authentic power of attorney for the officer executing on behalf of the surety.

PRINCIPAL

<table>
<thead>
<tr>
<th>Principal Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>Printed Name</td>
<td>Title</td>
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SURETY

<table>
<thead>
<tr>
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<th>Date</th>
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<tbody>
<tr>
<td>Printed Name</td>
<td>Title</td>
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</table>
MAINTENANCE BOND

CITY OF PACIFIC
PUBLIC WORKS

Pacific Project #: ______________________
Surety Bond #: ______________________
Date Posted: ______________________

RE: Project Name: ______________________
Owner/Developer/Contractor: ______________________
Project Address: ______________________

KNOW ALL PERSONS BY THESE PRESENTS: That we, ______________________ (hereinafter called the "Principal"), and ______________________, a corporation organized under the laws of the State of ______________________, and authorized to transact surety business in the State of Washington (hereinafter called the "Surety"), are held and firmly bound unto the City of Pacific, Washington, in the sum of ______________________ dollars ($________), lawful money of the United States of America, for the payment of which sum we and each of us bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these presents. THE CONDITIONS of the above obligation are such that:

WHEREAS, the above named Principal has constructed and installed certain improvements on public property in connection with a project as described above within the City of Pacific; and

WHEREAS, in accordance with the contract between the Principal and the City of Pacific, the Principal is required to post a bond for the 24 months following project completion in order to ensure that the project does not contain defects that require repair and to cover the cost of repair during that 24-month period; and

WHEREAS, such bond is needed in order to provide security for the obligation of the Principal to repair and/or replace said improvements against defects in workmanship, materials or installation for a period of twenty-four (24) months after written and final acceptance of the same and approval by the City;

NOW, THEREFORE, this Maintenance Bond has been secured and is hereby submitted to the City. It is understood and agreed that this obligation shall continue in effect until released in writing by the City of Pacific, but only after the Principal has performed and satisfied the following conditions:

A. The work or improvements installed by the Principal and subject to the terms and conditions of this Bond are as follows: (insert complete description of work here)
B. The Principal and Surety agree that the work and improvements installed in the above-referenced project shall remain free from defects in material, workmanship and installation (or, in the case of landscaping, shall survive,) for a period of twenty-four (24) months after written and final acceptance of the same and approval by the City. Maintenance is defined as acts carried out to prevent a decline, lapse or cessation of the state of the project or improvements as accepted by the City during the twenty-four (24) month period after final and written acceptance, and includes, but is not limited to, repair or replacement of defective workmanship, materials or installations.

C. The Principal shall, at its sole cost and expense, carefully replace and/or repair any damage or defects in workmanship, materials or installation to the City-owned real property on which improvements have been installed, and leave the same in as good condition as it was before commencement of the work.

D. The Principal and the Surety agree that in the event any of the improvements or restoration work installed or completed by the Principal as described herein, fail to remain free from defects in materials, workmanship or installation (or in the case of landscaping, fail to survive), for a period of twenty-four (24) months from the date of acceptance of the work by the City, the Principal shall repair and/replace the same within ten (10) days of demand by the City, and if the Principal should fail to do so, then the Surety shall:

1. Within twenty (20) days of demand of the City, make written commitment to the City that it will either:
   a). remedy the default itself with reasonable diligence pursuant to a time schedule acceptable to the City; or
   b). tender to the City within an additional ten (10) days the amount necessary, as determined by the City, for the City to remedy the default, up to the total bond amount.

   Upon completion of the Surety's duties under either of the options above, the Surety shall then have fulfilled its obligations under this bond. If the Surety elects to fulfill its obligation pursuant to the requirements of subsection D(1)(b), the City shall notify the Surety of the actual cost of the remedy, upon completion of the remedy. The City shall return, without interest, any overpayment made by the Surety, and the Surety shall pay to the City any actual costs which exceeded the City's estimate, limited to the bond amount.

2. In the event the Principal fails to make repairs or provide maintenance within the time period requested by the City, then the City, its employees and agents shall have the right at the City's sole election to enter onto said property described above for the purpose of repairing or maintaining the improvements. This provision shall not be construed as creating an obligation on the part of the City or its representatives to repair or maintain such improvements.

E. Corrections. Any corrections required by the City shall be commenced within ten (10) days of notification by the City and completed within thirty (30) days of the date of notification. If the work is not performed in a timely manner, the City shall have the right, without recourse to legal action, to take such action under this bond as described in Section D above.
F. **Extensions and Changes.** No change, extension of time, alteration or addition to the work to be performed by the Principal shall affect the obligation of the Principal or Surety on this bond, unless the City specifically agrees, in writing, to such alteration, addition, extension or change. The Surety waives notice of any such change, extension, alteration or addition thereunder.

G. **Enforcement.** It is specifically agreed by and between the parties that in the event any legal action must be taken to enforce the provisions of this bond or to collect said bond, the prevailing party shall be entitled to collect its costs and reasonable attorney fees as a part of the reasonable costs of securing the obligation hereunder. In the event of settlement or resolution of these issues prior to the filing of any suit, the actual costs incurred by the City, including reasonable attorney fees, shall be considered a part of the obligation hereunder secured. Said costs and reasonable legal fees shall be recoverable by the prevailing party, not only from the proceeds of this bond, but also over and above said bond as a part of any recovery (including recovery on the bond) in any judicial proceeding. The Surety hereby agrees that this Agreement shall be governed by the laws of the State of Washington. Venue of any litigation arising out of this Agreement shall be in King County Superior Court.

H. **Bond Expiration.** This bond shall remain in full force and effect until the obligations secured hereby have been fully performed and until released in writing by the City at the request of the Surety or Principal. The obligations of the Contractor and Surety under this bond are in addition to and do not limit or replace the obligations and duties under the Contract or otherwise.

I. **Bond Execution.** This bond may be executed in two (2) original counterparts, and shall be signed by the parties’ duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and authentic power of attorney for the officer executing on behalf of the surety.

DATED this ____ day of __________________, 2019.

SURETY COMPANY

CONTRACTOR

By: _____________________________
   Its ___________________________

By: _____________________________
   Its ___________________________

Business Name: __________________

Business Name: __________________

Business Address: _______________

Business Address: _______________

City/State/Zip Code: _____________

City/State/Zip Code: _____________

Telephone Number: ______________

Telephone Number: ______________
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INTRODUCTION TO THE SPECIAL PROVISIONS

(August 14, 2013 APWA GSP)

The work on this project shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, 2018 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter “Standard Specifications”). The Standard Specifications, as modified or supplemented by the Amendments to the Standard Specifications and these Special Provisions, all of which are made a part of the Contract Documents, shall govern all of the Work.

These Special Provisions are made up of both General Special Provisions (GSPs) from various sources, which may have project-specific fill-ins; and project-specific Special Provisions. Each Provision either supplements, modifies, or replaces the comparable Standard Specification, or is a new Provision. The deletion, amendment, alteration, or addition to any subsection or portion of the Standard Specifications is meant to pertain only to that particular portion of the section, and in no way should it be interpreted that the balance of the section does not apply.

The project-specific Special Provisions are not labeled as such. The GSPs are labeled under the headers of each GSP, with the effective date of the GSP and its source. For example:

(March 8, 2013 APWA GSP)
(April 1, 2013 WSDOT GSP)
(August 1, 2014 CoP GSP)

WSDOT General Special Provisions (and Bridges and Structures Special Provisions, if applicable) are similar to Standard Specifications in that they typically apply to many projects. Usually, the only difference from one project to another is the inclusion of variable project data, inserted as a “fill-in”.

APWA General Special Provisions are specifications developed by the American Public Works Association for use by local agencies.

Project Specific Special Provisions normally appear only in the contract for which they were developed.

Also incorporated into the Contract Documents by reference are:

- Manual on Uniform Traffic Control Devices for Streets and Highways, currently adopted edition, with Washington State modifications, if any
- Standard Plans for Road, Bridge and Municipal Construction, WSDOT/APWA, current edition

Contractor shall obtain copies of these publications, at Contractor’s own expense.

END OF SECTION
DIVISION 1 – GENERAL REQUIREMENTS

DESCRIPTION OF WORK
(March 13, 1995 WSDOT GSP)

This Contract provides for the improvement of sidewalk, driveway approaches, curb ramps, pavement, stormwater facilities, for the City of Pacific Public Works Shop located at 224 County Line Road SW, Pacific, WA 98047, and other work, all in accordance with the attached Contract Plans, these Contract Provisions, and the Standard Specifications.

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions
(January 4, 2016 APWA GSP)

Dates

Bid Opening Date
The date on which the Contracting Agency publicly opens and reads the Bids.

Award Date
The date of the formal decision of the Contracting Agency to accept the lowest responsible and responsive Bidder for the Work.

Contract Execution Date
The date the Contracting Agency officially binds the Agency to the Contract.

Notice to Proceed Date
The date stated in the Notice to Proceed on which the Contract time begins.

Substantial Completion Date
The day the Engineer determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the Physical Completion of the total Contract.

Physical Completion Date
The day all of the Work is physically completed on the project. All documentation required by the Contract and required by law does not necessarily need to be furnished by the Contractor by this date.

Completion Date
The day all the Work specified in the Contract is completed and all the obligations of the Contractor under the contract are fulfilled by the Contractor. All documentation required by the Contract and required by law must be furnished by the Contractor before establishment of this date.
Final Acceptance Date
The date on which the Contracting Agency accepts the Work as complete.

Supplement this Section with the following:

All references in the Standard Specifications, Amendments, or WSDOT General Special
Provisions, to the terms “Department of Transportation”, “Washington State Transportation
Commission”, “Commission”, “Secretary of Transportation”, “Secretary”, “Headquarters”, and
“State Treasurer” shall be revised to read “Contracting Agency”.

All references to the terms “State” or “state” shall be revised to read “Contracting Agency”
unless the reference is to an administrative agency of the State of Washington, a State
statute or regulation, or the context reasonably indicates otherwise.

All references to “State Materials Laboratory” shall be revised to read “Contracting Agency
designated location”.

All references to “final contract voucher certification” shall be interpreted to mean the
Contracting Agency form(s) by which final payment is authorized, and final completion and
acceptance granted.

Additive
A supplemental unit of work or group of bid items, identified separately in the Bid Proposal,
which may, at the discretion of the Contracting Agency, be awarded in addition to the base
bid.

Alternate
One of two or more units of work or groups of bid items, identified separately in the Bid
Proposal, from which the Contracting Agency may make a choice between different
methods or material of construction for performing the same work.

Business Day
A business day is any day from Monday through Friday except holidays as listed in Section
1-08.5.

Contract Bond
The definition in the Standard Specifications for “Contract Bond” applies to whatever bond
form(s) are required by the Contract Documents, which may be a combination of a Payment
Bond and a Performance Bond.

Contract Documents
See definition for “Contract”.

Contract Time
The period of time established by the terms and conditions of the Contract within which the
Work must be physically completed.

Notice of Award
The written notice from the Contracting Agency to the successful Bidder signifying the
Contracting Agency’s acceptance of the Bid Proposal.
Notice to Proceed
The written notice from the Contracting Agency or Engineer to the Contractor authorizing
and directing the Contractor to proceed with the Work and establishing the date on which
the Contract time begins.

Traffic
Both vehicular and non-vehicular traffic, such as pedestrians, bicyclists, wheelchairs, and
equestrian traffic.
1-02  BID PROCEDURES AND CONDITIONS

1-02.1  Prequalification of Bidders

Delete this Section and replace it with the following:

1-02.1 Qualifications of Bidder
(January 24, 2011 APWA GSP)

Before award of a public works contract, a bidder must meet at least the minimum qualifications of RCW 39.04.350(1) to be considered a responsible bidder and qualified to be awarded a public works project.

1-02.1(1)  Supplemental Qualifications Criteria
(July 31, 2017 APWA GSP)

In addition, the Contracting Agency has established Contracting Agency-specific and/or project-specific supplemental criteria, in accordance with RCW 39.04.350(3), for determining Bidder responsibility, including the basis for evaluation and the deadline for appealing a determination that a Bidder is not responsible. These criteria are contained in Section 1-02.14 Option B of these Special Provisions.

1-02.2 Plans and Specifications
(June 27, 2011 APWA GSP)

Delete this section and replace it with the following:

Information as to where Bid Documents can be obtained or reviewed can be found in the Call for Bids (Advertisement for Bids) for the work.

After award of the contract, plans and specifications will be issued to the Contractor at no cost as detailed below:

<table>
<thead>
<tr>
<th>To Prime Contractor</th>
<th>No. of Sets</th>
<th>Basis of Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced plans (11&quot; x 17&quot;)</td>
<td>2</td>
<td>Furnished automatically upon award.</td>
</tr>
<tr>
<td>Contract Provisions</td>
<td>2</td>
<td>Furnished automatically upon award.</td>
</tr>
<tr>
<td>Large plans (e.g., 22&quot; x 34&quot;)</td>
<td>2</td>
<td>Furnished only upon request.</td>
</tr>
</tbody>
</table>

Additional plans and Contract Provisions may be obtained by the Contractor from the source stated in the Call for Bids, at the Contractor’s own expense.

1-02.4  Examination of Plans, Specifications and Site of Work

1-02.4(2)  Subsurface Information
(March 8, 2013 APWA GSP)
The second sentence in the first paragraph is revised to read:

The Summary of Geotechnical Conditions and the boring logs, if and when included as an appendix to the Special Provisions, shall be considered as part of the Contract.

1-02.5 Proposal Forms
(July 31, 2017 APWA GSP)

Delete this section and replace it with the following:

The Proposal Form will identify the project and its location and describe the work. It will also list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for, but are not limited to, unit prices; extensions; summations; the total bid amount; signatures; date; and, where applicable, retail sales taxes and acknowledgment of addenda; the bidder’s name, address, telephone number, and signature; the bidder’s UDBE/DBE/M/WBE commitment, if applicable; a State of Washington Contractor’s Registration Number; and a Business License Number, if applicable. Bids shall be completed by typing or shall be printed in ink by hand, preferably in black ink. The required certifications are included as part of the Proposal Form.

The Contracting Agency reserves the right to arrange the proposal forms with alternates and additives, if such be to the advantage of the Contracting Agency. The bidder shall bid on all alternates and additives set forth in the Proposal Form unless otherwise specified.

1-02.6 Preparation of Proposal
(July 11, 2018 APWA GSP)

Supplement the second paragraph with the following:

4. If a minimum bid amount has been established for any item, the unit or lump sum price must equal or exceed the minimum amount stated.

5. Any correction to a bid made by interlineation, alteration, or erasure, shall be initialed by the signer of the bid.

Delete the last two paragraphs, and replace them with the following:

If no Subcontractor is listed, the Bidder acknowledges that it does not intend to use any Subcontractor to perform those items of work.

The Bidder shall submit with their Bid a completed Contractor Certification Wage Law Compliance form, provided by the Contracting Agency. Failure to return this certification as part of the Bid Proposal package will make this Bid Nonresponsive and ineligible for Award. A Contractor Certification of Wage Law Compliance form is included in the Proposal Forms.

The Bidder shall make no stipulation on the Bid Form, nor qualify the bid in any manner.

A bid by a corporation shall be executed in the corporate name, by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign).
A bid by a partnership shall be executed in the partnership name, and signed by a partner. A copy of the partnership agreement shall be submitted with the Bid Form if any UDBE requirements are to be satisfied through such an agreement.

A bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture. A copy of the joint venture agreement shall be submitted with the Bid Form if any UDBE requirements are to be satisfied through such an agreement.

1-02.7 Bid Deposit

(March 8, 2013 APWA GSP)

Supplement this section with the following:

Bid bonds shall contain the following:

1. Contracting Agency-assigned number for the project;
2. Name of the project;
3. The Contracting Agency named as obligee;
4. The amount of the bid bond stated either as a dollar figure or as a percentage which represents five percent of the maximum bid amount that could be awarded;
5. Signature of the bidder’s officer empowered to sign official statements. The signature of the person authorized to submit the bid should agree with the signature on the bond, and the title of the person must accompany the said signature;
6. The signature of the surety’s officer empowered to sign the bond and the power of attorney.

If so stated in the Contract Provisions, bidder must use the bond form included in the Contract Provisions.

If so stated in the Contract Provisions, cash will not be accepted for a bid deposit.

1-02.9 Delivery of Proposal

(******)

Delete this section and replace it with the following:

Each Proposal shall be submitted in a sealed envelope, with the Project Name and Project Number as stated in the Call for Bids clearly marked on the outside of the envelope, or as otherwise required in the Bid Documents, to ensure proper handling and delivery.

The Contracting Agency will not open or consider any Bid Proposal that is received after the time specified in the Call for Bids for receipt of Bid Proposals, or received in a location other than that specified in the Call for Bids.

1-02.10 Withdrawing, Revising, or Supplementing Proposal

(July 23, 2015 APWA GSP)

Delete this section, and replace it with the following:

After submitting a physical Bid Proposal to the Contracting Agency, the Bidder may withdraw, revise, or supplement it if:
1. The Bidder submits a written request signed by an authorized person and physically delivers it to the place designated for receipt of Bid Proposals, and

2. The Contracting Agency receives the request before the time set for receipt of Bid Proposals, and

3. The revised or supplemented Bid Proposal (if any) is received by the Contracting Agency before the time set for receipt of Bid Proposals.

If the Bidder’s request to withdraw, revise, or supplement its Bid Proposal is received before the time set for receipt of Bid Proposals, the Contracting Agency will return the unopened Proposal package to the Bidder. The Bidder must then submit the revised or supplemented package in its entirety. If the Bidder does not submit a revised or supplemented package, then its bid shall be considered withdrawn.

Late revised or supplemented Bid Proposals or late withdrawal requests will be date recorded by the Contracting Agency and returned unopened. Mailed, emailed, or faxed requests to withdraw, revise, or supplement a Bid Proposal are not acceptable.

1-02.13 Irregular Proposals

(June 20, 2017 APWA GSP)

Delete this section and replace it with the following:

1. A Proposal will be considered irregular and will be rejected if:
   a. The Bidder is not prequalified when so required;
   b. The authorized Proposal form furnished by the Contracting Agency is not used or is altered;
   c. The completed Proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
   d. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
   e. A price per unit cannot be determined from the Bid Proposal;
   f. The Proposal form is not properly executed;
   g. The Bidder fails to submit or properly complete a Subcontractor list, if applicable, as required in Section 1-02.6;
   h. The Bidder fails to submit or properly complete an Underutilized Disadvantaged Business Enterprise Certification, if applicable, as required in Section 1-02.6;
   i. The Bidder fails to submit written confirmation from each UDBE firm listed on the Bidder’s completed UDBE Utilization Certification that they are in agreement with the bidder's UDBE participation commitment, if applicable, as required in Section 1-02.6, or if the written confirmation that is submitted fails to meet the requirements of the Special Provisions;
   j. The Bidder fails to submit UDBE Good Faith Effort documentation, if applicable, as required in Section 1-02.6, or if the documentation that is submitted fails to demonstrate that a Good Faith Effort to meet the Condition of Award was made;
   k. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
   l. More than one Proposal is submitted for the same project from a Bidder under the same or different names.

2. A Proposal may be considered irregular and may be rejected if:
   a. The Proposal does not include a unit price for every Bid item;
b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Contracting Agency;
c. Receipt of Addenda is not acknowledged;
d. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
e. If Proposal form entries are not made in ink.

1-02.14 Disqualification of Bidders

(May 17, 2018 APWA GSP, Option B (modified))

Delete this section and replace it with the following:

A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1-7 listed in this Section.

The Contracting Agency will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1-2. Evidence that the Bidder meets Supplemental Criteria 3-7 shall be provided by the Bidder as stated later in this Section.

1. **Delinquent State Taxes**
   A. **Criterion:** The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

   B. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder does not owe delinquent taxes to the Washington State Department of Revenue, or if delinquent taxes are owed to the Washington State Department of Revenue, the Bidder must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency by the deadline listed below.

2. **Federal Debarment**
   A. **Criterion:** The Bidder shall not currently be debarred or suspended by the Federal government.

   B. **Documentation:** The Bidder shall not be listed as having an “active exclusion” on the U.S. government’s “System for Award Management” database (www.sam.gov).

3. **Subcontractor Responsibility**
   A. **Criterion:** The Bidder’s standard subcontract form shall include the subcontractor responsibility language required by RCW 39.06.020, and the Bidder shall have an established procedure which it utilizes to validate the responsibility of each of its subcontractors. The Bidder’s subcontract form shall also include a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also “responsible” subcontractors as defined by RCW 39.06.020.
B. **Documentation**: The Bidder, if and when required as detailed below, shall submit a copy of its standard subcontract form for review by the Contracting Agency, and a written description of its procedure for validating the responsibility of subcontractors with which it contracts.

4. **Claims Against Retainage and Bonds**

A. **Criterion**: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the three years prior to the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.

B. **Documentation**: The Bidder, if and when required as detailed below, shall submit a list of the public works projects completed in the three years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information:

- Name of project
- The owner and contact information for the owner;
- A list of claims filed against the retainage and/or payment bond for any of the projects listed;
- A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

5. **Public Bidding Crime**

A. **Criterion**: The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the five years prior to the bid submittal date.

B. **Documentation**: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

6. **Termination for Cause / Termination for Default**

A. **Criterion**: The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the five years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.

B. **Documentation**: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the five years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

7. **Lawsuits**
A. **Criterion:** The Bidder shall not have lawsuits with judgments entered against the Bidder in the five years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.

B. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the five years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the five years prior to the bid submittal date, along with a written explanation of the circumstances surrounding each such lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet terms of construction related contracts.

As evidence that the Bidder meets the Supplemental Criteria stated above, the apparent low Bidder must submit to the Contracting Agency by 12:00 P.M. (noon) of the second business day following the bid submittal deadline, a written statement verifying that the Bidder meets the supplemental criteria together with supporting documentation (sufficient in the sole judgment of the Contracting Agency) demonstrating compliance with the Supplemental Criteria. The Contracting Agency reserves the right to request further documentation as needed from the low Bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Contracting Agency also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and supplemental criteria, and to use that information in their evaluation. The Contracting Agency may consider mitigating factors in determining whether the Bidder complies with the requirements of the supplemental criteria.

The basis for evaluation of Bidder compliance with these mandatory and supplemental criteria shall include any documents or facts obtained by the Contracting Agency (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Contracting Agency from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Contracting Agency which is believed to be relevant to the matter.

If the Contracting Agency determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Contracting Agency shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within two (2) business days of the Contracting Agency's determination by presenting its appeal and any additional information to the Contracting Agency. The Contracting Agency will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Contracting Agency will not execute a contract with any other Bidder until at least two business days after the Bidder determined to be not responsible has received the Contracting Agency's final determination.
Request to Change Supplemental Bidder Responsibility Criteria Prior To Bid: Bidders with
concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility
Criteria may make or submit requests to the Contracting Agency to modify the criteria. Such
requests shall be in writing, describe the nature of the concerns, and propose specific
modifications to the criteria. Bidders shall submit such requests to the Contracting Agency no
later than five (5) business days prior to the bid submittal deadline and address the request to
the Project Engineer or such other person designated by the Contracting Agency in the Bid
Documents.

1-02.15 Pre Award Information
(August 14, 2013 APWA GSP)

Revise this section to read:

Before awarding any contract, the Contracting Agency may require one or more of these
items or actions of the apparent lowest responsible bidder:

1. A complete statement of the origin, composition, and manufacture of any or all materials
to be used,
2. Samples of these materials for quality and fitness tests,
3. A progress schedule (in a form the Contracting Agency requires) showing the order of
   and time required for the various phases of the work,
4. A breakdown of costs assigned to any bid item,
5. Attendance at a conference with the Engineer or representatives of the Engineer,
6. Obtain, and furnish a copy of, a business license to do business in the city or county
   where the work is located.
7. Any other information or action taken that is deemed necessary to ensure that the bidder
   is the lowest responsible bidder.
1-03 AWARD AND EXECUTION OF CONTRACT

1-03.1 Consideration of Bids
(January 23, 2006 APWA GSP)

Revise the first paragraph to read:

After opening and reading proposals, the Contracting Agency will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit will control. If a minimum bid amount has been established for any item and the bidder’s unit or lump sum price is less than the minimum specified amount, the Contracting Agency will unilaterally revise the unit or lump sum price, to the minimum specified amount and recalculate the extension. The total of extensions, corrected where necessary, including sales taxes where applicable and such additives and/or alternates as selected by the Contracting Agency, will be used by the Contracting Agency for award purposes and to fix the Awarded Contract Price amount and the amount of the contract bond.

1-03.1(1) Identical Bid Totals
(January 4, 2016 APWA GSP)

Revise this section to read:

After opening Bids, if two or more lowest responsive Bid totals are exactly equal, then the tiebreaker will be the Bidder with an equal lowest bid, that proposed to use the highest percentage of recycled materials in the Project, per the form submitted with the Bid Proposal. If those percentages are also exactly equal, then the tiebreaker will be determined by drawing as follows: Two or more slips of paper will be marked as follows: one marked “Winner” and the other(s) marked “unsuccessful”. The slips will be folded to make the marking unseen. The slips will be placed inside a box. One authorized representative of each Bidder shall draw a slip from the box. Bidders shall draw in alphabetic order by the name of the firm as registered with the Washington State Department of Licensing. The slips shall be unfolded and the firm with the slip marked “Winner” will be determined to be the successful Bidder and eligible for Award of the Contract. Only those Bidders who submitted a Bid total that is exactly equal to the lowest responsive Bid, and with a proposed recycled materials percentage that is exactly equal to the highest proposed recycled materials amount, are eligible to draw.

1-03.3 Execution of Contract
(October 1, 2005 APWA GSP)

Revise this section to read:

Copies of the Contract Provisions, including the unsigned Form of Contract, will be available for signature by the successful bidder on the first business day following award. The number of copies to be executed by the Contractor will be determined by the Contracting Agency.

Within $10 calendar days after the award date, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before
execution of the contract by the Contracting Agency, the successful bidder shall provide any
pre-award information the Contracting Agency may require under Section 1-02.15.

Until the Contracting Agency executes a contract, no proposal shall bind the Contracting
Agency nor shall any work begin within the project limits or within Contracting Agency-
furnished sites. The Contractor shall bear all risks for any work begun outside such areas
and for any materials ordered before the contract is executed by the Contracting Agency.

If the bidder experiences circumstances beyond their control that prevents return of the
contract documents within the calendar days after the award date stated above, the
Contracting Agency may grant up to a maximum of $10 additional calendar days for
return of the documents, provided the Contracting Agency deems the circumstances warrant
it.

1-03.4 Contract Bond
(July 23, 2015 APWA GSP)

Delete the first paragraph and replace it with the following:

The successful bidder shall provide executed payment and performance bond(s) for the full
contract amount. The bond may be a combined payment and performance bond; or be
separate payment and performance bonds. In the case of separate payment and
performance bonds, each shall be for the full contract amount. The bond(s) shall:
1. Be on Contracting Agency-furnished form(s);
2. Be signed by an approved surety (or sureties) that:
   a. Is registered with the Washington State Insurance Commissioner, and
   b. Appears on the current Authorized Insurance List in the State of Washington
      published by the Office of the Insurance Commissioner,
3. Guarantee that the Contractor will perform and comply with all obligations, duties, and
   conditions under the Contract, including but not limited to the duty and obligation to
   indemnify, defend, and protect the Contracting Agency against all losses and claims
   related directly or indirectly from any failure:
   a. Of the Contractor (or any of the employees, subcontractors, or lower tier
      subcontractors of the Contractor) to faithfully perform and comply with all contract
      obligations, conditions, and duties, or
   b. Of the Contractor (or the subcontractors or lower tier subcontractors of the
      Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors,
      material person, or any other person who provides supplies or provisions for carrying
      out the work;
4. Be conditioned upon the payment of taxes, increases, and penalties incurred on the
   project under titles 50, 51, and 82 RCW; and
5. Be accompanied by a power of attorney for the Surety’s officer empowered to sign the
   bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole
   proprietor or partner). If the Contractor is a corporation, the bond(s) must be signed by
   the president or vice president, unless accompanied by written proof of the authority of
   the individual signing the bond(s) to bind the corporation (i.e., corporate resolution,
   power of attorney, or a letter to such effect signed by the president or vice president).
Add the following at the end of this Section:

Maintenance Bond: The successful bidder shall provide an executed maintenance bond in the form provided in the Invitation.

1-03.7 Judicial Review
(July 23, 2015 APWA GSP)

Revise this section to read:

Any decision made by the Contracting Agency regarding the Award and execution of the Contract or Bid rejection shall be conclusive subject to the scope of judicial review permitted under Washington Law. Such review, if any, shall be timely filed in the Superior Court of the county where the Contracting Agency headquarters is located, provided that where an action is asserted against a county, RCW 36.01.05 shall control venue and jurisdiction.
1-04  SCOPE OF THE WORK

1-04.2 Coordination of Contract Documents, Plans, Special Provisions, Specifications, and Addenda

(March 13, 2012 APWA GSP)

Revise the second paragraph to read:

Any inconsistency in the parts of the contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 2 over 3, 3 over 4, and so forth):

1. Addenda,
2. Proposal Form,
3. Special Provisions,
4. Contract Plans,
5. Amendments to the Standard Specifications,
6. Standard Specifications,
7. Contracting Agency’s Standard Plans or Details (if any), and
8. WSDOT Standard Plans for Road, Bridge, and Municipal Construction.

1-04.5 Procedure and Protest by the Contractor

(*****)

Replace the first and second paragraphs and subsections 1 and 2(a) of the third paragraph of this Section with the following:

The Contractor accepts all requirements of a change order by: (1) endorsing it, (2) writing a separate acceptance, or (3) not protesting in the way this Section provides. A change order that is not protested as provided in this Section shall be full payment and final settlement of all claims for Contract Time and for all costs of any kind, including costs of delays, related to any Work either covered or affected by the change.

By not protesting as this Section provides, the Contractor waives any claim or entitlement to additional compensation, adjustment to the Contract Price, adjustment to the Contract Time, and any other legal or equitable relief. Also, by not protesting as provided by this Section the Contractor thereby accepts any written or oral order, change order, direction, instruction, interpretation, and determination issued by the Engineer.

If an occurrence, event, or action occurs whereby the Contractor believes it has or will have a right to additional compensation, adjustment to the Contract Price, adjustment to the Contract Time, legal or equitable relief, damages, or any modification or equitable adjustment of the terms of the Contract, or if the Contractor is in disagreement with anything required in a change order, another written order, an oral order, determination, or any other action by the Engineer, the Contractor shall:

1. Immediately give a signed written notice of protest to the Project Engineer or the Project Engineer’s field Inspectors before doing any Work related to the occurrence, event, or action that is the subject of the protest. In all cases, the notice of protest must be given within ten (10) calendar days of the occurrence, event, or action that is the subject of the protest. The notice of protest must include the date and description of the event, occurrence, or action together with a statement describing the anticipated effect of the event, occurrence, or action upon the Work and the Contract.
2. Supplement the written protest within fourteen (14) calendar days with a written statement and supporting documents providing the following:
   a. The date and nature of the occurrence, event, action, order, direction, instruction, interpretation, or determination that is the subject of the protest;
1-05 CONTROL OF WORK

1-05.4 Conformity With and Deviations from Plans and Stakes

Supplement this section with the following:

Roadway and Utility Surveys

(******)

Surveying, calculations, and measuring required for setting and maintaining the necessary lines and grades shall be the Contractor's responsibility.

The Contractor shall inform the Engineer when monuments are discovered that were not identified in the Plans, and which may be disturbed or damaged by construction activity. All monuments shall be protected or replaced at the Contractor's expense. Where monuments may be disturbed or replaced, the Contractor shall conform to the governing body's applicable requirements for such work.

The survey work shall include but not be limited to the following:

1. Verify the primary horizontal and vertical control furnished by the Contracting Agency, and expand into secondary control by adding stakes and hubs as well as any additional survey control needed for the project. Provide descriptions of secondary control to the Contracting Agency. The description shall include coordinates and elevations of all secondary control points.

2. For all other types of construction included in this provision, provide staking and layout as necessary to adequately locate, construct, and check the specific construction activity.

3. Provide survey offset points as required to establish line and grade for all underground utilities, structures and foundations.

4. Provide staking as necessary to grade the site as shown in the Contract Plans.

5. Record the vertical and horizontal locations of utilities located as part of the pre-construction investigations.

6. All other staking necessary to construct the improvements as shown in the Contract Plans.

The Contractor shall provide the Contracting Agency copies of any calculations and staking data when requested by the Project Engineer.

Measurement

No measurement will be made for the lump sum bid item “Construction Surveying and Staking”

Payment

Payment will be made in accordance with Section 1-04.1 for the following bid item when included in the proposal:

“Construction Surveying and Staking”, lump sum.

The lump sum contract price for “Construction Surveying and Staking” shall be full pay for all labor, equipment, materials, and supervision utilized to perform the Work specified, including
any resurveying, checking, correction of errors, replacement of missing or damaged hubs or stakes, and coordination efforts.

(*******)

The Contractor shall provide sufficient, safe, adequate space for the surveyors to set points and elevations, and shall use caution whenever it is necessary to have equipment working at the same time and in the same vicinity as the surveyors. Unsafe conditions will be reported to the Engineer. The surveyors may be withdrawn until corrective action is taken to the satisfaction of the Engineer.

The Engineer will determine what stakes are necessary to construct the project and at what intervals they shall be staked for each type of work. The Contractor shall assume full responsibility for the interpretation of these stakes and measurements from these hubs, stakes, or marks. If the Contractor notices any discrepancies in line or grade, he shall bring them to the immediate attention of the Engineer, prior to constructing the affected work.

The Contractor shall submit written staking requests to the inspector at least three (3) working days prior to commencement of any staking operations.

1-05.7 Removal of Defective and Unauthorized Work

(October 1, 2005 APWA GSP)

Supplement this section with the following:

If the Contractor fails to remedy defective or unauthorized work within the time specified in a written notice from the Engineer, or fails to perform any part of the work required by the Contract Documents, the Engineer may correct and remedy such work as may be identified in the written notice, with Contracting Agency forces or by such other means as the Contracting Agency may deem necessary.

If the Contractor fails to comply with a written order to remedy what the Engineer determines to be an emergency situation, the Engineer may have the defective and unauthorized work corrected immediately, have the rejected work removed and replaced, or have work the Contractor refuses to perform completed by using Contracting Agency or other forces. An emergency situation is any situation when, in the opinion of the Engineer, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

Direct or indirect costs incurred by the Contracting Agency attributable to correcting and remediing defective or unauthorized work, or work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Engineer from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor’s unauthorized work.

No adjustment in contract time or compensation will be allowed because of the delay in the performance of the work attributable to the exercise of the Contracting Agency’s rights provided by this Section.
The rights exercised under the provisions of this section shall not diminish the Contracting Agency’s right to pursue any other avenue for additional remedy or damages with respect to the Contractor’s failure to perform the work as required.

1-05.11 Final Inspection

Delete this section and replace it with the following:

1-05.11 Final Inspections and Operational Testing
(October 1, 2005 APWA GSP)

1-05.11(1) Substantial Completion Date

When the Contractor considers the work to be substantially complete, the Contractor shall so notify the Engineer and request the Engineer establish the Substantial Completion Date. The Contractor’s request shall list the specific items of work that remain to be completed in order to reach physical completion. The Engineer will schedule an inspection of the work with the Contractor to determine the status of completion. The Engineer may also establish the Substantial Completion Date unilaterally.

If, after this inspection, the Engineer concurs with the Contractor that the work is substantially complete and ready for its intended use, the Engineer, by written notice to the Contractor, will set the Substantial Completion Date. If, after this inspection the Engineer does not consider the work substantially complete and ready for its intended use, the Engineer will, by written notice, so notify the Contractor giving the reasons therefor.

Upon receipt of written notice concurring in or denying substantial completion, whichever is applicable, the Contractor shall pursue vigorously, diligently and without unauthorized interruption, the work necessary to reach Substantial and Physical Completion. The Contractor shall provide the Engineer with a revised schedule indicating when the Contractor expects to reach substantial and physical completion of the work.

The above process shall be repeated until the Engineer establishes the Substantial Completion Date and the Contractor considers the work physically complete and ready for final inspection.

1-05.11(2) Final Inspection and Physical Completion Date

When the Contractor considers the work physically complete and ready for final inspection, the Contractor, by written notice, shall request the Engineer to schedule a final inspection. The Engineer will set a date for final inspection. The Engineer and the Contractor will then make a final inspection and the Engineer will notify the Contractor in writing of all particulars in which the final inspection reveals the work incomplete or unacceptable. The Contractor shall immediately take such corrective measures as are necessary to remedy the listed deficiencies. Corrective work shall be pursued vigorously, diligently, and without interruption until physical completion of the listed deficiencies. This process will continue until the Engineer is satisfied the listed deficiencies have been corrected.

If action to correct the listed deficiencies is not initiated within 7 days after receipt of the written notice listing the deficiencies, the Engineer may, upon written notice to the
Contractor, take whatever steps are necessary to correct those deficiencies pursuant to Section 1-05.7.

The Contractor will not be allowed an extension of contract time because of a delay in the performance of the work attributable to the exercise of the Engineer’s right hereunder.

Upon correction of all deficiencies, the Engineer will notify the Contractor and the Contracting Agency, in writing, of the date upon which the work was considered physically complete. That date shall constitute the Physical Completion Date of the contract, but shall not imply acceptance of the work or that all the obligations of the Contractor under the contract have been fulfilled.

1-05.11(3) Operational Testing

It is the intent of the Contracting Agency to have at the Physical Completion Date a complete and operable system. Therefore when the work involves the installation of machinery or other mechanical equipment; street lighting, electrical distribution or signal systems; irrigation systems; buildings; or other similar work it may be desirable for the Engineer to have the Contractor operate and test the work for a period of time after final inspection but prior to the physical completion date. Whenever items of work are listed in the Contract Provisions for testing they shall be fully tested under operating conditions for the time period specified to ensure their acceptability prior to the Physical Completion Date.

Testing shall include testing of each equipment item installed and operational testing of the complete facility. During and following testing, the Contractor shall correct any items of workmanship, materials, or equipment which prove faulty, or that are not in first class operating condition. Equipment, electrical controls, meters, or other devices and equipment shall be tested under the observation of the Engineer, so that the Engineer may determine their suitability for the purpose for which they were installed. See Section 11-01.3(8) for startup and testing requirements, including:

- Equipment start-up and testing (must be completed to the satisfaction of the Engineer as a prerequisite to substantial completion)
- Pump station start-up and operational testing (must be completed to the satisfaction of the Engineer as a prerequisite to physical completion)

The costs for power, gas, labor, material, supplies, and everything else needed to successfully complete operational testing, shall be included in the unit contract prices related to the system being tested, unless specifically set forth otherwise in the proposal.

Operational and test periods, when required by the Engineer, shall not affect a manufacturer’s guaranties or warranties furnished under the terms of the contract.

1-05.12 Final Acceptance

Add the following new section:

1-05.12(1) One-Year Guarantee Period
(March 8, 2013 APWA GSP)
The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within one year after Final Acceptance of the Work. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Contracting Agency’s written notice of a defect, and shall complete such work within the time stated in the Contracting Agency’s notice. In case of an emergency, where damage may result from delay or where loss of services may result, such corrections may be made by the Contracting Agency’s own forces or another contractor, in which case the cost of corrections shall be paid by the Contractor. In the event the Contractor does not accomplish corrections within the time specified, the work will be otherwise accomplished and the cost of same shall be paid by the Contractor.

When corrections of defects are made, the Contractor shall then be responsible for correcting all defects in workmanship and materials in the corrected work for one year after acceptance of the corrections by Contracting Agency.

This guarantee is supplemental to and does not limit or affect the requirements that the Contractor’s work comply with the requirements of the Contract or any other legal rights or remedies of the Contracting Agency.

1-05.13 Superintendents, Labor and Equipment of Contractor
(August 14, 2013 APWA GSP)

Delete the sixth and seventh paragraphs of this section.

1-05.15 Method of Serving Notices
(March 25, 2009 APWA GSP)

Revise the second paragraph to read:

All correspondence from the Contractor shall be directed to the Project Engineer. All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, must be in paper format, hand delivered or sent via mail delivery service to the Project Engineer’s office. Electronic copies such as e-mails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

Add the following new section:

1-05.16 Water and Power
(October 1, 2005 APWA GSP)

The Contractor shall make necessary arrangements, and shall bear the costs for power and water necessary for the performance of the work, unless the contract includes power and water as a pay item.

Add the following new section:
1-05.17  Oral Agreements  
(October 1, 2005 APWA GSP)  

No oral agreement or conversation with any officer, agent, or employee of the Contracting 
Agency, either before or after execution of the contract, shall affect or modify any of the 
terms or obligations contained in any of the documents comprising the contract. Such oral 
agreement or conversation shall be considered as unofficial information and in no way 
binding upon the Contracting Agency, unless subsequently put in writing and signed by the 
Contracting Agency. 

Add the following new section: 

1-05.18  Record Drawings  
(March 8, 2013 APWA GSP)  

The Contractor shall maintain one set of full size plans for Record Drawings, updated with 
clear and accurate redlined field revisions on a daily basis, and within 2 business days after 
receipt of information that a change in Work has occurred. The Contractor shall not conceal 
any work until the required information is recorded. 

This Record Drawing set shall be used for this purpose alone, shall be kept separate from 
other Plan sheets, and shall be clearly marked as Record Drawings. These Record 
Drawings shall be kept on site at the Contractor’s field office, and shall be available for 
review by the Contracting Agency at all times. The Contractor shall bring the Record 
Drawings to each progress meeting for review. 

The preparation and upkeep of the Record Drawings is to be the assigned responsibility of a 
single, experienced, and qualified individual. The quality of the Record Drawings, in terms 
of accuracy, clarity, and completeness, is to be adequate to allow the Contracting Agency to 
modify the computer-aided drafting (CAD) Contract Drawings to produce a complete set of 
Record Drawings for the Contracting Agency without further investigative effort by the 
Contracting Agency. 

The Record Drawing markups shall document all changes in the Work, both concealed and 
visible. Items that must be shown on the markups include but are not limited to: 

- Actual dimensions, arrangement, and materials used when different than shown in the 
  Plans. 
- Changes made by Change Order or Field Order. 
- Changes made by the Contractor. 
- Accurate locations of storm sewer, sanitary sewer, water mains and other water 
  appurtenances, structures, conduits, light standards, vaults, width of roadways, 
  sidewalks, landscaping areas, building footprints, channelization and pavement 
  markings, etc. Include pipe invert elevations, top of castings (manholes, inlets, etc.). 

If the Contract calls for the Contracting Agency to do all surveying and staking, the 
Contracting Agency will provide the elevations at the tolerances the Contracting Agency 
requires for the Record Drawings.
When the Contract calls for the Contractor to do the surveying/staking, the applicable tolerance limits include, but are not limited to the following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>As-built sanitary &amp; storm invert and grate elevations</td>
<td>± 0.01 foot</td>
<td>± 0.01 foot</td>
</tr>
<tr>
<td>As-built monumentation</td>
<td>± 0.001 foot</td>
<td>± 0.001 foot</td>
</tr>
<tr>
<td>As-built waterlines, inverts, valves, hydrants</td>
<td>± 0.10 foot</td>
<td>± 0.10 foot</td>
</tr>
<tr>
<td>As-built ponds/swales/water features</td>
<td>± 0.10 foot</td>
<td>± 0.10 foot</td>
</tr>
<tr>
<td>As-built buildings (fin. Floor elev.)</td>
<td>± 0.01 foot</td>
<td>± 0.10 foot</td>
</tr>
<tr>
<td>As-built gas lines, power, TV, Tel, Com</td>
<td>± 0.10 foot</td>
<td>± 0.10 foot</td>
</tr>
<tr>
<td>As-built signs, signals, etc.</td>
<td>N/A</td>
<td>± 0.10 foot</td>
</tr>
</tbody>
</table>

Making Entries on the Record Drawings:

- Use erasable colored pencil (not ink) for all markings on the Record Drawings, conforming to the following color code:
  - Additions - Red
  - Deletions - Green
  - Comments - Blue
  - Dimensions - Graphite
- Provide the applicable reference for all entries, such as the change order number, the request for information (RFI) number, or the approved shop drawing number.
- Date all entries.
- Clearly identify all items in the entry with notes similar to those in the Contract Drawings (such as pipe symbols, centerline elevations, materials, pipe joint abbreviations, etc.).

The Contractor shall certify on the Record Drawings that said drawings are an accurate depiction of built conditions, and in conformance with the requirements detailed above. The Contractor shall submit final Record Drawings to the Contracting Agency. Contracting Agency acceptance of the Record Drawings is one of the requirements for achieving Physical Completion.

Payment will be made for the following bid item:

<table>
<thead>
<tr>
<th>Record Drawings</th>
<th>Lump Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Minimum Bid $ 5,000.00)</td>
<td></td>
</tr>
</tbody>
</table>

Payment for this item will be made on a prorated monthly basis for work completed in accordance with this section up to 75% of the lump sum bid. The final 25% of the lump sum item will be paid upon submittal and approval of the completed Record Drawings set prepared in conformance with these Special Provisions.

A minimum bid amount has been entered in the Bid Proposal for this item. The Contractor must bid at least that amount.
1-06 CONTROL OF MATERIAL

Section 1-06 is supplemented with the following:

1-06.1 Approval of Materials Prior to Use

Section 1-06.1 is supplemented as follows:

(******)

All notifications to the Engineer shall be at least seven (7) calendar days prior to use.

1-06.1(4) Fabrication Inspection Expense

(June 27, 2011 APWA GSP)

Delete this section in its entirety.

1-06.2(2) Statistical Evaluation of Materials for Acceptance

(******)

Section 1-06.2(2) shall not apply to this project.
1-07  LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 Laws to be Observed
(October 1, 2005 APWA GSP)

Supplement this section with the following:

In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

The Contractor shall maintain at the project site office, or other well-known place at the project site, all articles necessary for providing first aid to the injured. The Contractor shall establish, publish, and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor’s care, persons, including employees, who may have been injured on the project site. Employees should not be permitted to work on the project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor’s care.

The Contractor shall have sole responsibility for the safety, efficiency, and adequacy of the Contractor’s plant, appliances, and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation. The Contractor shall be solely and completely responsible for the conditions of the project site, including safety for all persons and property in the performance of the work. This requirement shall apply continuously, and not be limited to normal working hours. The required or implied duty of the Engineer to conduct construction review of the Contractor’s performance does not, and shall not, be intended to include review and adequacy of the Contractor’s safety measures in, on, or near the project site.

1-07.2 State Taxes

Delete this section, including its sub-sections, in its entirety and replace it with the following:

1-07.2 State Sales Tax
(June 27, 2011 APWA GSP)

The Washington State Department of Revenue has issued special rules on the State sales tax. Sections 1-07.2(1) through 1-07.2(3) are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Contracting Agency will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 1-07.2(2) describes this exception.

The Contracting Agency will pay the retained percentage (or release the Contract Bond if a FHWA-funded Project) only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid.
(RCW 60.28.051). The Contracting Agency may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to this contract or not. Any amount so deducted will be paid into the proper State fund.

1-07.2(1) State Sales Tax — Rule 171

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

1-07.2(2) State Sales Tax — Rule 170

WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Contracting Agency, retail sales tax on the full contract price. The Contracting Agency will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

Exception: The Contracting Agency will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

1-07.2(3) Services

The Contractor shall not collect retail sales tax from the Contracting Agency on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

1-07.4 Sanitation

Section 1-07.4 is supplemented with the following:

(******)

Portable Toilet Facility

The Contractor shall supply at least one portable toilet on the job site at all times when the Contractor has any employees on the job site performing contract work. Portable toilets shall be serviced on a weekly basis.
This item shall be included in the bid item for mobilization. An amount approximating the actual cost per week will be subtracted from the bid item for mobilization for each week the portable toilet is not supplied on the job site or serviced on a weekly basis.

1-07.5 Environmental Regulations

1-07.5(1) General

Section 1-07.5(1) is supplemented with the following:

(August 1, 2014 CoP GSP)

No construction related activity shall contribute to the degradation of the environment, allow material to enter surface or ground waters, or allow particulate emissions to the atmosphere, which exceed state or federal standards. Any actions that potentially allow a discharge to state waters must have prior approval of the Washington State Department of Ecology.

1-07.6 Permits and Licenses

Section 1-07.6 is supplemented with the following:

(January 2, 2018)

The Contracting Agency has obtained the below-listed permit(s) for this project. A copy of the permit(s) is attached as an appendix for informational purposes. Copies of these permits, including a copy of the Transfer of Coverage form, when applicable, are required to be onsite at all times.

Contact with the permitting agencies, concerning the below-listed permit(s), shall be made through the Engineer with the exception of when the Construction Stormwater General Permit coverage is transferred to the Contractor, direct communication with the Department of Ecology is allowed. The Contractor shall be responsible for obtaining Ecology’s approval for any Work requiring additional approvals (e.g. Request for Chemical Treatment Form). The Contractor shall obtain additional permits as necessary. All costs to obtain and comply with additional permits shall be included in the applicable Bid items for the Work involved.

- Fire Hydrant Use Permit
- Business License
- Permit for Work in Street Right of Way

1-07.7 Load Limits

Section 1-07.7 is supplemented with the following:

(March 13, 1995 WSDOT GSP)

If the sources of materials provided by the Contractor necessitate hauling over roads other than State Highways, the Contractor shall, at the Contractor’s expense, make all arrangements for the use of the haul routes.
1-07.9 Wages

General

Section 1-07.9(1) is supplemented with the following:

(January 5, 2018 WSDOT GSP, Option 1)

The Federal wage rates incorporated in this contract have been established by the Secretary of Labor under United States Department of Labor General Decision No. WA180001.

The State rates incorporated in this contract are applicable to all construction activities associated with this contract.

1-07.13 Contractor’s Responsibility for Work

1-07.13(4) Repair of Damage

Section 1-07.13(4) is revised to read:

******

The Contractor shall promptly repair all damage to either temporary or permanent work as directed by the Engineer. For damage qualifying for relief under Sections 1-07.13(1), 1-07.13(2) or 1-07.13(3), payment will be made in accordance with Section 1-09.4. Payment will be limited to repair of damaged work only. No payment will be made for delay or disruption of work.

1-07.16 Protection and Restoration of Property

1-07.16(2) Vegetation Protection and Restoration

Section 1-07.16(2) is supplemented with the following:

(August 2, 2010 WSDOT GSP)

Vegetation and soil protection zones for trees shall extend out from the trunk to a distance of 1-foot radius for each inch of trunk diameter at breast height.

Vegetation and soil protection zones for shrubs shall extend out from the stems at ground level to twice the radius of the shrub.

Vegetation and soil protection zones for herbaceous vegetation shall extend to encompass the diameter of the plant as measured from the outer edge of the plant.

1-07.17 Utilities and Similar Facilities

Section 1-07.17 is supplemented with the following:

(April 2, 2007 WSDOT GSP)
Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification.

Public and private utilities, or their Contractors, will furnish all work necessary to adjust, relocate, replace, or construct their facilities unless otherwise provided for in the Plans or these Special Provisions. Such adjustment, relocation, replacement, or construction will be done during the prosecution of the work for this project. It is anticipated that utility adjustment, relocation, replacement, or construction within the project limits will be completed as follows:

**Utility pole relocation as indicated in the Plans.**

The Contractor shall attend a mandatory utility preconstruction meeting with the Engineer, all affected Subcontractors, and all utility owners and their Contractors prior to beginning onsite work.

The following addresses and telephone numbers of utility companies or their Contractors that will be adjusting, relocating, replacing, or constructing utilities within the project limits are supplied for the Contractor’s use:

**Puget Sound Energy (PSE)**
Hong Nguyen, Project Manager
Phone: (425) 395-6904

**Century Link**
Alex Harb
Phone: (206) 345-4476
Alex.Harb@centuryLink.com

**Comcast**
Jerry Steele
Phone: (253) 288-7532
Email: Jerry_Steele2@Cable.Comcast.com

**Other utility contacts for the project include:**
City of Pacific – Sanitary Sewer and Water
Attn: Jim Schunke
253-929-1116
jschunke@ci.pacific.wa.us

**1-07.18 Public Liability and Property Damage Insurance**

*Delete this section in its entirety, and replace it with the following:*

**1-07.18 Public Liability and Property Damage Insurance**

Delete this section in its entirety, and replace it with the following:

**1-07.18 Insurance**

*(January 4, 2016 APWA GSP (Modified)*
1-07.18(1) General Requirements

A. The Contractor shall procure and maintain the insurance described in all subsections of section 1-07.18 of these Special Provisions, from insurers with a current A.M. Best rating of not less than A-. VII and licensed to do business in the State of Washington. The Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer’s financial condition.

B. The Contractor shall keep this insurance in force without interruption from the commencement of the Contractor’s Work through the term of the Contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated below.

C. If any insurance policy is written on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall state that coverage is claims made, and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Completion Date or earlier termination of this Contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period (“tail”) or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.

D. The Contractor’s Automobile Liability, Commercial General Liability and Excess or Umbrella Liability insurance policies shall be primary and non-contributory insurance as respects the Contracting Agency’s insurance, self-insurance, or self-insured pool coverage. Any insurance, self-insurance, or self-insured pool coverage maintained by the Contracting Agency shall be excess of the Contractor’s insurance and shall not contribute with it.

E. The Contractor shall provide the Contracting Agency and all additional insureds with written notice of any policy cancellation, within two business days of their receipt of such notice.

F. The Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the Contracting Agency.

G. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the Contracting Agency may, after giving five business days’ notice to the Contractor to correct the breach, immediately terminate the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Contracting Agency on demand, or at the sole discretion of the Contracting Agency, offset against funds due the Contractor from the Contracting Agency.

H. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the Contract and no additional payment will be made.

I. Products and Completed Operations coverage shall be provided for a period of 3 years following Substantial Completion of the Work.

1-07.18(2) Additional Insured

All insurance policies, with the exception of Workers Compensation, and of Professional Liability and Builder’s Risk (if required by this Contract) shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:
the Contracting Agency and its officers, elected officials, employees, agents, and volunteers

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 1-07.18(4) describes limits lower than those maintained by the Contractor.

For Commercial General Liability insurance coverage, the required additional insured endorsements shall be at least as broad as ISO forms CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

1-07.18(3) Subcontractors

The Contractor shall cause each Subcontractor of every tier to provide insurance coverage that complies with all applicable requirements of the Contractor-provided insurance as set forth herein, except the Contractor shall have sole responsibility for determining the limits of coverage required to be obtained by Subcontractors.

The Contractor shall ensure that all Subcontractors of every tier add all entities listed in 1-07.18(2) as additional insureds, and provide proof of such on the policies as required by that section as detailed in 1-07.18(2) using an endorsement as least as broad as ISO CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

Upon request by the Contracting Agency, the Contractor shall forward to the Contracting Agency evidence of insurance and copies of the additional insured endorsements of each Subcontractor of every tier as required in 1-07.18(4) Verification of Coverage.

1-07.18(4) Verification of Coverage

The Contractor shall deliver to the Contracting Agency a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. Failure of Contracting Agency to demand such verification of coverage with these insurance requirements or failure of Contracting Agency to identify a deficiency from the insurance documentation provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

Verification of coverage shall include:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in 1-07.18(2) as additional insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement.
3. Any other amendatory endorsements to show the coverage required herein.
4. A notation of coverage enhancements on the Certificate of Insurance shall not satisfy these requirements – actual endorsements must be submitted.

Upon request by the Contracting Agency, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s). If Builders Risk insurance is required on this Project, a full and certified copy of that policy is required when the Contractor delivers the signed Contract for the work.
1-07.18(5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Contractor’s maintenance of insurance, its scope of coverage, and limits as required herein shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the Contracting Agency’s recourse to any remedy available at law or in equity.

All deductibles and self-insured retentions must be disclosed and are subject to approval by the Contracting Agency. The cost of any claim payments falling within the deductible or self-insured retention shall be the responsibility of the Contractor. In the event an additional insured incurs a liability subject to any policy’s deductibles or self-insured retention, said deductibles or self-insured retention shall be the responsibility of the Contractor.

1-07.18(5)A Commercial General Liability

Commercial General Liability insurance shall be written on coverage forms at least as broad as ISO occurrence form CG 00 01, including but not limited to liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract. There shall be no exclusion for liability arising from explosion, collapse or underground property damage.

The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

Contractor shall maintain Commercial General Liability Insurance arising out of the Contractor’s completed operations for at least three years following Substantial Completion of the Work.

Such policy must provide the following minimum limits:

- $2,000,000 Each Occurrence
- $2,000,000 General Aggregate
- $2,000,000 Products & Completed Operations Aggregate
- $2,000,000 Personal & Advertising Injury each offense
- $1,000,000 Stop Gap / Employers’ Liability each accident

1-07.18(5)B Automobile Liability

Automobile Liability shall cover owned, non-owned, hired, and leased vehicles; and shall be written on a coverage form at least as broad as ISO form CA 00 01. If the work involves the transport of pollutants, the automobile liability policy shall include MCS 90 and CA 99 48 endorsements.

Such policy must provide the following minimum limit:

- $2,000,000 Combined single limit each accident

1-07.18(5)C Workers’ Compensation

The Contractor shall comply with Workers’ Compensation coverage as required by the Industrial Insurance laws of the State of Washington.

1-07.18(5)D Excess or Umbrella Liability

(January 4, 2016 APWA GSP)
The Contractor shall provide Excess or Umbrella Liability insurance with limits of not less than $2 Million Dollars ($2,000,000) each occurrence and annual aggregate. This excess or umbrella liability coverage shall be excess over and as least as broad in coverage as the Contractor’s Commercial General and Auto Liability insurance.

All entities listed under 1-07.18(2) of these Special Provisions shall be named as additional insureds on the Contractor’s Excess or Umbrella Liability insurance policy.

This requirement may be satisfied instead through the Contractor’s primary Commercial General and Automobile Liability coverages, or any combination thereof that achieves the overall required limits of insurance.

**1-07.18(5)E LHWCA Insurance**  
(January 4, 2016 APWA GSP)

If this Contract involves work on or adjacent to Navigable Waters of the United States, the Contractor shall procure and maintain insurance coverage in compliance with the statutory requirements of the U.S. Longshore and Harbor Workers’ Compensation Act (LHWCA).

Such policy must provide the following minimum limits:

- $1,000,000 Bodily Injury by Accident – each accident
- $1,000,000 Bodily Injury by Disease – each employee
- $1,000,000 Bodily Injury by Disease – policy limits

**1-07.18(5)J Pollution Liability**  
(January 4, 2016 APWA GSP)

The Contractor shall provide a Contractors Pollution Liability policy, providing coverage for claims involving bodily injury, property damage (including loss of use of tangible property that has not been physically injured), cleanup costs, remediation, disposal or other handling of pollutants, including costs and expenses incurred in the investigation, defense, or settlement of claims, arising out of any one or more of the following:

1. Contractor’s operations related to this project.
2. Remediation, abatement, repair, maintenance or other work with lead-based paint or materials containing asbestos.
3. Transportation of hazardous materials away from any site related to this project.

All entities listed under 1-07.18(2) of these Special Provisions shall be named by endorsement as additional insureds on the Contractors Pollution Liability insurance policy.

Such Pollution Liability policy shall provide the following minimum limits:

- $2,000,000 each loss and annual aggregate

**1-07.18(5)K Professional Liability**  
(January 4, 2016 APWA GSP)

The Contractor and/or its Subcontractor(s) and/or its design consultant providing construction management, value engineering, or any other design-related non-construction professional services shall provide evidence of Professional Liability insurance covering professional errors and omissions.

Such policy shall provide the following minimum limits:

- $1,000,000 per claim and annual aggregate
If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability insurance shall include coverage for Environmental Professional Liability.

If insurance is on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract.

1-07.23 Public Convenience and Safety

1-07.23(1) Construction Under Traffic
(May 2, 2017 APWA GSP)

Revise the third sentence of the second paragraph to read:

Accessibility to existing or temporary pedestrian push buttons shall not be impaired; if approved by the Contracting Agency activating pedestrian recall timing or other accommodation may be allowed during construction.

1-07.24 Rights of Way
(July 23, 2015 APWA GSP)

Delete this section and replace it with the following:

Street Right of Way lines, limits of easements, and limits of construction permits are indicated in the Plans. The Contractor’s construction activities shall be confined within these limits, unless arrangements for use of private property are made.

Generally, the Contracting Agency will have obtained, prior to bid opening, all rights of way and easements, both permanent and temporary, necessary for carrying out the work. Exceptions to this are noted in the Bid Documents or will be brought to the Contractor’s attention by a duly issued Addendum.

Whenever any of the work is accomplished on or through property other than public Right of Way, the Contractor shall meet and fulfill all covenants and stipulations of any easement agreement obtained by the Contracting Agency from the owner of the private property. Copies of the easement agreements may be included in the Contract Provisions or made available to the Contractor as soon as practical after they have been obtained by the Engineer.

Whenever easements or rights of entry have not been acquired prior to advertising, these areas are so noted in the Plans. The Contractor shall not proceed with any portion of the work in areas where right of way, easements or rights of entry have not been acquired until the Engineer certifies to the Contractor that the right of way or easement is available or that the right of entry has been received. If the Contractor is delayed due to acts of omission on the part of the Contracting Agency in obtaining easements, rights of entry or right of way, the Contractor will be entitled to an extension of time. The Contractor agrees that such delay shall not be a breach of contract.

Each property owner shall be given 48 hours notice prior to entry by the Contractor. This includes entry onto easements and private property where private improvements must be adjusted.

The Contractor shall be responsible for providing, without expense or liability to the Contracting Agency, any additional land and access thereto that the Contractor may desire for temporary construction facilities, storage of materials, or other Contractor needs.
However, before using any private property, whether adjoining the work or not, the Contractor shall file with the Engineer a written permission of the private property owner, and, upon vacating the premises, a written release from the property owner of each property disturbed or otherwise interfered with by reasons of construction pursued under this contract. The statement shall be signed by the private property owner, or proper authority acting for the owner of the private property affected, stating that permission has been granted to use the property and all necessary permits have been obtained or, in the case of a release, that the restoration of the property has been satisfactorily accomplished. The statement shall include the parcel number, address, and date of signature. Written releases must be filed with the Engineer before the Completion Date will be established.
1-08 PROSECUTION AND PROGRESS

Add the following new section:

1-08.0 Preliminary Matters

(May 25, 2006 APWA GSP)

Add the following new section:

1-08.0(1) Preconstruction Conference

(October 10, 2008 APWA GSP)

Add the following new section:

1-08.0 Preliminary Matters

(May 25, 2006 APWA GSP)

Add the following new section:

1-08.0(1) Preconstruction Conference

(October 10, 2008 APWA GSP)

Prior to the Contractor beginning the work, a preconstruction conference will be held between the Contractor, the Engineer and such other interested parties as may be invited. The purpose of the preconstruction conference will be:

1. To review the initial progress schedule;
2. To establish a working understanding among the various parties associated or affected by the work;
3. To establish and review procedures for progress payment, notifications, approvals, submittals, etc.;
4. To establish normal working hours for the work;
5. To review safety standards and traffic control; and
6. To discuss such other related items as may be pertinent to the work.

The Contractor shall prepare and submit at the preconstruction conference the following:

1. A breakdown of all lump sum items;
2. A preliminary schedule of working drawing submittals; and
3. A list of material sources for approval if applicable.

(******)

The Contractor shall request the preconstruction conference a minimum of 10 calendar days prior to the start of construction. The actual date of the preconstruction conference will depend on availability of City staff and the various parties associated with the work.

Add the following new section:

1-08.0(2) Hours of Work

(******)
Except in the case of emergency or unless otherwise approved by the Contracting Agency, the normal straight time working hours for the contract shall be any consecutive 8-hour period between 8:00 a.m. and 5:00 p.m. of a working day with a maximum 1-hour lunch break and Monday through Friday work week. The normal straight time 8-hour working period for the contract shall be established at the preconstruction conference or prior to the Contractor commencing the work.

If a Contractor desires to perform work on holidays, Saturdays, Sundays, or before 8:00 a.m. or after 5:00 p.m. on any day, the Contractor shall apply in writing to the Engineer for permission to work such times. Permission to work longer than an 8-hour period between 8:00 a.m. and 5:00 p.m. is not required. Such requests shall be submitted to the Engineer no later than noon on the working day prior to the day for which the Contractor is requesting permission to work.

The Contractor shall comply with local ordinances. Normal hours of work are limited from 8:00 AM to 6:00 PM. The Contractor has full responsibility for confining his operations to these hours and obtaining any needed waivers. Permission to work outside these hours may be granted on a case-by-case through the Engineer. Approval to continue work during these hours may be revoked at any time the Contractor exceeds the noise control regulations or complaints are received from the public or adjoining property owners regarding the noise or light glare from the Contractor’s operations. The Contractor shall have no claim for damages or delays should such permission be revoked for these reasons.

Permission to work Saturdays, Sundays, holidays or other than the agreed upon normal straight time working hours Monday through Friday may be given subject to certain other conditions set forth by the Contracting Agency or Engineer. These conditions may include but are not limited to: requiring the Engineer or such assistants as the Engineer may deem necessary to be present during the work; requiring the Contractor to reimburse the Contracting Agency for the costs in excess of straight-time costs for Contracting Agency employees who worked during such times, on non-Federal aid projects; considering the work performed on Saturdays, Sundays, and holidays as working days with regards to the Contract Time. Assistants may include, but are not limited to, survey crews; inspectors; and other Contracting Agency employees when in the opinion of the Engineer, such work necessitates their presence.

Add the following new section:

1-08.0(3) Reimbursement for Overtime Work of Contracting Agency Employees

(*****)

Where the Contractor elects to work on a Saturday, Sunday, or holiday, or longer than an 8-hour work shift on a regular working day, as defined in the Standard Specifications, such work shall be considered as overtime work. On all such overtime work an inspector will be present, and a survey crew may be required at the discretion of the Engineer. In such case, the Contracting Agency may deduct from amounts due or to become due to the Contractor for the costs in excess of the straight-time costs for employees of the Contracting Agency required to work overtime hours.

The minimum overtime pay is two (2) hours at one and one-half (1½) time City rates on weekdays (before or after normal work hours), Saturday, Sunday, or holidays.

The Contractor by these specifications does hereby authorize the Engineer to deduct such costs from the amount due or to become due to the Contractor.
1-08.3 Progress Schedule

1-08.3(2A) Type A Progress Schedule
(March 13, 2012 APWA GSP)

Revise this section to read:

The Contractor shall submit copies of a Type A Progress Schedule no later than at the preconstruction conference, or some other mutually agreed upon submittal time. The schedule may be a critical path method (CPM) schedule, bar chart, or other standard schedule format. Regardless of which format used, the schedule shall identify the critical path. The Engineer will evaluate the Type A Progress Schedule and approve or return the schedule for corrections within 15 calendar days of receiving the submittal.

1-08.4 Prosecution of Work

Delete this section and replace it with the following:

1-08.4 Notice to Proceed and Prosecution of Work

(******)

Notice to Proceed will be given after the contract has been executed and the contract bond and evidence of insurance have been approved and filed by the Contracting Agency. The Contractor shall not commence with the work until the Notice to Proceed has been given by the Engineer. Immediately following issuance of the Notice to Proceed, the Contractor shall begin procuring materials with extended lead times including, but not limited to, pumps, control systems, structures and generators. The Contractor shall commence physical construction activities on the project site immediately following delivery of all extended lead time materials and equipment, unless otherwise approved in writing. The Contractor shall diligently pursue the work to the physical completion date within the time specified in the contract. Voluntary shutdown or slowing of operations by the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

When shown in the Plans, the first order of work shall be the installation of high visibility fencing to delineate all areas for protection or restoration, as described in the Contract. Installation of high visibility fencing adjacent to the roadway shall occur after the placement of all necessary signs and traffic control devices in accordance with 1-10.1(2). Upon construction of the fencing, the Contractor shall request the Engineer to inspect the fence. No other work shall be performed on the site until the Contracting Agency has accepted the installation of high visibility fencing, as described in the Contract.

1-08.5 Time for Completion

1-08.5 Time for Completion
(September 12, 2016 APWA GSP, Option A (modified))

Revise the third and fourth paragraphs to read:

Contract Time shall begin on the first working day following the Notice to Proceed Date.

Each working day shall be charged to the contract as it occurs, until the contract work is physically complete. If substantial completion has been granted and all the authorized working days have been used, charging of working days will cease. Each week the
Engineer will provide the Contractor a statement that shows the number of working days: (1) charged to the contract the week before; (2) specified for the physical completion of the contract; and (3) remaining for the physical completion of the contract. The statement will also show the nonworking days and any partial or whole day the Engineer declares as unworkable. Within 10 calendar days after the date of each statement, the Contractor shall file a written protest of any alleged discrepancies in it. To be considered by the Engineer, the protest shall be in sufficient detail to enable the Engineer to ascertain the basis and amount of time disputed. By not filing such detailed protest in that period, the Contractor shall be deemed as having accepted the statement as correct.

Revise the sixth paragraph to read:

The Engineer will give the Contractor written notice of the completion date of the contract after all the Contractor’s obligations under the contract have been performed by the Contractor. The following events must occur before the Completion Date can be established:

1. The physical work on the project must be complete; and
2. The Contractor must furnish all documentation required by the contract and required by law, to allow the Contracting Agency to process final acceptance of the contract. The following documents must be received by the Project Engineer prior to establishing a completion date:
   a. Material Acceptance Certification Documents
   b. Monthly Reports of Amounts Credited as DBE Participation, as required by the Contract Provisions.
   c. Final Contract Voucher Certification
   d. Copies of the approved “Affidavit of Prevailing Wages Paid” for the Contractor and all Subcontractors
   e. Property owner releases per Section 1-07.24

Section 1-08.5 is supplemented with the following:

(******)
This project shall be physically completed within ***_______*** working days.

1-08.9 Liquidated Damages
(August 14, 2013 APWA GSP)

Revise the fourth paragraph to read:

When the Contract Work has progressed to Substantial Completion as defined in the Contract, the Engineer may determine that the work is Substantially Complete. The Engineer will notify the Contractor in writing of the Substantial Completion Date. For overruns in Contract Time occurring after the date so established, the formula for liquidated damages shown above will not apply. For overruns in Contract Time occurring after the
Substantial Completion Date, liquidated damages shall be assessed on the basis of direct
engineering and related costs assignable to the project until the actual Physical Completion
Date of all the Contract Work. The Contractor shall complete the remaining Work as
promptly as possible. Upon request by the Project Engineer, the Contractor shall furnish a
written schedule for completing the physical Work on the Contract.
1-09  MEASUREMENT AND PAYMENT

1-09.6 Force Account
(October 10, 2008 APWA GSP)

Supplement this section with the following:

The Contracting Agency has estimated and included in the Proposal, dollar amounts for all
items to be paid per force account, only to provide a common proposal for Bidders. All such
dollar amounts are to become a part of Contractor’s total bid. However, the Contracting
Agency does not warrant expressly or by implication that the actual amount of work will
correspond with those estimates. Payment will be made on the basis of the amount of work
actually authorized by Engineer.

1-09.9 Payments
(March 13, 2012 APWA GSP)

Delete the first four paragraphs and replace them with the following:

The basis of payment will be the actual quantities of Work performed according to the
Contract and as specified for payment.

The Contractor shall submit a breakdown of the cost of lump sum bid items at the
Preconstruction Conference, to enable the Project Engineer to determine the Work
performed on a monthly basis. A breakdown is not required for lump sum items that include
a basis for incremental payments as part of the respective Specification. Absent a lump
sum breakdown, the Project Engineer will make a determination based on information
available. The Project Engineer’s determination of the cost of work shall be final.

Progress payments for completed work and material on hand will be based upon progress
estimates prepared by the Engineer. A progress estimate cutoff date will be established at
the preconstruction conference.

The initial progress estimate will be made not later than 30 days after the Contractor
commences the work, and successive progress estimates will be made every month
thereafter until the Completion Date. Progress estimates made during progress of the work
are tentative, and made only for the purpose of determining progress payments. The
progress estimates are subject to change at any time prior to the calculation of the final
payment.

The value of the progress estimate will be the sum of the following:

1. Unit Price Items in the Bid Form — the approximate quantity of acceptable units of
   work completed multiplied by the unit price.

2. Lump Sum Items in the Bid Form — based on the approved Contractor’s lump sum
   breakdown for that item, or absent such a breakdown, based on the Engineer’s
determination.

3. Materials on Hand — 100 percent of invoiced cost of material delivered to Job site or
   other storage area approved by the Engineer.

4. Change Orders — entitlement for approved extra cost or completed extra work as
determined by the Engineer.

Progress payments will be made in accordance with the progress estimate less:
1. Retainage per Section 1-09.9(1), on non FHWA-funded projects;
2. The amount of progress payments previously made; and
3. Funds withheld by the Contracting Agency for disbursement in accordance with the
   Contract Documents.

Progress payments for work performed shall not be evidence of acceptable performance or
an admission by the Contracting Agency that any work has been satisfactorily completed.
The determination of payments under the contract will be final in accordance with Section
1-05.1.

(March 13, 2012 APWA GSP)
Supplement this section with the following:

Lump sum item breakdowns are not required when the bid price for the lump sum item is
less than $20,000.

1-09.9(1) Retainage
Section 1-09.9(1) content and title is deleted and replaced with the following:

(June 27, 2011 WSDOT GSP)

1-09.11(3) Time Limitation and Jurisdiction
(July 23, 2015 APWA GSP)
Revise this section to read:

For the convenience of the parties to the Contract it is mutually agreed by the parties that
any claims or causes of action which the Contractor has against the Contracting Agency
arising from the Contract shall be brought within 180 calendar days from the date of final
acceptance (Section 1-05.12) of the Contract by the Contracting Agency and it is further
agreed that any such claims or causes of action shall be brought only in the Superior Court
of the county where the Contracting Agency headquarters is located, provided that where an
action is asserted against a county, RCW 36.01.05 shall control venue and jurisdiction. The
parties understand and agree that the Contractor’s failure to bring suit within the time period
provided, shall be a complete bar to any such claims or causes of action. It is further
mutually agreed by the parties that when any claims or causes of action which the
Contractor asserts against the Contracting Agency arising from the Contract are filed with
the Contracting Agency or initiated in court, the Contractor shall permit the Contracting
Agency to have timely access to any records deemed necessary by the Contracting Agency
to assist in evaluating the claims or action.

1-09.12 Audits
1-09.12(1) General
(August 1, 2014 CoP GSP)
Supplement this section with the following:
The Contractor shall provide for the safe access to the construction site and to the 
Contractor’s records by Washington State Department of Ecology personnel.

All instances in this section referring to the Contracting Agency shall also refer to the 
Washington State Department of Ecology.

1-09.13 Claims Resolution

1-09.13(3) Claims $250,000 or Less

(October 1, 2005 APWA GSP)

Delete this section and replace it with the following:

The Contractor and the Contracting Agency mutually agree that those claims that total 
$250,000 or less, submitted in accordance with Section 1-09.11 and not resolved by 
nonbinding ADR processes, shall be resolved through litigation unless the parties mutually 
agree in writing to resolve the claim through binding arbitration.
1-10  TEMPORARY TRAFFIC CONTROL

1-10.2 Traffic Control Management

1-10-2(1) General

Section 1-10.2(1) is supplemented with the following:

(January 3, 2017 WSDOT GSP, Option 1)

Only training with WSDOT TCS card and WSDOT training curriculum is recognized in the State of Washington. The Traffic Control Supervisor shall be certified by one of the following:

The Northwest Laborers-Employers Training Trust
27055 Ohio Ave.
Kingston, WA 98346
(360) 297-3035

Evergreen Safety Council
12545 135th Ave. NE
Kirkland, WA 98034-8709
1-800-521-0778

The American Traffic Safety Services Association
15 Riverside Parkway, Suite 100
Fredericksburg, Virginia 22406-1022
Training Dept. Toll Free (877) 642-4637
Phone: (540) 368-1701

1-10.4 Measurement

1-10.4(1) Lump Sum Bid for Project (No Unit Items)

Section 1-10.4(1) is supplemented with the following:

(August 2, 2004 WSDOT GSP)

The proposal contains the item “Project Temporary Traffic Control”, lump sum. The provisions of Section 1-10.4(1) shall apply.

END OF SECTION

END OF DIVISION
DIVISION 2 – EARTHWORK

2-02  REMOVAL OF STRUCTURES AND OBSTRUCTIONS

2-02.4 Measurement

Section 2-02.4 is supplemented with the following:

(October 25, 2018 CoP GSP)

Sawcutting Pavement will be measured by the linear foot.

2-02.5 Payment

Section 2-02.5 is supplemented with the following:

(October 25, 2018 CoP GSP)

“Sawcutting Pavement”, per linear foot.

END OF SECTION

END OF DIVISION
DIVISION 5 – SURFACE TREATMENTS AND PAVEMENTS

5-04 HOT MIX ASPHALT

5-04.2 Materials

Section 5-04.2 is supplemented with the following:

(January 3, 2011 WSDOT GSP)

ESALs

The number of ESALs for the design and acceptance of the HMA shall be 160,000 for 10-
year design life overlay and 387,000 for 20-year design life reconstruction.

5-04.3 Construction Requirements

5-04.3(8)A5 Test Results

(January 16, 2014 APWA GSP)

The first paragraph of this section is deleted.

5-04.3(8)A6 Test Methods

(January 16, 2014 APWA GSP)

Delete this section and replace it with the following:

Testing of HMA for compliance of Va will be at the option of the Contracting Agency. If
tested, compliance of Va will be use WSDOT Standard Operating Procedure SOP 731.

Testing for compliance of asphalt binder content will be by WSDOT FOP for AASHTO T
308. Testing for compliance of gradation will be by WAQTC FOP for AASHTO T 27/T 11.

5-04.3(8)A7 Test Section - HMA Mixtures

The first sentence of Section 5-04.3(8)A7 is revised to read:

(March 3, 2014 WSDOT GSP)

For each class of HMA accepted by statistical evaluation, the Contractor may request a test
section to determine whether the mixture meets the requirements of Section 9-03.8(2)
excluding Hamburg Wheel-Track Testing and Indirect Tensile Strength of Bituminous
Materials and Section 9-03.8(6).

Section 5-04.3(8)A7 is supplemented with the following:

(January 6, 2014 WSDOT GSP)

The following requirements shall apply to mix designs with greater than 20 percent RAP by
weight or RAS:

For each class of HMA accepted by statistical evaluation, the Contractor shall construct a
test section to determine whether the mixture meets the requirements of Sections 9-03.8(2)
and 9-03.8(6). The test section shall be constructed at the beginning of paving and will be at least 600 tons and a maximum of 1,000 tons or as approved by the Project Engineer. No further wearing or leveling HMA will be paved on any of the four calendar days following the construction of the test section. The mixture in the test section will be evaluated as a lot with a minimum of three sublots required. If more than one test section is required, each test section shall be a separate lot.

For a test section to be acceptable the pay factor (PF) for gradation, asphalt binder and Va shall be 0.95 or greater for each constituent and the remaining test requirements in Section 9-03.8(2) (dust/asphalt ratio, sand equivalent, uncompacted void and fracture) shall conform to the requirements of that section. When the pay factor for any item is less than 0.95, the Contractor shall make adjustments to the mixture in accordance with Section 9-03.8(7) and construct a new test section. The Project Engineer may waive the requirement for the construction of a new test section.

5-04.3(13) Surface Smoothness

*The second sentence of Section 5-04.3(13) is revised to read:*

*(January 5, 2004 WSDOT GSP)*

The completed surface of the wearing course shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline.

5-04.3(14) Planing Bituminous Pavement

*Section 5-04.3(14) is supplemented with the following:*

*(January 5, 2004 WSDOT GSP)*

The Contractor shall perform the planing operations no more than 7 calendar days ahead of the time the planed area is to be paved with HMA, unless otherwise allowed by the Engineer in writing.

*(January 5, 2004 WSDOT GSP)*

At the start of the planing operation, the Contractor shall plane a 500-foot test section to be evaluated by the Engineer for compliance with the surface tolerance requirements. The test section shall have a minimum width of 10 feet. If the planing is in accordance with the surface tolerance requirements, the Contractor may begin production planing. If the planing is not in conformance with the surface tolerance requirements, the Contractor shall make adjustments to the planing operation and then plane another test section.

If at any time during the planing operation the Engineer determines the required surface tolerance is not being achieved, the Contractor shall stop planing. Planing shall not resume until the Engineer is satisfied that specification planing can be produced or until successful completion of another test section. The forward speed during production planing shall not exceed the speed used for the test section.

The completed surface after planing and prior to paving shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel or transverse to
the centerline. The planed surface shall have a matted texture and the difference between
the high and low of the matted surface shall not exceed 1/8 inch.

Pavement repair operations, when required, shall be accomplished prior to planing.

(March 13, 1995 WSDOT GSP)

**Vertical Edge Planing**
During planing of bituminous pavement in the travelled lanes, the Contractor shall
coordinate the planing and paving operations such that the planed roadway surface shall not
remain unpaved at the end of the workday. The Contractor shall have a contingency plan to
ensure that no planed areas remain unpaved due to equipment breakdown or other
emergency.

(August 3, 2009 WSDOT GSP)

**Beveled Edge Planing**
A beveled edge shall be constructed in areas that will not be paved during the same work
shift.

The Contractor shall use a beveled cutter on the mandrel of the planing equipment, or other
approved method(s), to eliminate the vertical edge(s). The beveled edge(s) shall be
constructed at a 4:1 slope.

END OF SECTION

END OF DIVISION
DIVISION 7 – DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS,
WATER MAINS, AND CONDUITS

7-04 STORM SEWERS

7-04.2 Materials

Section 7-04.2 is supplemented with the following:

Ductile Iron Pipe (DIP) 9-30.1(1)

7-04.4 Measurement

Section 7-04.4 is supplemented with the following:

Ductile Iron Pipe (DIP) shall be measured by the linear foot.

7-04.5 Payment

Section 7-04.5 is supplemented with the following:

“Ductile Iron Storm Sewer Pipe __ In. Diam.”, per linear foot.

END OF SECTION
DIVISION 8 – MISCELLANEOUS CONSTRUCTION

8-01 EROSION CONTROL AND WATER POLLUTION CONTROL

8-01.3 Construction Requirements

8-01.3(1) General

8-01.3(1)A Submittals

Section 8-01.3(1)A is revised to read:

In accordance with the National Pollutant Discharge Elimination System (NPDES) permit, the Contractor shall develop a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the 2016 King County Surface Water Design Manual, Chapter II. The Contractor shall incorporate the SWPPP implementation schedule into the Contractor’s progress schedule. The SWPPP and implementation schedule shall be submitted in accordance with 1-05.3 and 1-08.3.

The SWPPP is considered a “living” document that shall be revised to account for additional erosion control/pollution prevention BMPs as they become necessary and are implemented in the field during project construction. A copy of the most current SWPPP shall remain on site at all times and an additional copy shall be forwarded to the Engineer. At the Contractor’s preference, revisions to the SWPPP may be forwarded to the Engineer rather than submitting a complete document. Revisions to the SWPPP may be kept on-site in a file along with the original SWPPP document.

Prior to beginning any concrete or grinding work, the Contractor shall submit a plan, for the Engineer’s review and approval, outlining the procedures to be used to prevent high pH stormwater or dewatering water from entering surface waters. The plan shall include how the pH of the water will be maintained between pH 6.5 and pH 8.5 prior to being discharged from the project or entering surface waters.

8-01.3(2) Seeding, Fertilizing, and Mulching

8-01.3(2)B Seeding and Fertilizing by Hand

Section 8-01.3(2)B is supplemented with the following:

Seed rate of the Bioswale mix shall be 435 Pounds Pure Live Seed (PLS) Per Acre

Seed for the Filter strip areas shall match Mix 1 of Table 6.3.1C, “Grass Seed Mixes Suitable for Bioswale Treatment Areas”. (page 6-50)

The seed shall be certified in accordance with WAC 16-302 and meet the following requirements:

Prohibited Weed 0% max.
Noxious Weed 0% max.
Other Weed 0.20% max.
Other Crop 0.40% max.
8-01.4 Measurement

Section 8-01.4 is supplemented with the following:

No specific unit of measurement shall apply to the lump sum item “Stormwater Pollution Prevention Plan (SWPPP)."

The unit Contract price per acre for “Seeding and Fertilizing by Hand" shall be full pay for all costs necessary to grade, supply and place Bioretention Soil Media, seed, water (until grass is established), clean surrounding areas, remove and dispose of all debris, inspect, and obtain approval from the City.

8-01.5 Payment

Section 8-01.5 is supplemented with the following:

“Stormwater Pollution Prevention Plan (SWPPP)”, per lump sum

The lump sum contract price for “Stormwater Pollution Prevention Plan (SWPPP)” shall be full pay for all costs, including but not limited to, preparing, submitting, revising, and resubmitting revisions for the Stormwater Pollution Prevention Plan and monthly electronic discharge monitoring and reporting.

All costs associated with the treatment of pH in high pH stormwater or dewatering water shall be included in the applicable concrete, grinding or sawcutting items of work.

“Seeding and Fertilizing by Hand”, per acre

All costs associated with the establishment of the grass surface in the filter strip areas.
8-02 ROADSIDE RESTORATION

8-02.2 Materials

Section 8-02.2 is supplemented with the following:

Bioretention Soil Media (BSM) 9-14.1(4)

8-02.3 Construction Requirements

8-02.3(5) Planting Area Preparation

Section 8-02.3(5) is supplemented with the following:

After initial area weed control, grading, and soil placement are completed, all soil shall be covered with compost.

Prior to the placement and incorporation of compost, the application and incorporation methods shall be approved by the Engineer.

Compost shall not be placed when a condition exists, such as frozen or water saturated soil that may be detrimental to successful application, incorporation, or soil structure.

The Contractor shall notify the Engineer a minimum of five working days prior to the start of compost work.

Compost shall be uniformly and evenly placed in all designated areas at a depth of two inches.

After placement of the compost, the Contractor shall incorporate the layer uniformly into the existing soil to a depth of six inches.

END OF SECTION
8-04 CURBS, GUTTERS, AND SPILLWAYS

8-04.3 Construction Requirements

Section 8-04.3 is supplemented with the following:

8-04.3(5) Precast Concrete Wheel Stop with Drain

Precast concrete wheel stop with drain shall be 72 inches long, 6-inches high, and a minimum of 9-inches wide at the base. Minimum 1-1/2-inch high drain slots shall make up at least 50% of the length. Wheel stops shall be precast using air entrained concrete Class 4000, with a minimum of two #4 reinforcing bars running the length of the cast. Two 1” fastening holes shall be cast into the wheel stop to allow the wheel stop to be staked in place. The wheel stops shall be staked in place with a minimum #4 reinforcing bar driven a minimum of 1 foot into the ground. Excess reinforcing bar shall be cut flush or recessed from the top of the wheel stop. Void space around the rebar shall be filled with epoxy grout compound and struck off flush with the top of the wheel stop.

8-04.4 Measurement

Section 8-04.4 is supplemented with the following:

Precast concrete wheel stop with drain will be measured per each wheel stop delivered and installed in place.

8-04.5 Payment

Section 8-04.5 is supplemented with the following:

“Precast Concrete Wheel Stop with Drain”, per each.

The unit Contract price per each “Precast Concrete Wheel Stop with Drain” shall be full payment for all costs for the specified work including furnishing, delivery, and installation of the wheel stops.

END OF SECTION
8-14 CEMENT CONCRETE SIDEWALKS

8-14.3 Construction Requirements

Section 8-14.3 is supplemented with the following:

The Contractor shall request a pre-meeting with the Engineer to be held 2 to 5 working days before any work can start on cement concrete sidewalks, curb ramps or other pedestrian access routes to discuss construction requirements. Those attending shall include:

1. The Prime Contractor and Subcontractor in charge of constructing forms, and placing, and finishing the cement concrete.

2. Project Engineer (or representative) and Project Inspectors for the cement concrete sidewalk, curb ramp or pedestrian access route Work.

Items to be discussed in this meeting shall include, at a minimum, the following:

1. Slopes shown on the Plans.

2. Inspection

3. Traffic control

4. Pedestrian control, access routes and delineation

5. Accommodating utilities

6. Form work

7. Installation of detectable warning surfaces

END OF SECTION

END OF DIVISION
DIVISION 9 – MATERIALS

9-02 BITUMINOUS MATERIALS
(April 2, 2018)

9-02.1 Asphalt Material, General

The second paragraph is revised to read:

The Asphalt Supplier of Performance Graded (PG) asphalt binder and emulsified asphalt shall have a Quality Control Plan (QCP) in accordance with WSDOT QC 2 “Standard Practice for Asphalt Suppliers That Certify Performance Graded and Emulsified Asphalts”. The Asphalt Supplier’s QCP shall be submitted and receive the acceptance of the WSDOT State Materials Laboratory. Once accepted, any change to the QCP will require a new QCP to be submitted for acceptance. The Asphalt Supplier of PG asphalt binder and emulsified asphalt shall certify through the Bill of Lading that the PG asphalt binder or emulsified asphalt meets the Specification requirements of the Contract.

9-02.1(4) Performance Graded Asphalt Binder (PGAB)

This section’s title is revised to read:

9-02.1(4) Performance Graded (PG) Asphalt Binder

The first paragraph is revised to read:

PG asphalt binder meeting the requirements of AASHTO M 332 Table 1 of the grades specified in the Contract shall be used in the production of HMA. For HMA with greater than 20 percent RAP by total weight of HMA, or any amount of RAS, the new asphalt binder, recycling agent and recovered asphalt (RAP and/or RAS) when blended in the proportions of the mix design shall meet the PG asphalt binder requirements of AASHTO M 332 Table 1 for the grade of asphalt binder specified by the Contract.

The second paragraph, including the table, is revised to read:

In addition to AASHTO M 332 Table 1 specification requirements, PG asphalt binders shall meet the following requirements:

<table>
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<tr>
<th>Property</th>
<th>Test Method</th>
<th>PG58S-22</th>
<th>PG58H-22</th>
<th>PG58V-22</th>
<th>PG64S-28</th>
<th>PG64H-28</th>
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<td>RTFO Residue: Average Percent Recovery @ 3.2 kPa</td>
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<td>20% Min.</td>
<td>25% Min.</td>
<td>30% Min.</td>
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</table>

¹Specimen conditioned in accordance with AASHTO T 240 – RTFO.

The third paragraph is revised to read:
The RTFO $J_{n,diff}$ and the PAV direct tension specifications of AASHTO M 332 are not required.

*This section is supplemented with the following:*

If the asphalt binder verification sample test results fail to meet AASHTO Test Method T 350 “Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)” for average percent recovery @ 3.2 kPa for the applicable grades of binder in accordance with Section 9-02.1(4), the Contracting Agency may elect to test the sample using AASHTO Test Method T 301 “Standard Method of Test for Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer.”

When AASHTO T 301 is used, a minimum of 65% elastic recovery (ER) will be required when tested at 25°C ± 0.5°C.

9-02.1(6) **Cationic Emulsified Asphalt**

*This section is revised to read:*

Cationic Emulsified Asphalt meeting the requirements of AASHTO M 208 Table 1 of the grades specified in the Contract shall be used.

9-02.5 **Warm Mix Asphalt (WMA) Additive**

*This section, including title, is revised to read:*

9-02.5 **HMA Additive**

Additives for HMA shall be accepted by the Engineer.

**END OF SECTION**
APPENDICES

(January 2, 2012 WSDOT GSP)

The following appendices are attached and made a part of this contract:

APPENDIX A:
Washington State Prevailing Wage Rates

APPENDIX B:
Federal Prevailing Wage Rates

APPENDIX C:
Geotechnical Engineering Report, Milwaukee Boulevard Sidewalk Project and Roadway Improvements, Pacific, WA

APPENDIX D:
Geotechnical Engineering Report, Supplement No. 1, Stormwater Retrofit and LID Grant Projects, Milwaukee Boulevard Sidewalk Project and Roadway Improvements, Pacific, WA

END OF SECTION
STANDARD PLANS
(January 7, 2019)

The State of Washington Standard Plans for Road, Bridge and Municipal Construction M21-01 transmitted under Publications Transmittal No. PT 16-048, effective August 6, 2018 is made a part of this contract.

The Standard Plans are revised as follows:

A-40.10
Section View, PCCP to HMA Longitudinal Joint, callout, was – “Sawed Groove ~ Width 3/16” (IN) MIN. to 5/16” (IN) MAX. ~ Depth 1” (IN) MIN. ~ see Std. Spec. 5-04.3(12)B“ is revised to read; “Sawed Groove ~ Width 3/16” (IN) MIN. to 5/16” (IN) MAX. ~ Depth 1” (IN) MIN. ~ see Std. Spec. Section 5-04.3(12)A2”

A-50.10
Sheet 2 of 2, Plan, with Single Slope Barrier, reference C-14a is revised to C-70.10

A-50.20
Sheet 2 of 2, Plan, with Anchored Barrier, reference C-14a is revised to C-70.10

A-50.30
Sheet 2 of 2, Plan (top), reference C-14a is revised to C-70.1

B-10.60
DELETED

B-82.20
DELETED

B-90.40
Valve Detail - DELETED

C-2C
CASE 9A (typical of 2 callouts): The dimensions were “3'-0” MIN. ~ TO FACE OF GUARDRAIL”. are now revised to read “5'-0” MIN ~ TO FACE OF GUARDRAIL”.

C-4b
DELETED

C-4e
DELETED

C-4f
Sheet 1, BULLNOSE GRADING PLAN: Slopes shall be not steeper than 10H:1V for the bullnose guardrail system including slopes into the guardrail face to 1 foot behind the guardrail post.

Sheet 2, POST 1R & 1L, 2R & 2L, 3R TO 8R and 3L TO 8L, 9R TO 12 R and 9L TO
12L elevation view details: Slopes into the guardrail face to 1 foot behind the guardrail post shall not be steeper than 10H:1V.

Sheet 3, SECTION B, callout – was: “THE NUT SHALL BE ASTM A563D STEEL, AND GALVANIZED ACCORDING TO STANDARD SPEC. 9-16.3(3).” Is revised to read: “THE NUT SHALL BE ASTM A307 STEEL, AND GALVANIZED ACCORDING TO STANDARD SPEC. 9-16.3(3).”

C-20.14
CASE 3-31: The dimension was “5'-0” MIN” from the back of guardrail to the center of railroad signal support is now revised to “5'-0” MIN” from face of guardrail to the front edge of the railroad signal support.

Note 3, was – “The slope from the edge of the shoulder into the face of the guardrail cannot exceed 10H : 1V when the face of the guardrail is less than 12’ – 0” from the edge of the shoulder.” is revised to read: “The slope from the edge of the shoulder into the face of the guardrail cannot be steeper than 10H : 1V when the face of the guardrail is less than 12’ – 0” from the edge of the shoulder. The slope from the edge of the shoulder into the face of the guardrail cannot be steeper than 6H : 1V when the guardrail is 12’ – 0” or more from the edge of the shoulder.”

C-20.18
ALL CASES: The dimensions were “3'-0” MIN” from the face of guardrail to the front edge of the fixed feature are now revised to “5'-0” MIN” from the face of guardrail to the front edge of the fixed feature.

Note 1, was – “The slope from the edge of the shoulder into the face of the guardrail should not exceed 10H : 1V when the guardrail is within 12’ – 0” from the edge of the shoulder.” Is revised to read: “The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 10H : 1V when the guardrail is less than 12’ – 0” from the edge of the shoulder. The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 6H : 1V when the guardrail is 12’ – 0” or more from the edge of shoulder.”

C-22.14
DELETED

C-22.16
Note 3, formula, was: “Elevation G = (Elevation S – D x (0.1) + 31” is revised to read: “Elevation G = (Elevation S – D x (0.1) + 31/12”

C-22.40
PLAN VIEW, MSKT-SP-MGS (TL-3) SHOWN: The dimension was “4'-0” MIN” from the 2 face of the terminal to the edge of the widened embankment is now revised to “4'-0” MIN” from the back of the terminal post to the edge of the widened embankment.

Elevation View, MSKT-SP-MGS (TL-3), dimension, MSKT-SP-MGS (TL-3) SYSTEM LENGTH = 50’ – 0”, dimension is revised to read: 46’ – 101/2”

C-22.45
PLAN VIEW, MSKT-SP-MGS (TL-2) SHOWN: The dimension was “4’-0” MIN” from the face of the terminal to the edge of the widened embankment is now revised to “4’-0” MIN” from the back of the terminal post to the edge of the widened embankment.

Elevation View, MSKT-SP-MGS (TL-2), dimension, MSKT-SP-MGS (TL-2) SYSTEM LENGTH = 25’ – 0”, dimension is revised to read 34’ – 4 1/2”

Elevation View, SOFTSTOP (TL-2), dimension, SOFTSTOP (TL-2) SYSTEM LENGTH = 38’ – 3 1/2”, dimension is revised to read 38’ – 4 1/2”

Note 6, was “…flare of 38.29 : 1 or flatter is allowed over the system length of 38’ – 3 ½” with a maximum…” is revised to read: “…flare of 38.38 : 1 or flatter is allowed over the system length of 38’ – 4 ½” with a maximum…”

C-25.26
Elevation View, TYPE 23: The guardrail height dimension was 2’-8” from the top of the thrie beam to the top of the bridge curb is now revised to 2’-8” from the top of the thrie beam to the top of the ground line.

C-25.80
Plan View, callout, was – “12” (IN) BLOCKOUT” is revised to read; “12” (IN) or 8” (IN) BLOCKOUT (12” (IN) SHOWN)”

Elevation View, add labels to posts (below view); beginning at left side of view – Label Posts as follows; POST 1, POST 2 through POST 6”.

General Notes, add Note 6. Note reads as follows; “6. Post 1 shall use an 8 inch blockout, and posts 2 through post 6 shall use 12 inch or 8 inch blockouts.”

C-40.14
DELETED

C-90.10
DELETED

D-10.10
Wall Type 1 may be used if no traffic barrier is attached on top of the wall. Walls with traffic barriers attached on top of the wall are considered non-standard and shall be designed in accordance with the current WSDOT Bridge Design Manual (BDM) and the revisions stated in the 11/3/15 Bridge Design memorandum.

D-10.15
Wall Type 2 may be used if no traffic barrier is attached on top of the wall. Walls with traffic barriers attached on top of the wall are considered non-standard and shall be designed in accordance with the current WSDOT BDM and the revisions stated in the 11/3/15 Bridge Design memorandum.

D-10.20
Wall Type 3 may be used in all cases. The last sentence of Note 6 on Wall Type 3 shall be revised to read: The seismic design of these walls has been completed using a site adjusted (effective) peak ground acceleration of 0.32g.
D-10.25
Wall Type 4 may be used in all cases. The last sentence of Note 6 on Wall Type 4 shall be revised to read: The seismic design of these walls has been completed using a site adjusted (effective) peak ground acceleration of 0.32g.

D-10.30
Wall Type 5 may be used in all cases.

D-10.35
Wall Type 6 may be used in all cases.

D-10.40
Wall Type 7 may be used if no traffic barrier is attached on top of the wall. Walls with traffic barriers attached on top of the wall are considered non-standard and shall be designed in accordance with the current WSDOT BDM and the revisions stated in the 11/3/15 Bridge Design memorandum.

D-10.45
Wall Type 8 may be used if no traffic barrier is attached on top of the wall. Walls with traffic barriers attached on top of the wall are considered non-standard and shall be designed in accordance with the current WSDOT BDM and the revisions stated in the revisions stated in the 11/3/15 Bridge Design memorandum.

D-15.10
STD Plans D-15 series “Traffic Barrier Details for Reinforced Concrete Retaining Walls” are withdrawn. Special designs in accordance with the current WSDOT BDM are required in place of these STD Plans.

D-15.20
STD Plans D-15 series “Traffic Barrier Details for Reinforced Concrete Retaining Walls” are withdrawn. Special designs in accordance with the current WSDOT BDM are required in place of these STD Plans.

D-15.30
STD Plans D-15 series “Traffic Barrier Details for Reinforced Concrete Retaining Walls” are withdrawn. Special designs in accordance with the current WSDOT BDM are required in place of these STD Plans.

F-10.12
Section Title, was – “Depressed Curb Section” is revised to read: “Depressed Curb and Gutter Section”

F-10.40
"EXTRUDED CURB AT CUT SLOPE", Section detail - Deleted

F-10.42
DELETE – “Extruded Curb at Cut Slope” View

H-70.20
Sheet 2, Spacing Detail, Mailbox Support Type 1, reference to Standard Plan I-70.10 is revised to H-70.10
I-30.30

8" Diameter Wattle Spacing Table, lower left corner, was – “Slope: 1H : 1V, Maximum Spacing: 10’ – 0’” is revised to read: “Slope: 1H : 1V, Maximum Spacing: 8’ – 0’”.

J-10.21

Note 18, was – “When service cabinet is installed within right of way fence, see Standard Plan J-10.22 for details.” Is revised to read: “When service cabinet is installed within right of way fence, or the meter base is mounted on the exterior of the cabinet, see Standard Plan J-10.22 for details.”

J-10.22

Key Note 1, was – “Meter base per serving utility requirements~ as a minimum, the meter base shall be safety socket box with factory-installed test bypass facility that meets the requirements of EUSERC drawing 305.” Is revised to read; “Meter base per serving utility requirements~ as a minimum, the meter base shall be safety socket box with factory-installed test bypass facility that meets the requirements of EUSERC drawing 305. When the utility requires meter base to be mounted on the side or back of the service cabinet, the meter base enclosure shall be fabricated from type 304 stainless steel.”

Key Note 4, “Test with (SPDT Snap Action, Positive close 15 Amp – 120/277 volt “T” rated).” Is revised to read: “Test Switch (SPDT snap action, positive close 15 amp – 120/277 volt “T” rated).”

Key Note 14, was – “Hinged dead front with ¼ turn fasteners or slide latch.” Is revised to read; “Hinged dead front with ¼ turn fasteners or slide latch. ~ Dead front panel bolts shall not extend into the vertical limits of the breaker array(s).”

Key Note 15, was – “Cabinet Main Bonding Jumper. Buss shall be 4 lug tinned copper. See Cabinet Main bonding Jumper detail, Standard Plan J-3b.” is revised to read; “Cabinet Main Bonding Jumper Assembly ~ Buss shall be 4 lug tinned copper ~ See Standard Plan J-10.20 for Cabinet Main Bonding Jumper Assembly details.”

Note 1, was – “…socket box mounting detail, see Standard Plan J-3b.” is revised to read: “…socket box mounting detail, see Standard Plan J-10.20.”

Note 6, was – “…See door hinge detail, Standard Plan J-3b.” is revised to read: “…See door hinge detail, Standard Plan J-10.20.”

J-20.10

Add Note 5, “5. One accessible pedestrian signal assembly per pedestrian pushbutton post.”

J-20.11

Sheet 2, Foundation Detail, Elevation, callout – “Type 1 Signal Pole” is revised to read: “Type PS or Type 1 Signal Pole”

Sheet 2, Foundation Detail, Elevation, add note below Title, “(Type 1 Signal Pole Shown)”

Add Note 6, “6. One accessible pedestrian signal assembly per pedestrian pushbutton post.”

J-20.26

Add Note 1, “1. One accessible pedestrian pushbutton station per pedestrian pushbutton post.”

J-20.16

View A, callout, was – LOCK NIPPLE, is revised to read; CHASE NIPPLE

J-21.10
Sheet 1, Elevation View, Round Concrete Foundation Detail, callout – “ANCHOR BOLTS ~ ¾” (IN) x 30” (IN) FULL THREAD ~ THREE REQ’D. PER ASSEMBLY” IS REVISED TO READ: “ANCHOR BOLTS ~ ¾” (IN) x 30” (IN) FULL THREAD ~ FOUR REQ’D. PER ASSEMBLY”.

Sheet 1 of 2, Elevation view (Round), add dimension depicting the distance from the top of the foundation to find 2 #4 reinforcing bar shown, to read; 3” CLR. Delete “(TYP.)” from the 2 ½” CLR. dimension, depicting the distance from the bottom of the foundation to find 2 # 4 reinf. Bar.

Sheet 1 of 2, Elevation view (Square), add dimension depicting the distance from the top of the foundation to find 1 #4 reinforcing bar shown, to read; 3” CLR. Delete “(TYP.)” from the 2 ½” CLR. dimension, depicting the distance from the bottom of the foundation to find 1 # 4 reinf. Bar.

Sheet 2 of 2, Elevation view (Round), add dimension depicting the distance from the top of the foundation to find 2 #4 reinforcing bar shown, to read; 3” CLR. Delete “(TYP.)” from the 2 ½” CLR. dimension, depicting the distance from the bottom of the foundation to find 2 # 4 reinf. Bar.

Sheet 2 of 2, Elevation view (Square), add dimension depicting the distance from the top of the foundation to find 1 #4 reinforcing bar shown, to read; 3” CLR. Delete “(TYP.)” from the 2 ½” CLR. dimension, depicting the distance from the bottom of the foundation to find 1 # 4 reinf. Bar.

Detail F, callout, “Heavy Hex Clamping Bolt (TYP.) ~ ¾” (IN) Diam. Torque Clamping Bolts (see Note 3)” is revised to read; “Heavy Hex Clamping Bolt (TYP.) ~ ¾” (IN) Diam. Torque Clamping Bolts (see Note 1)”.

Detail F, callout, “3/4” (IN) x 2’ – 6” Anchor Bolt (TYP.) ~ Four Required (See Note 4)” is revised to read; “3/4” (IN) x 2’ – 6” Anchor Bolt (TYP.) ~ Three Required (See Note 2)”.

Partial View, callout, was – LOCK NIPPLE ~ 1 ½” DIAM., is revised to read; CHASE NIPPLE ~ 1 ½” (IN) DIAM.

Detail A, callout, was – LOCK NIPPLE, is revised to read; CHASE NIPPLE.

Ramp Meter Signal Standard, elevation, dimension 4’ - 6” is revised to read; 6’-0” (2x) Detail A, callout, was – LOCK NIPPLE ~ 1 ½” DIAM. is revised to read; CHASE NIPPLE ~ 1 ½” (IN) DIAM.

J-21.15

Sheet 2 of 2, Detail F, callout, “12 – 13 x 1 ½” S.S. PENTA HEAD BOLT AND 12” S. S. FLAT WASHER” is revised to read; “12 – 13 x 1 ½” S.S. PENTA HEAD BOLT AND 1/2” (IN) S. S. FLAT WASHER”.

J-60.14

All references to J-16b (6x) are revised to read; J-60.11

K-80.30

In the NARROW BASE, END view, the reference to Std. Plan C-8e is revised to Std. Plan K-80.35

Plan Title, was “ALTERNATIVE TEMPORARY CONC. BARRIER (F-SHAPE)” is revised to read: “CONCRETE BARRIER TYPE F”
The following are the Standard Plan numbers applicable at the time this project was advertised. The date shown with each plan number is the publication approval date shown in the lower right-hand corner of that plan. Standard Plans showing different dates shall not be used in this contract.

<table>
<thead>
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<th>Plan</th>
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Public Works Shop Project
SP-66
SPECIAL PROVISIONS
PW1901

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END OF STANDARD PLANS
SECTION 033000 - CAST-IN-PLACE CONCRETE

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. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Vapor-retarder installation.
d. Anchor rod and anchorage device installation tolerances.
e. Cold and hot weather concreting procedures.
f. Concrete finishes and finishing.
g. Curing procedures.
h. Forms and form-removal limitations.
i. Floor and slab flatness and levelness measurements.
j. Concrete protection.
k. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
l. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Aggregates.
   5. Admixtures:
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   6. Vapor retarders.
   7. Slab treatments.
   8. Curing materials.

B. Design Mixtures: For each concrete mixture, include the following:
   1. Mixture identification.
   2. Minimum 28-day compressive strength.
   3. Maximum w/cm.
   4. Slump limit.
   5. Air content.
   7. Intended placement method.

C. Shop Drawings:
   1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
      a. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
   1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Curing compounds.
   4. Floor and slab treatments.
   5. Vapor retarders.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Aggregates.
   5. Admixtures.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE
A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.8 DELIVERY, STORAGE, AND HANDLING
A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS
A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
   1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:
   1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
   2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
   3. Obtain aggregate from single source.
   4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M, Type I/II.
   2. Fly Ash: ASTM C618, Class C or F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M. Provide aggregates from a single source.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.
Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 6 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Barrier-Bac; Inteplast Group.
   c. ISI Building Products.
   d. Poly-America, L.P.
   e. Raven Industries, Inc.
   f. Reef Industries, Inc.
   g. Reliable Concrete Accessories.
   h. Stego Industries, LLC.
   i. Tex-Trude.
   j. W.R. Meadows, Inc.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corporation.
   b. ChemMasters, Inc.
   c. ChemTec International.
   d. Concrete Sealers USA.
   e. Curecrete Distribution Inc.
   f. Dayton Superior.
   g. Euclid Chemical Company (The); an RPM company.
   h. Kaufman Products, Inc.
   i. Laticrete International, Inc.
CAST-IN-PLACE CONCRETE

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Water: Potable or complying with ASTM C1602/C1602M.

C. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type I, Class B.

2.6 RELATED MATERIALS


B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.9 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings.
   1. Minimum Compressive Strength: 3000 psi at 28 days.

B. Class C: Normal-weight concrete used for interior slabs-on-ground.
   1. Minimum Compressive Strength: 4000 psi at 28 days.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.
3.5 JOINTS

A. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

B. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.

2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.

2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
   a. Do not use vibrators to transport concrete inside forms.
   b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
   c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
   d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.
   6. Slope surfaces uniformly to drains where required.
   7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
   8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FLOORS AND SLABS
A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:
   1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
   2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
   3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:
   1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
   2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   4. Do not add water to concrete surface.
   5. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring.
6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
   a. Slabs on Ground:
      1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
   2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
   3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
   1. Begin curing immediately after finishing concrete.
   2. Interior Concrete Floors:
      a. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
         1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
         2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.
         3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
      b. Floors to Receive Curing and Sealing Compound:
1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES
A. Conform to ACI 117.

3.10 APPLICATION OF LIQUID FLOOR TREATMENTS
A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
   3. Rinse with water; remove excess material until surface is dry.
   4. Apply a second coat in a similar manner if surface is rough or porous.
B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.11 JOINT FILLING
A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month.
   2. Do not fill joints until construction traffic has permanently ceased.
B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS
A. Defective Concrete:
   1. Repair and patch defective areas when approved by Architect.
   2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
   
   a. Limit cut depth to 3/4 inch.
   b. Make edges of cuts perpendicular to concrete surface.
   c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
   d. Fill and compact with patching mortar before bonding agent has dried.
   e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
   
   a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
   b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
   
   a. Correct low and high areas.
   b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

3. After concrete has cured at least 14 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   
   a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.
   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
   a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:
   1. Headed bolts and studs.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C143/C143M:
      a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
      b. Perform additional tests when concrete consistency appears to change.
   3. Concrete Temperature: ASTM C1064/C1064M:
      a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
      a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
      a. Test one set of four laboratory-cured specimens at seven days and one set of two specimens at 28 days.
      b. Test one set of four field-cured specimens at seven days and one set of two specimens at 28 days.
c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests:
   a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
   b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit use of acids or acidic detergents over concrete surfaces.
4. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION
SECTION 061000 - ROUGH CARPENTRY

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. Framing with dimension lumber.
   2. Framing with timber.
   3. Framing with engineered wood products.
   4. Shear wall panels.
   5. Rooftop equipment bases and support curbs.
   6. Wood blocking and nailers.
   7. Wood furring.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

B. Exposed Framing: Framing not concealed by other construction.

C. OSB: Oriented strand board.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.
1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:
   1. Engineered wood products.
   2. Power-driven fasteners.
   3. Post-installed anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
   1. Application: Interior partitions not indicated as load bearing.
   2. Species:
      a. Hem-fir; WCLIB, or WWPA.
      b. Western woods; WCLIB or WWPA.

B. Load-Bearing Interior Partitions: No. 2 grade.
   1. Species:
      a. Douglas fir-larch; WCLIB or WWPA.

C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
   1. Species:
      a. Douglas fir-larch; WCLIB or WWPA.

2.4 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Louisiana-Pacific Corporation.
      c. Roseburg.
      d. Standard Structures Inc.
      e. Weyerhaeuser Company.
2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
3. Modulus of Elasticity, Edgewise: 1,800,000 psi.

C. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Louisiana-Pacific Corporation.
   c. Roseburg.
   d. Standard Structures Inc.
   e. Weyerhaeuser Company.

2. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1 or Plywood, complying with DOC PS 1, Exterior grade.
3. Structural Properties: Depths and design values not less than those indicated.

D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
5. Furring.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of the following species:

1. Hem-fir; WCLIB or WWPA.
2. Western woods; WCLIB or WWPA.
C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Simpson Strong-Tie Co., Inc.
2. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. I-Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For interior partitions and walls, provide 2-by-6-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

3.4 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood. Attach floor joists as follows:

1. Where supported on wood members, by toe nailing or by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

D. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

E. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

F. Provide solid blocking between joists under jamb studs for openings.
3.5 INSTALLATION OF TIMBER FRAMING

A. Install timber beams with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch airspace at sides and ends of wood members.

3.6 INSTALLATION OF STAIR FRAMING

A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:

1. Size: 2-by-12-inch nominal size, minimum.
2. Material: Laminated-veneer lumber or solid lumber as indicated.
3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 5-1/2 inches of effective depth.
4. Spacing: At least four framing members for each 36-inch clear width of stair.

B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

END OF SECTION
SECTION 133419 - METAL BUILDING SYSTEMS

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. Structural-steel framing.
      2. Metal roof panels.
      3. Metal wall panels.
      4. Thermal insulation.
      5. Personnel doors and frames.
      7. Accessories.

1.3 DEFINITIONS
   A. Terminology Standard: See MBMA’s "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION
   A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
   B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review methods and procedures related to metal building systems including, but not limited to, the following:
         a. Condition of foundations and other preparatory work performed by other trades.
         b. Structural load limitations.
c. Construction schedule.
d. Required tests, inspections, and certifications.
e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
   a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
   b. Structural limitations of purlins and rafters during and after roofing.
   c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   d. Temporary protection requirements for metal roof panel assembly during and after installation.
   e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
   a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
   b. Structural limitations of girts and columns during and after wall panel installation.
   c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   d. Temporary protection requirements for metal wall panel assembly during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Metal roof panels.
      b. Metal wall panels.
      c. Thermal insulation and vapor-retarder facings.
      d. Personnel doors and frames.
      e. Windows.
      f. Louvers.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
   1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
   a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
   b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Gutters.
   c. Downspouts.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
   1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
   2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

E. Delegated-Design Submittal: For metal building systems.
   1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For erector and manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
   1. Name and location of Project.
   2. Order number.
   3. Name of manufacturer.
   4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shop primers.

F. Source quality-control reports.

G. Field quality-control reports.

H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

I. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.
   1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
   2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

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. A&S Building Systems, Inc.; a division of NCI.
2. Alliance Steel, Inc.
4. BC Steel Buildings, Inc.
7. CBC Steel Buildings; a Nucor Company.
8. Garco Building Systems; a division of NCI.

B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of load-bearing end-wall and corner columns and rafters.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and girts.

E. Roof System: Manufacturer's standard standing-seam, trapezoidal-rib or lap-seam, tapered-rib metal roof panels.

F. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib metal wall panels.
2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings.

2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."

3. Deflection and Drift Limits: No greater than the following:
   b. Girts: Horizontal deflection of 1/180 of the span.
   c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
   d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
   e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
   f. Lateral Drift: Maximum of 1/60 of the building height.

C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

2.4 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

   a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch wide flanges.
   a. Depth: As needed to comply with system performance requirements.

2. Purlins: Steel joists of depths indicated on Drawings.
3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges.
   a. Depth: As required to comply with system performance requirements.

7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.

8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.

9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

G. Bracing: Provide adjustable wind bracing using any method as follows:

1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50; or ASTM A529/A529M, Grade 50; minimum 1/2-inch diameter steel; threaded full length or threaded a minimum of 6 inches at each end.

2. Cable: ASTM A475, minimum 1/4-inch diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.

H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

I. Materials:

1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.

2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.

3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.

4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.

6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.

7. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.

8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.

   b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.
9. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

10. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

11. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1 hardened carbon-steel washers.


J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
   a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.5 METAL ROOF PANELS

A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a. Color: As selected by Owner from manufacturer's full range.
B. Exposed Fastener, Tapered-Rib, Metal Roof Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a. Color: As selected by Owner from manufacturer's full range.

C. Finishes:

1. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 METAL WALL PANELS

A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   a. Color: As selected by Owner from manufacturer's full range.

B. Finishes:

1. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 THERMAL INSULATION

A. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

B. Faced, Polyisocyanurate Board Insulation: ASTM C1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.

C. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

D. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96/E96M, Desiccant Method.

E. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.8 PERSONNEL DOORS AND FRAMES

A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.

1. Steel Doors: 1-3/4 inches thick; fabricated from metallic-coated steel face sheets, 0.036-inch nominal uncoated steel thickness, hollow-metal construction; with 0.060-inch nominal uncoated steel thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
   a. Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F.

2. Steel Frames: Fabricate 2-inch- wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness.

3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
4. Hardware:
   a. Provide hardware for each door leaf, as follows:
      1) Hinges: BHMA A156.1. Three standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches, with nonremovable pin.
      2) Lockset: BHMA A156.2. Key-in-lever cylindrical or mortise, with lever handle type.
      4) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
      5) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
      6) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.

5. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A123/A123M.

6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

B. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS, Type B; free of scale, pitting, or surface defects; pickled and oiled.
   3. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS, Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.

C. Finishes for Personnel Doors and Frames:
   1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.
      a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

      a. Color and Gloss: As selected by Owner from manufacturer's full range.

2.9 WINDOWS

A. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."
B. Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:

1. Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/LS.2/A440.
2. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.
   a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
3. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
4. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
   a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
5. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze.
7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit.

C. Finish:

1. Mill finish.
2. Baked-Enamel Finish, Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil, medium gloss.
   a. Color: As selected by Owner from manufacturer's full range.

2.10 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure
strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. **Closures:** Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. **Clips:** Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. **Cleats:** Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
4. **Backing Plates:** Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. **Closure Strips:** Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. **Thermal Spacer Blocks:** Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

**C. Wall Panel Accessories:** Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. **Closures:** Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. **Backing Plates:** Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. **Closure Strips:** Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

**D. Flashing and Trim:** Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. **Opening Trim:** Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

**E. Gutters:** Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. **Gutter Supports:** Fabricated from same material and finish as gutters.
2. **Strainers:** Bronze, copper, or aluminum wire ball type at outlets.
F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.036-inch nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

   2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
   3. Free Area: Not less than 7.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
   4. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
   5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.

H. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

   1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
   2. Insulation: 1-inch-thick, rigid type.

I. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

J. Materials:

   1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

      a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.

      b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.
d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

4. Metal Panel Sealants:
   b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.11 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.


C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.12 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

   a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.


1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

   a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
   1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
   2. Locate and space wall girts to suit openings such as doors and windows.
   3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
   1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
      a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge and hip caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
   1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
   2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
   3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
   4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. When two rows of metal panels are required, lap panels 4 inches minimum.
   4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
   5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
   6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   8. Install flashing and trim as metal wall panel work proceeds.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
  10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
  11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
   a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

3.8 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
1. Between Doors and Frames at Jambs and Head: 1/8 inch.
3. At Door Sills with Threshold: 3/8 inch.
4. At Door Sills without Threshold: 3/4 inch.
5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

C. Door Hardware:

1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

3.9 WINDOW INSTALLATION

A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/LS.2/A440.

B. Set sill members in bed of sealant or with gaskets, for weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Mount screens directly to frames with tapped screw clips.

3.10 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.

2. Tie downspouts to underground drainage system indicated.

E. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

F. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
3.11 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.

D. Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.

1. Adjust louver blades to be weathertight when in closed position.

3.13 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.

1. Immediately before final inspection, remove protective wrappings from doors and frames.

G. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

H. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

   a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION
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Notice:

The following list of specifications and drawings represents those documents that were prepared under the provisions of the Revised Code of Washington RCW 18.43, by BCE Engineers, Inc. of Tacoma, Washington. The sealing of this specification and drawings list is provided in accordance with Washington Administrative Code WAC196-23-020.

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SECTION 200000 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, furnishing labor, materials, and equipment for completion of work unless indicated or noted otherwise. See Division 1 for sequence of work.

B. Work indicated on the mechanical plans and in the specifications that will not be performed by this Mechanical Contractor (i.e. duct and pipe block-outs, penetrations through walls, floors, and attic, wall patching, work indicated to be performed by other Contractors, etc) shall be coordinated with the General Contractor prior to bid. The Mechanical Contractor is responsible for identifying quantity, size, and type of work with the General Contractor. Work not coordinated will be the responsibility of the Mechanical Contractor and shall not be charged as additional cost to the Owner.

C. All work included in Division 22 and 23 shall be the responsibility of a single Mechanical Subcontractor.

D. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the mechanical work. It is the Contractor's responsibility to contact all utility organizations serving the building, prior to bid, and to include all charges for inspections, installation of materials, equipment and connection of all required utilities.

E. Furnish exact location of electrical connections and complete information on motor controls to Division 26, prior to bid.

F. Putting heating, ventilating, cooling, and exhaust systems into full operation and continuing their operation during each working day of testing and balancing.

G. Making changes in mechanical drive systems (pulleys, belts, VFD’s, motor speed, etc) and dampers or adding dampers as required for correct balance as recommended by Section 23 05 93 and at no additional cost to Owner. All equipment shall be provided with a single point electrical connection, unless otherwise indicated.

H. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

I. The ductwork and accessibility to HVAC equipment shall take precedence over all other equipment in the ceiling interstitial spaces or other mechanical areas including, but not limited to, sprinkler piping, heating piping, domestic water piping and electrical conduit (except fire pump rooms where as fire sprinkler equipment takes precedence).

1.2 RELATED SECTIONS

A. General and Supplementary Conditions and Division 1 apply to this Section.
1.3 SUBMITTALS REQUIREMENTS OF THIS SECTION

A. Access doors.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Perform work in accordance with applicable Codes.
   2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

B. Product Approvals: See paragraphs elsewhere in this specification.

C. Warranties:
   1. In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. In order to be protected, secure proper guarantees from suppliers and Subcontractors.
   3. Provide certificates of warranty for each piece of equipment. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

D. Manufacture: Use domestic made pipe, pipe fittings, and motors on Project.

E. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.5 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over mechanical installation.
   6. Local Sewer and Water District Requirements
   7. State and County Department of Health
   8. Local Fire Marshal
   9. State Boiler Inspector
   10. Puget Sound Air Pollution Control
   11. State of Washington Boiler and Unfired Pressure Vessel Inspection Law
   12. Occupational Safety and Health Administration (OSHA)
   13. Washington Industrial Safety and Health Act (WISHA)
   14. National Fire Protection Association (NFPA)
B. ASME code stamp required on all pressure vessels and relief valves. Certificate required from the State Boiler Inspector showing approval of the equipment and its installation.

1.6 SYSTEMS DESCRIPTION

A. Site Inspection:
   1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
   2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

1.7 DESIGN DRAWINGS

A. Mechanical drawings are not shop drawings and are intended to show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

B. Consider architectural, structural and electrical drawings part of this work in so far as these drawings furnish information relating to design and construction of building. Architectural drawings take precedence over mechanical drawings.

C. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Mechanical Contractor shall include in the bid a sufficient quantity of offsets, fittings, and accessories for the size of the project, based upon the contractor’s experience, necessary to facilitate mechanical utility installation. No additional costs shall be charged for additional offsets, fittings, and accessories required for installation of the mechanical utilities shown on the design drawings. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required in meeting the design conditions.

1.8 PRE-CONSTRUCTION COORDINATION MEETING

A. This Contractor is responsible to participate in coordination meetings with the General Contractor, Fire Protection Contractor and other subcontractors needing to coordinate special requirements (such as electrical contractor, HVAC contractor, plumbing contractor, etc.)

B. Coordination meetings shall consider elevations, required clearances, and routings of all trades to assure that all trades can be installed without conflict.

C. The outcome of this coordination shall allow each system (Mechanical, Fire Protection, Plumbing, Electrical, etc) to be installed without further conflicts for space or locations.

D. Failure to coordinate with other trades and/or existing conditions that result in the removal and re-installation of systems shall not be charged as additional costs.
1.9 COORDINATION DRAWINGS

A. Develop coordination drawings, and other pre-installation coordination methods as necessary to coordinate layouts prior to installation. Coordination drawings shall consist of overlay drawings, or other similar methods to graphically indicate plumbing, fire protection, HVAC, electrical, and other similar elements in a single location in order to identify conflicts. All elements shall be drawn to scale. Coordination drawings are not required to be submitted for approval, except where indicated otherwise in the specification. However, a minimum of one hard copy of coordination drawings shall be present on site at all times and made available to the Architect/Engineer (A/E) Representative upon request. If coordination drawings are not on file, or if systems are not installed per coordination drawings, costs and delays of required reengineering, replacement and other work required to correct conflicts shall be solely the Contractor’s.

1. Contractor shall have the underground coordination drawings available upon request by A/E Representative within 60 days after Notice to Proceed.
2. Contractor shall have the aboveground coordination drawings available upon request by A/E Representative within 90 days after Notice to Proceed.

B. Coordination drawings shall consist of one of the following:

1. Drawing sheets developed sequentially by each trade with all components drawn to scale and color coded to represent each trade.

C. Where coordination drawings, or other preinstallation coordination methods show that available space is inadequate or that modifications will affect architectural elements, request information from the Architect before proceeding with work. No additional payment will be made for installation conflicts which could have been identified by coordination drawings or other pre-installation coordination methods.

D. Make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Each subcontractor shall:

1. Indicate the exact name, location and dimension of each element to be provided by that subcontractor.
2. Arrange components as necessary to avoid conflict with new and existing conditions and the work of other subcontractors as directed by the General Contractor.
3. Note requirements for sleeves, block-outs, cutting, patching, access doors, blocking, supports, inserts and other similar items.
4. Notify the General Contractor of conflicts.
5. Approve the coordination drawings when all conflicts are resolved and an acceptable layout is obtained.

F. The General Contractor shall coordinate the layouts indicated on the coordination drawings and resolve any conflicts prior to commencement of subject portions of the work.
1.10 ELECTRICAL

A. All electrical work, conduit, boxes and devices in connection with control wiring as required to install the control equipment as specified herein or shown on the drawings shall be furnished and installed complete by the Division 26 Contractor.

B. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Division 26 specifications and shall conform to all governing codes.

C. All equipment shall be factory wired to a junction box for connection to electrical service.

D. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter, disconnect switches and wiring from the electrical panel to the motor control devices and to the motor shall be provided by the Division 26 Contractor unless stated otherwise in the mechanical specification and/or on the mechanical drawings.

E. All motor controllers and equipment panels (including but not limited to packaged equipment, custom control panels, custom air handler panels) shall comply with NEC (including, but not limited to, marking on controllers and labeling requirements).

1.11 TEMPORARY HEATING

A. Temporary heating for facility during construction phase shall not be supplied by the permanent system installed under these specifications, unless all of the following are satisfied:

1. Product warranties shall be extended to account for construction use. Contractor shall furnish certified document stating such extended warranties.
2. Contractor shall obtain letter of approval from the Owner stating that they understand equipment expected life may be shortened due to severe usage.
3. Contractor shall be responsible for pressure cleaning all coils and vacuum cleaning all ductwork prior to occupancy.

1.12 PRODUCT HANDLING AND PROTECTION

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this Section from damage, water, corrosion, freezing and dust, both in storage and when installed, until final project acceptance.

B. Provide temporary heated and sheltered storage facilities for material and equipment.

C. Completely cover motors and other moving machinery to protect from dirt and water during construction.

D. Handle and protect equipment and/or material in manner precluding unnecessary fire hazard.

E. Equipment requiring rotation and/or lubrication during storage shall have records maintained and witnessed on a monthly basis and forwarded to the Architect/Engineer prior to acceptance. Provide recorded maintenance for the O&M Manual.
F. Material or equipment damaged because of improper storage or protection will be rejected.

G. Equipment finish that is damaged by handling, storage, etc. shall be corrected by the Contractor at no additional cost to the Owner.

1.13 DEFINITIONS

A. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.

B. Unfinished Spaces: Spaces used for storage or work areas, such as fan rooms, mechanical and boiler rooms, etc., where appearance is not a factor.

C. Concealed Spaces: Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

D. Exposed: Open to view. For example, pipe running through a room and not covered by other construction.

E. Outside: Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

F. Conditioned Space: An area, room or space normally occupied and being heated or cooled for human habitation by any equipment as defined by the extent of the building envelope insulation.

G. Replace: Existing mechanical equipment and components shall be demolished and discarded from the project site or as directed otherwise. New mechanical equipment and components shall be installed in the area where the existing mechanical equipment and components were demolished or as indicated on the contract documents.

H. Removed: Existing mechanical equipment and components identified on the contract documents shall be taken apart, taken down, and discarded from the project site unless directed otherwise on plan. Removed items shall not be brought back to the project site for use or reinstallation.

I. Reinstall: Existing mechanical equipment and components identified on the contract documents that need to be taken down and installed in the same or new location.

1.14 ABBREVIATIONS

ADA Americans with Disabilities Act
A/E Architect/Engineer
AFF Above Finish Floor
AGA American Gas Association
AMCA Air Moving & Conditioning Association
ANSI American National Standards Institute
APWA American Public Works Association
ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME American Society of Mechanical Engineers
ASTM American Society of Testing & Materials
AWWA  American Water Works Association
BFF    Below Finish Floor
BHP    Brake Horsepower
BTU    British Thermal Unit
CFM    Cubic Feet per Minute
CISPI  Cast Iron Soil Pipe Institute
fpm    feet per minute
FS or  Federal Specifications
F.D.C.  Fire Department Connection
F.C.O  Flush Cleanout
F.D.   Floor Drain
FWH    Freeze Proof Wall Hydrant
GPM    Gallons per Minute
HP     Horsepower
IAPMO  International Association of Plumbing and Mechanical Officials
IAQ    Indoor Air Quality
IEEE   Institute of Electrical and Electronics Engineers
KW     Kilowatt
LPG    Liquefied Petroleum Gas
MBH    One Thousand British Thermal Units per Hour
MS     or
Mil.Spec. Military Specifications
MSS    Manufacturers Standardization Society
NEC    National Electrical Code
NEMA   National Electrical Manufacturers Association
NFPA   National Fire Protection Association
NP     Non-Potable Water
NPSH   Net Positive Suction Head
OS&Y   Outside Screw and Yoke
P.I.V.  Post Indicator Valve
PDI    Plumbing and Drainage Institute
per    in accordance with
POC    Point of Connection
PSI    Pounds per Square Inch Gauge Pressure
PVC    Polyvinyl Chloride
SMACNA Sheet Metal and Air Conditioning Contractors National Association
SP     Static Pressure
SWP    Steam Working Pressure
1.15 SCHEDULE OF VALUES

A. General: Provide schedule of values per Division 1 and related project requirements:

1. Division 22 and 23 Breakdown: Provide schedule of values for each building, broken down into labor and materials per specification section at a minimum. Further breakdown into subcategories is at the option of the Contractor, except as noted below:
   a. Section 20 00 00 – General Mechanical Requirements: Provide a subcategory for “Mechanical Punchlist, Closeout and Owner Training”. The dollar value for this subcategory shall be no less than 2.25% of the total dollar value of the Division 22 and 23 work (or as indicated in Division 1, whichever is higher. The contractor shall receive payment upon completion of all Mechanical Punchlist and Closeout items and Owner Training.
   b. Section 20 00 00 – General Mechanical Requirements: Provide a subcategory for “Pre-Construction Coordination Meeting.” The dollar value for this subcategory shall be no less than 1% of the total dollar value of the Division 22 and 23 work. Contractor shall submit the meetings sign in sheet to the Engineer for review. The sign in sheet shall include the printed and signed names of the General and all subcontractors who attended the meeting. The contractor shall receive payment once the sign-in sheet has been verified to meet the Pre-Instruction Coordination requirements of this Section.
   c. Section 20 00 00 – General Mechanical Requirements: Provide a subcategory for “Coordination Drawings”. The dollar value for this subcategory shall be no less than 1% of the total dollar value of the Division 22 and 23 work. The contractor shall receive payment upon Engineer’s verification of Coordination Drawing completion, in accordance with the requirements of this Section.
   d. Section 23 08 00 – Commissioning HVAC System: The dollar value for “Commissioning” shall in no case be less than 0.75% of the total dollar value of the Division 22 and 23 work (or as indicated in Division 1, whichever is higher). The contractor shall receive payment upon completion of all outstanding commissioning items as identified by the commissioning agent, Engineer, and/or Owner.
   e. Section 23 09 00 – Energy Management & Control Systems: Provide a subcategory for “Trend Logs”. The dollar value for this subcategory shall be no less than 1% of the total dollar value of the Division 23 work. The contractor shall receive payment upon completion of the trend logs in accordance with the requirements of this Section and Section 23 09 00.
B. The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. “Mechanical Punchlist, Closeout, and Owner Training”), as specified above and in Division 1, the Owner reserves the right to withhold 10% of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested, adjusted, and balanced.

1.16 SUBMITTAL PROCEDURES

A. All material used on the project shall be new and free of defects. The Architect and/or Engineer reserve the right to reject any material, the appearance of which has been damaged on the site or in shipment. The material shall be of pre-approved equal quality to that which is specified. Should the make and type of material differ from that specified, the Contractor may be required to submit catalog and engineering data (samples if requested) necessary to make a comparison and determine its suitability. The Contractor shall also bear the cost of all changes to any aspect of the project (electrical, mechanical, building, etc.) made necessary by any approved substitutions. Approved substitutions include those listed as approved manufacturers or approved substitutions. Tentative approval of substitute material and equipment will be made prior to bid only. Such request for approval shall be made two weeks in advance of the bid opening to allow time to assess its suitability. Failure to obtain approval prior to bid shall require the successful bidder to furnish materials and equipment only as specified herein (see paragraph 2.01, this specification).

B. Equipment submittals shall be submitted per one of the following processes as selected by the Architect/Engineer Representative and/or Owner:

1. Electronic Submittal Process:
   a. The Contractor shall upload one complete PDF file of the Electronic Submittal Package to the Architect’s SharePoint Site for approval. The Electronic Submittal package shall include the following:
      1) All required submittals (i.e. equipment cut sheets, shop drawings, etc.) per each specification section.
      2) Table of contents identifying each specification section, submittal requirement of each specification, and the manufacturer name and model number of each item submitted.
      3) Index sheet for each specification section.
      4) Submission of PDF files of individual specifications or equipment cuts will be automatically rejected.
      5) The Contractor shall complete and upload a Submittal Information Form, in Microsoft WORD format, for the A/E team to review. The equipment submittal will not be considered “Received” nor will a review be provided until both the Electronic Submittal Package and Submittal information Form have been uploaded.
      6) If the Electronic Submittal Process is not feasible for a particular submittal section (i.e. samples, certain shop drawings, recorded videos, CD’s, etc.), the Contractor shall submit a request in writing to the A/E Representative to deviate from the Electronic Submittal Process. If acceptable by the A/E Representative the Contractor shall follow the Hard Copy Submittal Process for the submission.
2. Hard Copy Submittal Process:
   a. The Contractor shall submit to the Architect, for approval, complete information on all equipment and materials to be provided on the project. Provide copies as specified by Division 1 and at a minimum provide six (6) copies of the manufacturer's catalog and engineering data, shop drawings of shop fabricated equipment and instruction data for each item included under this Section of the Specifications. The Contractor shall submit a typed, signed list including all items to be furnished on the project. The signature on the aforementioned list shall indicate that the Contractor has examined the suitability of all material and equipment with respect to compliance with these specifications. The Contractor's approval shall also indicate that physical dimensions of the equipment have been verified with the installation requirements and were found to cause no interference therewith. The submittal packages are as follows:
   b. Furnish submittals in a hard-back, three-ring binder. The binder shall have tabs which are indexed with a Table of Contents. The Table of Contents shall correlate an index number for each individual specification number. If the equipment submittal is not bound to the Engineer’s satisfaction, it may be rejected.

3. Review of submittal data by the Engineer or Architect does not relieve the Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

4. Furnish submittals generally according to the list below. Individual sections may contain more specific submittal listing of the particular section labeled “Submittal Requirements.” Furnish on each particular section and the following equipment:
   a. Pipe
   b. Pipe Insulation
   c. Duct Insulation and Lining
   d. Hot Water Tanks
   e. Boilers
   f. Plumbing Fixtures
   g. Valves
   h. Pipe Hangers
   i. Piping Specialties
   j. Pumps
   k. Gas Flues
   l. Fire Sprinkler Equipment
   m. HVAC Equipment
   n. Temperature Control Equipment and Shop Drawings
   o. Air Balance Contractor
   p. Hydronic Equipment
   q. Air Compressor & Devices
   r. Natural Gas Components
   s. Fire Marshal Stamped and Approved Shop Drawings for Fire Sprinkler System

5. Any material found to be installed without prior approval will be required to be removed and replaced with only specified material at Contractor's cost.

6. Mechanical Drawings for the project have been developed by the Engineer using AutoCAD™ Revision 2015 software. These drawing files will be made available to the Contractor for development of shop drawings and/or "As-Builts" for a fee of $30.00 per sheet. Full payment to be made prior to release of drawing files.
1.17 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

A. Bind Operation & Maintenance Manual for Mechanical Systems in three-ring, hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

   OPERATION
   AND
   MAINTENANCE
   MANUAL
   FOR MECHANICAL SYSTEMS

B. Provide master index at beginning of Manual showing items included. Use plastic permanent tab indexes for Sections of Manual.

C. First Section shall consist of name, address, and phone number of Architect, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature control, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

D. Provide Section for each type of item of equipment.

E. Submit copies as specified by Division 1 and at a minimum provide three (3) copies of Operation & Maintenance Manual to Architect for his approval.

F. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

G. Include all warranties/guarantees including extended warranties.

H. Include all start-up logs.

I. Operating Instructions shall include:

   1. General description of each mechanical system.
   2. Step-by-step procedure to follow in putting each piece of mechanical equipment into operation.
   3. Provide schematic control diagrams for all systems. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.
   4. Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays.
   5. Provide drawing of each temperature control panel identifying components on panels and their function.
J. Maintenance Instructions shall include:

1. Manufacturer's maintenance instructions for each piece of mechanical equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists operation instructions of equipment, and maintenance and lubrication instructions.
2. Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
3. List of mechanical equipment used to indicate name, model, serial number, and name plate data of each item together with number and name associated with each system item.
4. For hydronic systems, include gallons in system, amounts and types of each chemical, etc. Also, include step-by-step procedure to recharge the system.

1.18 COMMISSIONING

A. General Requirements: The building’s systems shall be tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the approved plans and specifications. This shall include the following:

1. Commissioning Plan
2. Systems Testing and Balancing
3. Controls Functional Performance Testing
4. Preliminary Commissioning Report
5. Post Construction Documentation
6. Final Commissioning Report

B. Commissioning Plan: A commissioning plan shall be developed by a registered design professional or approved agency and shall include at a minimum the following:

1. A detailed explanation of the design intent.
2. Equipment and systems to be tested.
3. Functions to be tested (for example, economizer control, discharge air temperature control, etc.)
4. Conditions under which the test shall be performed.
5. Measureable criteria for acceptable performance.

C. System Testing and Balancing: Provide testing and balancing as specified in Sections 23 05 93 and 23 05 95.

D. Controls Functional Performance Testing: Functional testing shall demonstrate the correct installation and operation of each component, system, and system to system intertie relationship in accordance with the plans and specifications. This demonstration is to prove operation, function, and maintenance serviceability for each of the commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the sequence of operation.
2. Performance of alarms.
3. Mode of operation upon a loss of power and restored power.
4. The HVAC control system shall be tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the plans and specifications.

E. Preliminary Commissioning Report: The preliminary commissioning report, completed and certified by the registered design professional or approved agency, shall be provided to the Owner. The preliminary commissioning report shall include test procedures and results, and shall identify the following:
   1. Deficiencies found during testing which have not been corrected at the time of report preparation and the anticipated date of correction.
   2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions. Include the climatic conditions required for testing and the anticipated date of each deferred test.
   3. Record of progress and completion of operator training.

F. Post Construction Documentation: Provide Operation and Maintenance (O&M) data, as-built record drawings, final commissioning report and test and balance report, as specified in this section, within 90 days of the date of receipt of the Certificate of Occupancy.

G. Final Commissioning Report: Provide a complete report of test procedures and results and submitted to the Engineer and the Owner. The report shall identify the following:
   1. Procedures and results of all functional performance tests.
   2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.

H. The Contractor is responsible to submit to the code official a commissioning compliance checklist, Figure C408.1.2.1 of the WSEC, signed by the building owner.

1.19 WARRANTY

A. All warranty information shall be submitted as part of the “Operation and Maintenance Manual for Mechanical Systems” in this section.

B. All warranties for mechanical and plumbing equipment shall start upon completion of commissioning.

1.20 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to coordination drawings, an as-built set of prints that clearly identify all deviations from the original design. The As-Built drawings shall be drafted per one of the following methods:
   1. Draft all revisions on a separate dark layer, on the coordination drawing set. The Contractor shall maintain a copy of the original coordination drawing set.
   2. Draft all revisions on the design drawings with a red color pencil.
B. This red lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions.

C. Drawings shall show locations of all underground pipe and duct installed by this Contractor. Underground pipes and ducts shall be shown with cross section elevations. All pipe, raceway, manholes or lines of other trades shall be included.

D. The Contractor shall update all references to specific products to indicate products actually installed on project. This shall include, but not be limited to, air handlers, heat pumps etc.

1. Upon completion of the Division 22 and 23 Work, the Contractor shall deliver the red lined drawings and one set of neatly drafted as-built drawings on electronic media in ACAD 2015 format and PDF files to the Engineer for transmittal through the Engineer to the Owner.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Any reference to the specifications or on the drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The manufacturer listed as Approved Manufacturers are approved to bid the project for the items indicated without obtaining prior approval. Other manufacturers desiring to bid the project require prior approval.

C. The listing of a manufacturer as an Approved Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers.

D. Products provided by Approved Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Architect/Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not, then the manufacturer shall submit data as required to obtain the Design Consultant's approval prior to bid opening.

E. The approval of a manufacturer applies to the manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.

F. Contractor shall be responsible for all costs to other trades and all revisions required in accommodating any products which are different from those specified or shown.
G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer/Architect and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry/access utility needs, and similar concerns.

H. If approval is received to use other than specified items, responsibility for specified capacities and ensuring that items to be furnished will fit space available lies with this Division.

I. If non-specified equipment is used and it will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

2.2 ACCESS DOORS

A. This Contractor shall be responsible for furnishing and installing flush mounted access doors in walls, ceiling and floors and chases where the following equipment is concealed and is not accessible through same.

B. Valves (shut off, balancing, control, trap primers, etc).

C. Dampers (control, balancing, fire, smoke, etc.).

D. Doors shall be UL listed 20 ga. cold rolled steel with concealed hinge, screwdriver operated lock and prime coated. Furnish suitable for area mounted. Provide stainless steel access doors for non-painted surfaces (i.e. tile, MDF)

E. Approved Manufacturers:
   1. Milcor
   2. Acudor
   3. Greenheck
   4. Nystrom

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Engineer, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall or replace same and patch and paint surrounding surfaces in a manner acceptable to the Engineer, without increase in cost to the Owner.
3.2 FINAL INSPECTION

A. Final Inspection:

1. Prior to acceptance of the mechanical work, the Contractor shall put all mechanical systems into operation for a period of not less than 5 working days so that they may be inspected by the Architect/Engineer and the Owner's representatives.
2. The time of the final inspection shall be mutually agreed to by the Owner, Engineer, and Contractor.
3. The Contractor shall furnish adequate staff to operate the mechanical systems during inspection.

3.3 OPERATION AND MAINTENANCE TRAINING

A. Upon completion of the work, and after all tests and final inspection of the work by the Authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various mechanical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be Superintendents or Foremen knowledgeable in each system and Supplier's Representative when so specified.

B. Scheduled instruction periods shall be:

<table>
<thead>
<tr>
<th>System</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC System Controls</td>
<td>16</td>
</tr>
<tr>
<td>HVAC Equipment Maintenance</td>
<td>8</td>
</tr>
<tr>
<td>Plumbing Equipment</td>
<td>4</td>
</tr>
<tr>
<td>Boiler Start-Up and Training with Factory Rep</td>
<td>16</td>
</tr>
</tbody>
</table>

C. The contractor shall, at a minimum, include an Owner Training sign-in sheet in the O&M Manual that indicates the start and end times of the training and the type of training provided. Owner shall sign off on the Owner training sign-in sheet to be considered complete and satisfactory to Owner.

D. Costs for time involved by Contractor shall be included in the bid.

3.4 CLOSEOUT SUBMITTALS

A. Requirements: Final approval of mechanical installation will be recommended upon completion of the following:

1. Completion of all punchlist items
2. Owner Training Sign-In sheet with Owner's signature
3. Permit Submittal
4. Valve Diagrams
5. Reproducible As-Built drawings delivered to Architect
6. Air and/or Water Balance Report
7. Asbestos Free Statement
8. Guarantees
9. Equipment Manufacturer of all HVAC compressor units shall provide start-up logs.
10. EMCS Trend Logs.

3.5 PREPARATION

A. New Buildings: Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

B. Existing Buildings:

1. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
2. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes by General Contractor.
3. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
4. This work shall be scheduled such that utility services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.
5. The Mechanical Contractor shall be responsible for the removal of all existing mechanical equipment and utilities indicated to be removed on the drawings. The Mechanical Contractor shall also be responsible for the removal and reinstallation of all existing mechanical equipment and utilities that will interfere with installation and operation of any new construction indicated or required and shall be responsible for the removal of all existing mechanical equipment and utilities indicated to be abandoned that will interfere with installation and operation of any new construction indicated or required. All mechanical equipment (other than piping) to be removed shall remain the property of the Owner, and shall be transported - stored - or disposed of, as directed by the Owner. This will be at no cost to the Owner.

3.6 INSTALLATION

A. Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance, (e.g., coils, heat exchanger bundles, sheaves, filters, motors, bearings, etc.) can be removed. Relocate items, which interfere with access.

B. Provide access doors in equipment, ducts, and walls/ceilings as required to allow for inspection and proper maintenance.

C. Valves, damper operators, and other devices which are manually adjusted or operated shall be located so as to be easily accessible by a person standing on the floor. Any such items which are not in the open shall be made accessible through access openings in the building construction.
D. Gauges, thermometers, instrumentation and other components which are installed to monitor equipment performance, operating conditions, etc., shall be oriented so as to be easily read by a person standing on the floor. Provide necessary brackets and hangers as needed.

E. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a poor access location.

F. Belts, pulleys, couplings, projecting set screws, keys and other rotating parts which may pose a danger to personnel, shall be fully enclosed or guarded in accordance with OSHA regulations.

G. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil black plastic tape wrapped at point of contact or plastic centering inserts.

H. Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below panel to structure and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by NEC to be more. Such offsets are typically not shown on the drawings, but are required per this paragraph.

I. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each fixture and on at least 48-inch centers.

J. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and 2" wide reflective red/white striped self-sticking safety tape.

K. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the laying out of pipe and duct routings, and in coordinating all work. Poor access to equipment will not be accepted. Contractor shall note that in essentially all areas, piping routed in ceiling space needs to run in joist space, necessitating elbows/fittings/transitions at crosses with other trades, at structural beams, and at all connections to mains and branches. Hatched areas at HVAC units indicate equipment access areas. These (and all other) access areas shall be clear of obstructions. The Mechanical Contractor is responsible to coordinate and ensure that all trades stay clear of access areas for any Division 22 and 23 furnished equipment.

L. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

M. Pipe Installation: Install piping in longest reasonable lengths. The use of short lengths of pipe with multiple couplings where a single length of pipe could have been used is not acceptable.
3.7 CONCRETE BASES
   A. Provide a 3-inch high "minimum" concrete base under boilers, hot water tanks, and floor-mounted pumps located in mechanical/utilities spaces. Provide 6" thick structural concrete pad for equipment located outside the building or as detailed on drawings.

3.8 ADJUSTMENT AND CLEANING
   A. Properly lubricate equipment before Owner's acceptance.
   B. Clean exposed piping, ductwork, equipment, and fixtures, remove debris from site. Repair all damaged finishes and leave everything in working order.
   C. Remove stickers from fixtures and adjust flush valves.

3.9 PAINTING
   A. Paint all exposed pieces of equipment if not factory finished or painted under the Architectural Section of these specifications. Paint shall be one coat primer and two coats enamel color as directed by the Architect.

3.10 REBATES
   A. Furnish vendor invoices on heat pumps to Owner after installation for power company rebates.

3.11 REQUESTS FOR INFORMATION (RFI)
   A. It is our intent to provide a timely response for RFIs regarding Division 22 and 23 Work. To further expedite this process, if a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete. RFI's will be returned to the Contractor within seven (7) business days from the time received by the Architect/Engineer Representative. All Mechanical RFIs shall be written on the form provided at the back of this Section.

END OF SECTION
REQUEST FOR INFORMATION

Project: __________________________  RFI No. __________________________

Reference Drawing or Specification: _________________________________________

Suggested Solution: _______________________________________________________

Response Needed By: _______________________________________________________

Contractor: __________________________  By: __________________________  Date: __________________________

Response: ________________________________________________________________

Contractor: __________________________  By: __________________________  Date: __________________________

This is not an authorization to proceed with work involving additional cost and/or time. Contractor shall obtain authorization prior to proceeding with this work if the response in this RFI will result in additional cost and/or time.
SECTION 220548 - VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. This section includes, but not limited to vibration isolation and seismic restraint installation for all equipment and piping as described here-in.

B. Seismic Restraints shall be bidder-designed. Seismic Design Criteria are to be established per the International Building Code and ASCE along with Project Structural drawings.

C. Items not included in this specification shall not relieve the contractor of the responsibility of providing seismic bracing that meets all the criteria required by the referenced codes and in accordance with the seismic design guidelines and the project structural drawings.

1.2 REFERENCED CODE AND STANDARDS

A. The latest adopted versions of the following codes and standards apply to this section.

1. International Building Code (IBC)
2. National Fire Protection Association (NFPA-13)
4. ASCE 7-10, American Society of Civil Engineers “Minimum Design Loads for Buildings and Other Structures”
5. Applicable Project Structural Drawings for Seismic Design Criteria
6. Applicable Manufacturer’s Seismic Design Guides for proprietary listed seismic bracing and mounting hardware
7. Where there is a conflict in requirements between these guidelines and above-mentioned codes the more stringent parameters shall prevail.

1.3 RELATED SECTIONS

A. General Conditions, Division 1 and Division 22

B. Section 200000 – General Mechanical Requirements

1.4 DESIGN CRITERIA

A. Occupancy Category of Structure (I-IV) per IBC or ASCE

B. Component Importance Factor (Ip) per ASCE

C. Mapped Acceleration Parameters (S1 and (Ss) per IBC and Project Structural Drawings

D. Site Class (A – F) per IBC and Project Structural Drawings
E. Site Coefficient (Fa) per IBC and Project Structural Drawings

F. Site Coefficient (Fv) per IBC and Project Structural Drawings

G. Seismic Design Category (A – D) based on Short Period Response Accelerations per IBC and Project Structural Drawings

H. Seismic Design Category (A – D) based on 1-Second Period Response Acceleration per IBC and Project Structural Drawings

I. Amplification Factor ap per ASCE

J. Response Modification Factor Rp per ASCE

1.5 SUBMITTAL REQUIREMENTS

A. Isolation Pads

B. Spring Isolators

C. Seismic Control:

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the registered professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, seismic, and wind forces required to select vibration isolators, seismic and wind restraints.

3. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other sections for equipment mounted outdoors.

4. Seismic and Wind Restraint Details:
   a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraint to the restrained items and to the structure. Show attachment locations, methods, and spacing’s. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors.

5. Periodic Special Inspections: The mechanical contractor shall provide a list of components/systems requiring periodic special inspections per IBC.

6. Special Certification Requirements: Each contractor responsible for the construction of a “Designated Seismic System” for active plumbing equipment that must remain operable following the design earthquake, or components with hazardous contents certified by the manufacturer to maintain containment following the design earthquake shall submit a Manufacturer’s Certificate of Compliance for review and approval by the Registered Design Professional responsible for the design of the system. This information shall then be submitted to the AHJ.
7. All brace or restraint components, mounting devices, snubbers and anchors.

PART 2 - PRODUCTS

2.1 NEOPRENE ISOLATORS

A. Isolation Pads: Oil resistant neoprene pads, minimum $\frac{1}{4}$-inch thick, with cross-ribbed or waffle design. Size pads for not more than 50 psi or as recommended by vibration isolator manufacturer.

B. Floor Mounted Isolators: Double deflection type neoprene mounts, having minimum deflection of 0.35 inch. All metal surfaces shall be neoprene covered, base plate shall have mounting holes, and top shall have threaded steel plate or threaded steel insert. Element shall be color coded or labeled with molded symbols to identify capacity. Mason Series ND, Amber Booth "RV" or approved.

C. Suspension Isolators: Shall be double deflection neoprene type, with isolator encased in open steel bracket and minimum 3/8-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD, Amber Booth "BRD" or approved.

2.2 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection (as shown on drawings) not less than 1-1/2", except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2 inches. Floor isolator springs shall have deflection of not less than 1 inch. All isolators shall provide at least 96% isolation efficiency. Note: Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved.

B. Floor Type Spring Isolators: Shall be open spring type with approximate ratio between horizontal and vertical spring constant of 1.0. A ribbed neoprene acoustical friction pad shall be bonded to the underside of the isolator. Provide with height saving bracket.

1. Approved Manufacturers:
   a. Mason Series SLF
   b. Amber Booth "SW" or approved.

C. Floor Housed Type: Housed spring isolator with ductile iron housing, steel base plate with mounting holes, spring inspection ports, neoprene cushion, leveling screws.

1. Approved Manufacturers:
   a. Mason Series SSLFH
   b. Amber Booth "XLS" or approved.
D. Suspension Type Spring Isolators: Shall consist of a rigid steel frame, a stable steel spring in the bottom part of the frame, and double deflection neoprene isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than on half rod diameter shall be provided all around the rod.

1. Approved Manufacturers:
   a. Mason Series DNHS
   b. Amber Booth "BSSR" or approved.

2.3 SEISMIC RESTRAINTS

A. Materials: Steel shall be per ASTM A36; hangers and other devices shall be as shown in "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems". Sheet metal used for bracing shall be no less than 16 gauge. Cable bracing may be used provided that opposed acting cables are provided on the items being braced to provide bracing equal to that provided by rigid angle bracing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. Motorized equipment shall be mounted on or suspended from spring vibration isolators either integral or external to the equipment. Floor mounted or suspended isolators.

2. Unless otherwise indicated, resilient mounts for motorized equipment shall be of the type and size to provide maximum ten percent transmissibility. Use unhoused, free-standing stable steel springs which are preferred over housed spring assemblies. The horizontal stiffness of the spring shall be approximately equal to its vertical stiffness. The spring deflection shall be selected based on the equipment power range (HP), speed range (RPM), and static deflection of the supporting structural floor. For large equipment such as fans the steel spring static deflection of the supporting structural floor. It is a specific recommendation that whenever a steel spring is used, two pads of ribbed waffle-pattern neoprene be used in series with the spring.

3. The design of vibration dampening shall consider lateral load as well as vertical load and be suitably snubbed against earthquake forces.

4. A list of isolators accompanied by certified transmissibility ratings for the required duty shall be submitted for each item of equipment.

5. Unless noted otherwise, all vibration isolating equipment shall be of the same make and shall be submitted as one group.

6. All piping in the mechanical equipment rooms connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.

7. Special equipment, such as compressors, condensation pumps, boilers, etc., shall be selected on an individual basis.
8. Inertia bases shall be provided for all equipment with rotating or reciprocating parts when such equipment is located above occupied spaces and for equipment where the motor is separate from equipment. Bases shall be constructed of welded steel angles and channel frame filled solid with structural concrete with #4 rebar at 6 inches on center spanning short dimensions.

3.2 SEISMIC CONTROL

A. Support and bracing from the structure to pipes, ducts and mechanical equipment shall conform to ASCE and the plumbing & HVAC industry standard SMACNA “Seismic Restraint Manual, Guidelines for Mechanical Systems.”

B. Provide earthquake bumpers for all equipment that is supported on isolators and weighing over 300 lbs. including base. Provide minimum of four bumpers for equipment weighing less than 2,000 lbs., and eight bumpers for heavier equipment.

C. For equipment 400 lbs or greater, provide lateral force calculations per IBC if required by the building official.

D. Piping: Longitudinal and transverse bracing shall be required for all piping 2-1/2-inch diameter and larger and on all fuel gas piping 1 inch and larger. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 40 feet, except on fuel gas piping on maximum intervals of 20 feet.
2. Longitudinal bracing shall occur at maximum intervals of 80 feet, except on fuel gas piping on maximum intervals of 40 feet. Transverse bracing for one pipe section may also act as a longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 2 feet of the elbow or tee of similar size. Piping conveying fluids at 100°F. and higher shall have expansion devices provided in between longitudinal braces to allow for thermal expansion.
3. Bracing may be omitted when the top of the pipe is suspended 12 inches or less from the supporting structural member and the pipe is suspended by an individual hanger.
4. Seismic bracing for fire sprinkler system shall be as specified per Division 21.
5. Provide seismic bracing for hot water tanks.

E. Provide seismic bracing for hot water tanks.

END OF SECTION
SECTION 220553 - MECHANICAL IDENTIFICATION FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION
A. General Requirements: Drawings and general provisions of the Contract, including General and other Conditions and Division 01 - General Requirements sections, apply to the work specified in this Section.

1.2 STANDARDS
A. ANSI Compliance: Comply with ANSI A13.1 for lettering size, colors, and installed viewing angles of identification devices.

1.3 SCHEDULES
A. Submit Valve Schedule for each piping system, typewritten, and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. Provide a framed copy of Valve Tag Schedule in the mechanical/janitors room.

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
Not Applicable

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURES
Not Applicable.

2.2 PLASTIC PIPE MARKERS
A. Provide manufacturer's standard preprinted, flexible or semi-rigid, permanent, color-coded, plastic sheet pipe markers.

1. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125° F (52° C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
2. Small Pipes: For external diameters less than 6" (including insulation if any), provide full band pipe markers, extending 360° around pipe and minimum 12" long at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap. Laminate or bonded application of pipe marker to pipe (or insulation).
   c. Strapped to pipe with nylon strap.

3. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
   a. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.3 PLASTIC TAPE

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
   1. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6".

2.4 PLASTIC VALVE TAGS

A. Provide manufacturer's standard plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener.

2.5 VALVE TAG FASTENERS

A. Manufacturer's standard solid brass (wire link or beaded type), or solid brass S-hooks of sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.6 VALVE SCHEDULE FRAMES

A. For each page of Valve Schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraved stock phenolic plastic laminate, complying with FS L-P-387, engraved with engraver's standard letter style of sizes and wording, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" for units up to 20 sq in or 8" length; 1/8" for larger units.
2. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.
3. Letter Size: No less than ½" tall. (Use unit# as noted on the equipment schedules)

B. Provide for all equipment and signage at emergency shut-offs, etc and on all acid resistant waste and vent piping at 10' intervals stating "Acid Waste".

2.8 PAINT

A. Benjamin Moore Impervo or equivalent.

B. Use appropriate primer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING IDENTIFICATION

A. Install pipe markers on each system, and include arrows to show normal direction of flow.

3.3 PIPE MARKERS AND COLOR BANDS

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied space, machine rooms, accessible maintenance spaces and exterior non-concealed locations or in accessible ceiling spaces.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floor/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes, and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermittently at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings omit intermittently spaced markers.
8. Color assignments and stencil for piping identification shall be as listed below (colors used shall be verified with Owner prior to ordering).

<table>
<thead>
<tr>
<th>Service/Stencil</th>
<th>Color</th>
<th>Stencil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Domestic Hot Water Recir.</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Non-Potable Cold Water*</td>
<td>Orange</td>
<td>Black</td>
</tr>
<tr>
<td>Non-Potable Hot Water*</td>
<td>Orange</td>
<td>Black</td>
</tr>
<tr>
<td>Non-Potable Hot Water Recir.*</td>
<td>Orange</td>
<td>Black</td>
</tr>
<tr>
<td>Waste &amp; Vent Piping</td>
<td>Orange</td>
<td>Black</td>
</tr>
<tr>
<td>Gas Piping</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Sprinkler Work</td>
<td>Red</td>
<td>White</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Blue</td>
<td>White</td>
</tr>
</tbody>
</table>

* = (CAUTION: NON-POTABLE WATER, DO NOT DRINK)
9. Identification stenciling and flow arrows shall be the same color.

3.4 VALVE IDENTIFICATION
A. Provide valve tag on every valve, cock, and control devices in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn watering hose bibbs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in Valve Schedule for each piping system.

3.5 SCHEDULES
A. Mount Valve Schedule frames and schedules in riser rooms or as directed by Engineer.

3.6 PLUMBING EQUIPMENT IDENTIFICATION
A. Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operation device. Provide signs for the following general categories of equipment and operational devices. Provide signs or suspended ceiling tile below mechanical equipment located above ceiling.
Pumps and similar motor-driven units.
Tanks and pressure vessels.
3.7 NON-POTABLE DOMESTIC SYSTEMS

A. Furnish and install label reading “CAUTION: NON-POTABLE WATER, DO NOT DRINK” at each fixture served by a non-potable system.

3.8 CONCEALED ITEMS

A. Items concealed above accessible ceilings requiring access, shall have the ceiling marked to indicate such items location. The marking system shall consist of colored phenolic plates with ½” tall engraved lettering specifying the item concealed; plate shall be applied to ceiling T-bar framing with rivets or other owner approved method below the concealed item. Colors used shall be verified with Owner, and unless directed otherwise, shall be:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Plumbing System Component</td>
<td>Blue</td>
</tr>
<tr>
<td>Fire Protection System Component</td>
<td>Red</td>
</tr>
</tbody>
</table>

B. Provide three (3) color legends (hard laminate) listing the above colors. Locate as directed by Owner.

END OF SECTION
SECTION 220719 - PIPING INSULATIONS

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, insulating of piping and fittings per schedule in Part 3 of this specification.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems. Inserts at hangers are specified in Section 22 05 29 and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hangers/supports. See Section 22 05 29.

C. The intent of this section is to meet or exceed the requirements of the most current version of the Washington State Energy Code (WSEC). The stricter of this section and WSEC shall be met.

1.2 RELATED SECTIONS

A. Section 200000 – General Mechanical Requirements

B. Section 221116 – Domestic Water Pipe and Fittings

1.3 SECTION INCLUDES

A. Piping insulation, jackets, and accessories.

1.4 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. All insulation

B. Field Applied Jackets

1.5 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not applicable
PART 2 - PRODUCTS

2.1 PIPE INSULATIONS

A. Glass Fiber: Meeting ASTM C547; rigid molded, noncombustible.
   1. 'K' Value: 0.23 Btu-in/hr. Ft² °F at 75 degrees F per ASTM C 518.
   2. Maximum Service Temperature: 850 degrees F.
   3. Rated 25/50 per ASTM 84, UL 723 and NFPA 255.
   4. Vapor Retarder Jacket: All service (ASJ) white kraft paper reinforced with glass fiber
      yarn and bonded to aluminum foil, secure with self-sealing longitudinal closure laps and
      butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as
      needed.
   5. Approved Manufacturers:
      a. Manville
      b. Knauf
      c. Owens Corning
      d. Manson Insulation

B. Elastomeric Insulation: Meeting ASTM C534; flexible, closed cell, cellular elastomeric,
molded or sheet.
   1. “K” Value: 0.25 Btu-in/hr. Ft² °F at 75 degrees F.
   2. Maximum Service Temperature of -70 degrees F. to 220 degrees F.
   4. Maximum Smoke Developed: 25/50 through 1” wall.
   5. Maximum water vapor permeability, wet cup, perm-in .10.
   6. Connection: Waterproof vapor retarder adhesive as needed.
   7. UV-Protection: Outdoor protective coating.
   8. Shall have R-Value of 4.2 at 1” and R=8 at 2”.
   9. The material shall be manufactured under an independent third-party supervision testing
      program covering the properties of fire performance, thermal conductivity and WVT.
   10. Shall be fiber free, formaldehyde-free, and low VOC’s.
   11. Approved Manufacturers:
       a. Armacell
       b. Armstrong
       c. Kflex
       d. Aeroflex
       e. Durkflex

C. Cellular Glass: ASTM C552: “K” value of 0.35 at 75 degrees F; 8.0 lb/cu ft. density.
   1. Glass cell insulation, Pittsburgh Corning “Foamglass”, with water-vapor permeability of
      0.00 perm-inch as tested per ASTM and “pittwrap” heat sealed water-proof membrane.
   2. Approved Manufacturers:
       a. Glass Cell Isofab
       b. Pittsburgh Corning
D. Field Applied Jackets:

1. PVC Plastic: One-piece molded type fitting covers and jacketing material, gloss white.
2. Connections: Tacks; Pressure sensitive color matching vinyl tape.
4. Aluminum Jacket: 0.016-inch (0.045 mm) thick sheet, (smooth/embossed) finish, with longitudinal slip joints and 2-inch (50 mm) laps, die shaped fitting covers with factory attached protective liner.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that piping has been tested for leakage in accordance with U.P.C./I/P.C. standards before applying insulation materials.

B. Verify that all surfaces are clean, dry, and free of foreign material.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's recommendations, building codes, and industry standards.

B. Continue insulating vapor barrier through penetrations except where prohibited by code.

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 cold pipes conveying fluids below ambient temperature with vapor retardant jacket with self sealing laps. Insulate complete system.
4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions.
5. Insulated pipe supports and insulation shield shall be in place at each hanger and support as required by Section 220529 prior to insulating.
6. For pipe exposed in mechanical equipment rooms or exposed in finished spaces up to 10 feet above finished floor, finish with Manville Zeston 2000 PVC jacket and fitting covers, self-adhering jacket, or aluminum jacket.
7. For exterior applications, provide weather protection jacket or coating. Insulated pipe, fittings, joints, and valves shall be covered with Manville Zeston 2000 PVC, self-adhering jacket, or aluminum jacket. Jacket seams shall be located on bottom side of horizontal piping. Install per manufacturer’s recommendations.
8. Insulate trap and hot water supply on ADA compliant lavatories. For rigid piping, insulate with elastomeric foam insulation, 3/8” minimum thickness. See Plumbing Fixture Schedule and Section 224000 for ADA compliant lavatory for approved application.
9. Installation of below ground domestic hot water piping insulation: All piping shall be insulated with cellular glass with heat sealed "pittwrap" or pre-insulated pipe system with Type K copper carrier (See Section 230719-HVAC Piping Insulation).

10. Elastomeric Insulation Installation:
   a. For PEX piping installation, elastomeric insulation shall be installed continuous through stud framing and all penetration locations through walls, floors, and ceilings.
   b. Elastomeric insulation with wall thicknesses greater than 1” shall not be installed in air plenums.
   c. All elastomeric foam and sheet seams shall be sealed with adhesive per the insulation manufacturer’s recommendations.
   d. Install elastomeric insulation on all PEX domestic hot water and recirculation water piping.

3.3 PIPING INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>INSULATION TYPE</th>
<th>PIPE SIZE</th>
<th>THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass Fiber Insulation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water, Aboveground</td>
<td>½” to 1 ¼”</td>
<td>1”</td>
</tr>
<tr>
<td></td>
<td>1 ½ and greater</td>
<td>1 ½”</td>
</tr>
<tr>
<td>Cold Water</td>
<td>All Sizes</td>
<td>1”</td>
</tr>
<tr>
<td>Piping Exposed to Freezing or Semi-Heated Spaces</td>
<td>All Sizes</td>
<td>1 ½”</td>
</tr>
<tr>
<td>Elastomeric Insulation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Drain and Overflow Roof Drain Bodies</td>
<td>All Sizes</td>
<td>1”</td>
</tr>
<tr>
<td>Roof and Overflow Drainage, All Horizontal Pipe from Drain Body</td>
<td>All Sizes</td>
<td>1”</td>
</tr>
<tr>
<td>PEX Domestic Hot Water</td>
<td>All Sizes</td>
<td>1”</td>
</tr>
<tr>
<td>PEX Cold Water</td>
<td>All Sizes</td>
<td>Not Required</td>
</tr>
<tr>
<td>Copper Condensate Piping</td>
<td>All Sizes</td>
<td>½”</td>
</tr>
<tr>
<td>Cellular Glass and Pre-Insulated:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water, Below Ground</td>
<td>All Sizes</td>
<td>1 ½”</td>
</tr>
</tbody>
</table>

3.4 FITTINGS, VALVES, STRainers, FLANGES, HEADERS, AND Expansion Covers

A. General: Provide all fitting insulation covers for pipe fittings, grooved end couplings, and for pipe flanges.

B. Exposed Work: Provide "Zeston PVC" insulated fitting covers applied after pipe insulation is installed. A pre-cut "Hi-Lo Temp" insulation insert, conforming to the UL 25/50 rating, shall be snugly tucked around the fitting making sure the fitting is covered with the full thickness of insulation.

1. All others provide covering in pad form, constructed as follows: Use 1-inch thick Owens-Corning Fiberglas TIW Glass Wool, Type I, non-oiled, fully enclosed on all sides and edges within tight-weave canvas jacket. Attach Bergen hooks around edges of pad. Fit pad to device with edges tightly butted and secure with copper wire laced between hooks. Provide vapor seal where vapor seal is required for adjacent insulation.
C. The one-piece UL 25/50 rated PVC fitting cover shall be snapped over the insulated fitting and secured with tack fasteners, staples, or tape.

D. Concealed Downspout Piping and Domestic Cold-Water Piping: Zeston fitting covers, stapled, and adhesive sealed to adjacent vapor barrier jacket, same as specified for exposed work.

E. Gauge Lines: Insulate to the gauge shutoff valve.

3.5 PIPE HANGERS

A. Do not allow pipes to come in contact with hangers.

END OF SECTION
SECTION 221116 - DOMESTIC WATER PIPE AND FITTINGS

PART 1 - GENERAL

1.1 GENERAL
   A. Includes, but not limited to, general piping installation procedures for domestic water systems.

1.2 RELATED SECTIONS
   A. Section 200000 – General Mechanical Requirements.
   B. Section 220719 – Piping Insulations
   C. Section 221119 – Piping Specialties
   D. Section 221300 – Soil, Waste, and Vent Piping System
   E. Section 222100 – Sleeves and Seals for Plumbing Equipment

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Pipe
   B. Solder

1.4 REFERENCES
   B. UL 1479: Through-Penetration Fire Stop Systems.
   C. NSF/ANSI 61: Leaching of contaminants into the water.
   D. NSF/ANSI 372: Lead content in drinking water system components.

1.5 QUALITY ASSURANCE
   A. NSF Compliance: NSF 61 for potable water service.
   B. Domestic water fittings, joining materials, and all other appurtenances in contact with potable water shall be lead-free except those specifically exempted in Section 3874 of the Safe Water Drinking Act.
1. Lead-free shall mean:
   a. Not containing more than 0.2% lead when used with respect to solder and flux; and
   b. Not more than a weighted average of 0.25% when used with respect to the vetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

1.6 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 PIPE (FOR POTABLE SYSTEMS)

A. Underground Piping (Outside Building Perimeter):
   1. Schedule 80 PVC, solid core.

B. Underground Piping (Inside Building Perimeter):
   1. Type K Copper, ASTM B 88:
      a. Approved Manufacturers:
         1) Mueller
         2) Cambridge
         3) Nibco
         4) Cerro
   2. Fittings:
      a. Solder type (all sizes)

C. Above Ground Piping:
   1. Type L Copper, ASTM B 88:
      a. Approved Manufacturers:
         1) Mueller
         2) Cambridge
         3) Nibco
         4) Cerro
   2. Fittings:
      a. Solder type (all sizes), or
      b. Mechanical press type (all sizes):
         1) Approved Manufacturers:
            a) Viega ProPress
            b) Nibco
      c. NSF 61 Mechanical couplings (2-1/2” and larger):
         1) Approved Manufacturers:
            a) Victaulic
            b) Prior approved equal.
3. NSF61 316 L Stainless Steel:
   a. Fittings:
   1) Welded (all sizes), or
   2) Mechanical press type (2” and smaller)
      a) Approved Manufacturers:
         i) Victaulic

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING AND FITTINGS

A. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.

B. Properly make adequate provisions for expansion, contraction, slope, and anchorage.

C. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.

D. Remove burr and cutting slag from pipes.

E. Make changes in direction with proper fittings.

F. Install piping at such heights and in such a manner as to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

G. Coordinate installation of piping with all trades which are affected by installation to avoid conflicts.

H. Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

I. Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

J. Make connections of dissimilar metals with insulating couplings. (di-electric unions). See Section 221119 – Piping Specialties.

K. During installation cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

L. Do not use reducing bushings, street elbows, or close nipples.

M. T-drill procedure for connecting pipes will not be allowed.
N. Wrought tees shall be used on all branch piping and branch to main connections.

O. Bury water piping 6 inches minimum below bottom of slab and encase in 2 inches minimum of sand.

P. All copper joints below slab shall be cleaned bright and brazed.

Q. Copper joints to be soldered shall be cleaned bright by manual or mechanical means. The joints shall be properly fluxed with approved-type flux before soldering.

R. Solder for potable water pipes shall be of a lead-free type and shall conform to current UPC standards for solder and all local code requirements.

1. Approved Manufacturers:
   a. Canfield
   b. J.W. Harris
   c. Aqua-Clean

S. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

T. Pitch all piping and provide drain valves so that all piping and equipment can be drained.

U. Provide escutcheons where pipe passes through walls, floors, or ceilings.

V. Install all exposed piping parallel to the closest wall and in a neat, workmanlike manner.

3.2 DOMESTIC WATER PIPING TESTS AND STERILIZATION

A. Tests: As the work progresses each section of the water system shall be tested under a 100psi hydrostatic test held for 2 hours without reduction of pressure (a pressure fluctuation of +/- 1 psi is acceptable). If any leaks occur or piping or valves are found to be defective, same shall be removed and new material installed, and the test made on that section again until all material is found to be satisfactory. Such test shall be made in the presence of the Owner's Representative.

B. Flushing and Chlorination: All piping shall be flushed to remove all dirt and foreign material. After flushing, all piping shall be chlorinated in accordance with regulations of the Washington State Health Dept. After the contact period, the chlorine shall be drained from the piping and the piping flushed. The Contractor will take samples for bacteriological analysis. The water analysis must be satisfactory before piping is acceptable.

END OF SECTION
SECTION 221119 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL
   A. Furnish devices as indicated with complete installation procedures for systems.

1.2 RELATED SECTIONS
   A. General Conditions, Division 1
   B. Section 200000 – General Mechanical Requirements
   C. Section 221116 – Domestic Water Pipe and Fittings

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Thermometers
   B. Pressure Gauges
   C. Strainers
   D. Unions
   E. Flexible Connectors
   F. Trap Primers
   G. Thermostatic Mixing Valves and Manufacturers Approved Piping Diagram
   H. Backflow Prevention Devices
   I. Pressure Reducing Valves
   J. Aquastats
   K. Thermal Expansion Tanks
   L. Water hammer Arrestors

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   A. Trap Primers
B. Thermostatic Mixing Valves

C. Backflow Prevention Devices

D. Aquastats

1.5 QUALITY ASSURANCE

A. NSF Compliance: Fittings, specialties, and other appurtenances serving the potable water system shall be NSF61 certified.

B. Domestic water fittings, joining materials, and all other appurtenances in contact with potable water shall be lead-free except those specifically exempted in Section 3874 of the Safe Water Drinking Act.

1. Lead-free shall mean:
   a. Not containing more than 0.2% lead when used with respect to solder and flux; and
   b. Not more than a weighted average of 0.25% when used with respect to the vetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Adjustable angle type, 304 stainless steel stem, 5" reading dial type, true anti-parallax-dial black numerals, markings in degrees F., stainless steel, double-strength glass viewing window. Provide sockets with extension necks where installed on insulated piping

B. Thermometer Temperature Ranges:

<table>
<thead>
<tr>
<th>Measuring</th>
<th>Range Degree F.</th>
<th>Increments Degree F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water</td>
<td>0 – 100</td>
<td>1</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>30 – 180</td>
<td>2</td>
</tr>
</tbody>
</table>

C. Approved Manufacturers:

1. Ashcroft
2. March
3. Weiss
4. Tel-Tru
5. Winters
6. Taylor
2.2 PRESSURE GAUGES

A. Glycerin filled type, 2 ½” reading dial with aluminum face and black numerals, markings in English units, 304 stainless steel case and acrylic lens. Provide each gauge with snubber and needle valve. Provide sockets with extension necks where installed on insulated piping.

B. Pressure gauge ranges:

<table>
<thead>
<tr>
<th>Measuring</th>
<th>Range PSIG</th>
<th>Numeral Intervals</th>
<th>Inter - Graduations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Hot Water</td>
<td>0 – 160</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>0 – 160</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>0 – 160</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

C. Approved Manufacturers:

1. Ashcroft
2. Marsh
3. Weiss
4. Tel-Tru
5. Winters
6. Taylor

2.3 STRAINERS

A. Water Strainers ½”-2”: "Y" type, same size as the pipe in which they are installed, with bronze bodies rated for 125 psi working pressure, and with removable cover and sediment basket. Basket screen shall be stainless steel or monel, with a net free area of at least 3 times that of the entering pipe. Provide with blowdown valve where shown on the drawings.

B. Water Strainers 2 ½” and Larger: “Y” type, same size as the pipe in which they are installed, with cast iron body coated with FDA approved Epoxy finish, flanged Class 125 lb. connection, removable cover and sediment basket. Basket screen shall be stainless steel with a net free area of at least 3 times that of the entering pipe. Provide with blowdown valve where shown on the drawings.

C. Air Strainers: Unless otherwise noted, air and gas line strainers shall be Y-pattern, iron body, 250 psi working pressure, with 40 mesh Monel screens packed with Everdur wool. Air line strainers shall be fitted with brass blowoff cock.

D. Approved Manufacturers:

1. Armstrong
2. Bell and Gossett
3. Apollo
4. Conbraco
5. Hoffman
6. Wheatley
7. Nibco
2.4 UNIONS

A. Dielectric Waterways: Inert, non-corrosive thermoplastic lining with zinc electroplated casing, rated at 300 psi at 225 deg. F., conforming to ANSI/NSF 61. Type and size to match piping.

1. Approved Manufacturers:
   a. Walter Vallett Company V-line
   b. Clear Flow

B. Unions on Copper Pipe:

1. In 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union.
2. In 2-1/2-Inch Pipe and Larger: Brass flange unions.
3. Approved Manufacturers:
   a. Watts
   b. Nibco
   c. Mueller

2.5 FLEXIBLE CONNECTORS

A. Water Pump Flexible Connectors: Flexible bronze braid, bronze hose, and copper ends rated to a working pressure of 470 psi at 70°F for a 1” flexible connector.

1. Approved Manufacturers:
   a. Metraflex
   b. Minnesota Flex
   c. Resistoflex

2.6 PIPE SHIELDS (SADDLES)

A. Pipe shields shall be minimum, 20-gauge galvanized sheet steel.

B. Pipe shield shall cover 40% of the insulation, minimum, where the pipe is supported at the bottom.

C. Pipe shield shall cover 100% of the insulation where the pipe is clamped to the hanger or support.

D. See Section 220529-Hangers and Supports for information on length and gauge.

2.7 TRAP PRIMERS

A. Provide an approved trap primer at each floor drain, funnel drain, shower drain, janitor mop sink, and floor sink.
1. Automatic Trap Primers (Water Pressure Drop Activated): Up to 4 traps may be served by a single trap primer and trap primer distribution system. Automatic primers shall be concealed in every case, located in pipe spaces or wall cavities; and where not accessible in a pipe space, provide an access panel. Elevate trap primer at increments of 12” per 20L.F. of pipe run to trap.
   a. Approved Manufacturers:
      1) Sioux Chief Manufacturing
      2) Mifab

2. Automatic Trap Primers (Electronically Activated): Up to 30 trap primers may be served by a single electronic trap primer assembly. Electronic trap primer assemblies shall be provided preassembled with an atmospheric vacuum breaker, preset 24-hour clock, manual override switch/test button, calibrated manifold providing equal water distribution, and a recessed wall box with a locking stainless steel access panel.
   a. Approved Manufacturers:
      1) PPP (Precision Plumbing Products)

3. Trap primer Tailpieces: 17 GA chrome plated. To be installed on lavatories and hand sinks only. One trap may be served by a single tailpiece trap primer. Provide with stainless steel braided primer hose and escutcheon.
   a. Approved Manufacturers:
      1) JR Smith
      2) Watts
      3) Zurn

2.8 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves for Emergency Eyewashes, Showers, and Combination Eyewash/Showers:
   1. The mixing valve shall be manufactured specifically for emergency fixture applications and be compliant with ANSI 358-1.
   2. The mixing valve shall have solid bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature and pressure fluctuations.
   3. Provide a locking type temperature regulator to prevent accidental movement, set temperature at 80 degrees F.
   4. The mixing valve shall close down on failure of cold-water supply.
   5. Shall have internal cold-water bypass capable full flow upon failure of hot water supply.
   6. Provide outlet dial thermometer, integral wall support, union angle check stops on inlets, and recessed or surface mounted cabinet with locking access panel.
   7. Mixing valves for eyewashes shall be capable of 4 gpm, including cold water bypass. Mixing valves for showers and combination eyewash showers shall be capable of 20 gpm, including cold water bypass.
   8. Approved Manufacturers:
      a. Bradley
      b. Apollo Conbraco
      c. Acorn
2.9 BACKFLOW PREVENTION DEVICES

A. Provide letter of certification to Owner.

B. Type and configuration shall conform to local authority requirements.

C. Approved Manufacturers:
   1. Apollo Conbraco
   2. Wilkins
   3. Watts

2.10 PRESSURE REDUCING VALVES

A. Furnish for water service above 70 psi.
   1. Type A: 1/2" through 2", adjustable pressure from 25-75 psi, provide 75-100 psi type if higher pressure.
   2. Type B: 2" and larger adjustable pressure from 25-75 psi.
   3. Approved Manufacturers:
      a. Wilkins
      b. Watts
      c. Apollo Conbraco

2.11 AQUASTATS

A. Automatic Timer Kit:
   1. The timer kit shall be UL approved.
   2. The timer kit shall be installed on the connection box of the pump.
   3. The timer kit will be suitable for 115/120V, 60 HZ operation.
   4. The timer shall provide automatic ON-OFF. It shall also have the option of providing manual ON-OFF control.

B. Aquastats:
   1. The aquastat shall be UL approved.
   2. The aquastat shall be connected to the lead wires in the connection box of the pump.
   3. The aquastat will be suitable for 115/120V, 60 HZ operation.
   4. The aquastat shall provide thermostat control to the circulator. It will turn OFF (open) at 120°F (48.9°C) water temperature and ON (closed) at 100°F (37.8°C) water temperature.

C. Automatic Timer Kit and Aquastat Combination:
   1. The automatic timer kit and aquastat shall be combined to provide automatic time and temperature control to the pump.
   2. When the automatic timer and the aquastat are used together, the pump will only circulate water when the ON time conditions are met and when the water temperature is low enough to cause the aquastat to switch ON.
D. Approved Manufacturers:
   1. Bell & Gossett
   2. Honeywell

2.12 THERMAL EXPANSION TANKS

A. ASME Domestic Water Thermal Expansion Tank (For Systems with Water Heaters Greater Than 119 Gallons and/or 199 mbh):
   1. The ASME domestic water thermal expansion tank shall be IAPMO and NSF listed.
   2. The outer shell shall be high grade steel with exterior coating. The bladder shall be FDA approved butyl rubber and prevent water from contact with shell interior. The assembly shall incorporate a shrader valve for adjustable air precharge and lead-free bronze system connection. Tank sizes larger than 8 gallons shall be provided in a vertical configuration with a ring base, lifting rings, and an NPT system connection. Expansion tank pressure is to be set at the domestic water operating pressure.

B. Approved Manufacturers:
   1. Armstrong
   2. Amtrol
   3. Wilkens

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read.

B. Pressure Gauges: Install pressure gauges at each side of pressure reducing valves; and as indicated.

C. Strainers: Install strainers as indicated. Provide plugged gate or ball valve in blow-off connection on strainers, valve shall be same size as blow-off tapping.

D. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated.

E. Thermostatic Mixing Valves: Install in accordance to installation detail and the manufacturer’s recommendations.
F. Install (1) piston type water hammer arrester at each quick acting valve for branch supply lines up to 20’ in length serving plumbing fixture groups. Install water hammer arrester between last two fixtures, for branch supply lines exceeding 20’ in length, serving plumbing fixture groups install water hammer arrester between middle two fixtures and last two fixtures, sizes as indicated in the table below.

**Water Hammer Arrester Table**

<table>
<thead>
<tr>
<th>Fixtures Units</th>
<th>Connection Size</th>
<th>PDI Rating</th>
<th>Water Hammer Arrester Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-11</td>
<td>½”</td>
<td>A</td>
<td>Sioux Chief #652-A</td>
</tr>
<tr>
<td>12-32</td>
<td>¾”</td>
<td>B</td>
<td>Sioux Chief #653-B</td>
</tr>
<tr>
<td>33-60</td>
<td>1”</td>
<td>C</td>
<td>Sioux Chief #654-C</td>
</tr>
<tr>
<td>61-113</td>
<td>1”</td>
<td>D</td>
<td>Sioux Chief #655-D</td>
</tr>
<tr>
<td>114-154</td>
<td>1”</td>
<td>E</td>
<td>Sioux Chief #656-E</td>
</tr>
<tr>
<td>155-330</td>
<td>1”</td>
<td>F</td>
<td>Sioux Chief #657-F</td>
</tr>
</tbody>
</table>

G. Approved Manufacturers:

1. Sioux Chief: 650 Series
2. Wilkins: 1250 XL
3. Wade: WP5-100
SECTION 221300 - SOIL, WASTE, AND VENT PIPING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Includes but not limited to:

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building, or as indicated.
2. Furnish and install acid waste piping system within building, or as indicated.
3. Perform excavating and backfilling required by work of this Section.

1.2 RELATED SECTIONS

A. General Conditions, Division 1
B. Section 200000 – General Mechanical Requirements
C. Section 221116 – Domestic Water Pipe and Fittings

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe and Fittings
B. Above ground couplings
C. Below ground couplings
D. Entire acid waste system (pipe, fittings, procedures)
E. Acid Neutralization Tank
F. Solvent Cement

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 SOIL WASTE AND VENT PIPING

A. Cast Iron:
1. Each piece of cast-iron pipe shall bear the manufacturer's identification mark and shall be certified by the manufacturer to have met the requirements of the latest ASTM specifications.
   a. Above Ground Waste and Vent: All soil, waste and vent piping above ground shall be:
      1) Hubless cast iron pipe and fittings: Conform to ASTM A888 and CISPI 301.
         a) Approved Manufacturers:
            i) AB&I
            ii) Charlotte
            iii) Tyler
      2) Couplings shall be constructed of 300 Series type stainless steel. There shall be 2 bands for pipe sizes up to 4” and a minimum of 4 bands for pipe sizes 5” and larger. Sealing bands shall require a minimum of 60-inch lbs. torque per band. Neoprene gasket shall meet ASTM C 564.
      3) Approved Above Ground No Hub Couplers:
         a) Thermafit-Regular Duty
         b) Tyler-Standard No-Hub
         c) Clamp-All Corp. - HI-TORQ 80
   b. Below Ground Waste and Vent: All soil and waste vent below ground shall be:
      1) Hubless Cast Iron Pipe and Fittings: Conform to ASTM A 888 & CISPI 301.
         a) Approved Manufacturers:
            i) AB&I
            ii) Charlotte
            iii) Tyler
      2) No Hub Coupling: Couplings shall be constructed of 300 Series type stainless steel with a minimum shield thickness equal to 0.015. There shall be 2 bands for pipe sizes up to 4” and a minimum of 4 bands for pipe sizes 5” and larger. Coupling shall be capable of holding 15 psi of pressure. Sealing bands shall have a minimum thickness of 0.026 and require a minimum of 80-inch lbs. torque per band. Neoprene gasket shall meet ASTM C 564.
      3) Approved No Hub Coupling Manufacturers:
         a) Clamp-All Corp. - HI-TORQ 80
         b) Thermafit-Heavy Duty
   c. Belowground Waste and Vent Beyond 5’ From the Building: All soil, waste, and vent piping below ground shall be:
      2) Fitting: Comply with current UPC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not caulk threaded work.
B. Place cleanouts as follows:

1. Where shown on Drawings and near bottom of each stack and riser.
2. At every 90-degree change of direction for horizontal lines.
3. Every 100 feet of horizontal run.
4. Extended cleanout to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

C. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gases pass freely to atmosphere with no pressure or siphon condition on water seal.

D. Vent entire waste system to atmosphere. Discharge vent pipe minimum 14 inches above roof. Join lines together in least practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley.

E. Use torque wrench to obtain proper tension in cinch bands on above ground hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

F. Flash pipes passing through roof with 4 lbs. per sq. ft. of sheet lead flashing (or as shown on the plan) fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound. Extend lead up and turn in to pipe for min. 1”/vent. Flashing base shall be at least 24 inches square.

G. Grade soil and waste lines within building perimeter 1/4-inch fall per ft. in direction of flow.

H. For exterior waste piping under parking areas or roads use ductile iron or SDR 35 PVC (DWV rated) if pipe is buried less than 5'-0" below finish paving or grade.

I. Installation shall comply with all the latest local plumbing, building, and fire code requirements. Solvent cement joints shall be made in a two-step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D 2564, test installation with water.

J. Install an expansion joint in each vertical straight run of PVC or polypropylene waste and vent pipe at intervals in excess of 30 feet. Install and anchor pipe per expansion joint manufacturer’s instructions. Provide access panel as required for servicing the expansion joint.

K. Install vertical waste pipe to comply with standard installation practices for suds control.

L. Install grease traps, grease interceptor, and oil/water separators to allow access for lid removal and servicing.

M. Provide hubless cast iron for the first 20 feet downstream of drains located in the kitchen and boiler room.

3.2 ACID WASTE PIPING INSTALLATION

A. All installation of acid waste system shall be performed per manufacturers recommendations by contractors trained and certified by the manufacturer of the submitted brand.
3.3 FIELD QUALITY CONTROL

A. Before piping is covered, conduct tests for leaks and defective work. Notify Architect prior to testing. Correct leaks and defective work. Fill waste and vent system to roof level with water, 10 feet minimum, and show no leaks for two hours.

END OF SECTION
SECTION 221500 - COMPRESSED AIR

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To: Furnish and install air compressor, dryer and appurtenances, piping and fittings.

B. Related Sections:
   1. General Conditions, Division 1
   2. Section 200000 – General Mechanical Requirements
   3. Section 221116 – Domestic Water Pipe and Fittings

1.2 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Valves
B. Stops
C. Air Compressor
D. Dryer
E. Outlets
F. Auto Electric Drain Valve

1.3 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Air Compressor
B. Dryer
C. Auto –Electric Drain Valve

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Atlas Copco
B. Quincy
C. Speed Aire
D. Ingersoll Rand

2.2 PIPE
A. Meet requirements of ASTM A 53-87b, "Specification for Piping, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".
B. Carbon steel, Schedule 40 black steel pipe.
C. Pipe running underground shall be Type 'K' copper.
D. Pipe running concealed above finish floor may be Type 'L' copper.

2.3 FITTINGS
B. For copper, see Section 221116 – Domestic Water Pipe and Fittings.

2.4 VALVES
A. 125 psi bronze or iron body, square head cock, with bronze plug or AGA approved ball valve.
B. Approved Manufacturers: Crane 1228 or equal.

2.5 STOPS
A. Furnish Crane or Mueller stops as hereinbefore specified. Furnish union joints as required for removal of equipment.

2.6 AIR COMPRESSOR
A. Shall have 2-stage, cast iron crankcase compressor, inlet filter silencer, ASME vertical tank, open drip-proof motor.

2.7 DRYER
A. Shall be refrigerated, compressed air dryer rated.
2.8 OUTLETS
   A. Furnish and install female quick disconnect couplers to suit Owner's equipment. Quality per U.S. MIL-C4109E

2.9 AUTO ELECTRIC DRAIN VALVE
   A. Solid state-controlled solenoid valve, corrosion – resistant water proof molded solenoid coil, brass & stainless valve, and manual override switch. Provide with ‘Y’ strainer (Speed Aire or Approved Equal, Granger Model # 62948.)

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Provide at each connection to equipment a shut-off valve.
   B. Fasten tank to floor through vibration isolators.
   C. Run after cooler and tank drains to drain.
   D. Provide auto electric drain valve at each compressor and each air dryer.

END OF SECTION
SECTION 222100 - SLEEVES AND SEALS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL

A. Includes sleeving and sealing of plumbing piping.

1.2 RELATED SECTIONS

A. General Conditions, Division 1
B. Section 221116 – Domestic Water Pipe and Fittings

1.3 REFERENCES

A. ASTM E814: Fire Tests of Through-Penetration Fire Stops
B. UL 1479: Through-Penetration Fire Stop Systems.

1.4 SUBMITTAL REQUIREMENTS

A. Submittal requirements for this Section.

1. Seals

1.5 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products shall comply with Section 200000, paragraph 2.1, Approved Manufacturers.
B. Fire Seals: 3M, Dow Corning, General Electric, Rectorseal Metacaulk.
2.2 PIPE SLEEVES

A. Size: Inside diameter of pipe sleeves shall be at least 1/2-inch larger than the outside diameter of the pipe or pipe covering, so as to allow free movement of piping.

B. Ends: Sleeve ends shall be cut flush with finished surfaces, except in rooms having floor drains where sleeves shall be extended 3/4-inch above finished floor.

C. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe.

D. Material - Non-structural: Sleeves through non-structural elements shall be fabricated from 18-gauge galvanized sheet metal or 24-gauge spiral duct.

E. De-burr pipe ends and smooth slab penetration (to accept final slab finish) from sleeves extending above finished floor.

2.3 SEALS

A. Seals in Interior Fire Rated Assemblies: Shall be tested in accordance with ASTM E814 and shall be UL classified per UL 1479 as a through-penetration fire stop device.

B. Seals in Exterior Masonry Walls and Floors:
   1. Piping: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute watertight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Thunderline "Link-Seal" or approved equal.

C. Seals in Other Areas: Packed fiberglass or wool insulation, where no weatherproofing or adhesive properties are required; otherwise, sealants shall be silicone type.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE SLEEVES

A. Provide pipe sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the piping passes through the solid elements (e.g., solid wood stud, core drilled solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element.

B. Set sleeves plumb or level (or sloped as required for drainage pipe) in proper position, tightly fitted into the work.
C. Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

D. Seal around all pipes inside of pipe sleeve.

E. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

F. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

3.2 INSTALLATION OF SEALS

A. Provide seals around all piping passing through walls, floors, roofs, foundations, footings, grade beams, partitions, and similar elements.

B. Seals shall be of material and workmanship to maintain the fire and smoke rating of element being penetrated. Seals ability to maintain the rating of the element being penetrated shall be listed in UL Laboratories Building Materials Directory or otherwise confirmed by an approved listing agency. It shall be the Contractor's responsibility to submit shop drawings and technical data showing seals and systems proposed, and corresponding agency approval. The Contractor shall also be responsible to submit any data as required by local agencies to satisfy them that the Contractor's proposed fire seals are satisfactory.

C. Seals shall be watertight where the penetration may be exposed to water or moisture.

END OF SECTION
SECTION 223300 - ELECTRIC STORAGE TYPE WATER HEATERS

PART 1 - GENERAL

1.1 GENERAL
   A. Includes, but not limited to, furnishing and installing specified system.

1.2 RELATED SECTIONS
   A. General Conditions, Division 1
   B. Section 200000 – General Mechanical Requirements
   C. Section 220548 – Vibration and Seismic Control
   D. Section 221116 – Domestic Water Pipe and Fittings

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Water heaters.

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   A. Water Heaters

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
   A. State
   B. Lochinvar
   C. Rheem/Ruud
   D. Bradford White
   E. PVI
2.2 COMMERCIAL HEATER

A. The heater(s) shall be as scheduled. The heater shall be for (vertical/horizontal) installation with lifting lugs and channel skid base. Vessel shall be constructed to Section IV of the ASME Code for 125 psi working pressure. Vessel shall be glass-lined with anodic protection. Entire vessel and electrical controls are to be encased in a rectangular sheet metal enclosure with baked enamel finish. Tank to be insulated with fiberglass insulation. Separate 2" dial type temperature gauge will be mounted on the front of the enclosure. Enclosure to have hinged locking door over electric controls. There shall be individually replaceable 4 bolt flange mounted, incoloy sheathed heating elements, each complete with prewired terminal leads. These elements will be switched by magnetic contactors which are operated by a 120V fused control circuit protected by manual reset high limit. Control circuit is activated by a master pilot switch and electronic low water cutoff. The thermostatic control of the contacts shall be staged thru solid state modulating step control which will balance the water heating input to the demand. This control shall prevent the entire electrical load from being switched on instantaneously. The control shall have even load progressive sequencing which utilizes the "first on, first off" principle thereby equalizing the operating time of heating elements and contactors. Each magnetic contactor and heating element circuit will be protected by a maximum of 60-amp cartridge type fuses with a minimum of 100,000 amp interrupting capacity. The entire water heating package shall be prewired to solderless terminal lugs, factory tested, complete with ASME temperature and pressure relief valve and bear the Underwriter's Laboratories label. Heater(s) shall have a 3-year limited warranty as outlined in the written warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water heaters shall each have a relief valve sized to match heat input and set to relieve at 120 psi.

B. Install temperature-pressure relief valve on hot water heater and pipe discharge directly above funnel of floor drain or as shown on plans.

C. If system has a hot water recirculating line and/or check valve in the cold-water supply to tank, provide a pre-charged, diaphragm type expansion tank "Amtrol" Model AST or approved equal. Size per schedule on Hot Water Tank Piping Diagram.

D. Water heaters installed in unconditioned space or on a concrete floor shall be placed on incompressible insulation having a minimum insulation value of R-10.

E. Provide and install seismic bracing per S.M.A.C.N.A. zone 3.

END OF SECTION
SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes, but not limited to, furnishing and installing specified plumbing fixtures. Provide and install soft flow aerators on all lavatories and sinks (service sinks not included). See 3.03 for energy conservation devices.

1.2 RELATED SECTIONS

A. General Conditions, Division 1
B. Section 200000 – General Mechanical Requirements
C. Section 221116 – Domestic Water Pipe and Fittings

1.3 QUALITY ASSURANCE (REGULATORY REQUIREMENTS)

A. Installation shall meet requirements of local codes and manufacturer's instructions.

1.4 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. All plumbing fixtures in this section and called out on the plans.
B. Floor drains.
C. Clean outs.
D. Carriers.
E. Hydrants.
F. Hose Bibbs.
G. Point of Use Thermostatic Mixing Valves.
H. Drinking Fountain.
I. Water Cooler.
J. Bottle Fillers.
1.5  OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Faucets, Exploded Parts Diagram
B. Flush Valves
C. Sensor Faucets
D. Wall Hydrants
E. Mixing Valves
F. Drinking Fountain
G. Water Cooler
H. Bottle Fillers

PART 2 - PRODUCTS

2.1  APPROVED MANUFACTURERS

A. Vitreous China and Cast-Iron Fixtures:
   1. American Standard
   2. Mansfield
   3. Kohler
   4. Toto
   5. Zurn
   6. Sloan

B. Supply Stops:
   1. Chicago Faucets “STB” Series, Loose Key
   2. Engineered Brass Company (EBC) “LAH” Series, Loose Key
   3. BrassCraft “KT” Series, Loose Key

C. Faucets:
   1. Chicago Faucets
   2. Zurn
   3. Symmons
   4. Toto
   5. Speakman
   6. Moen
   7. Delta

D. Waste:
   1. EBC
2. Just
3. Elkay

E. Traps:
1. EBC
2. Just
3. Elkay
4. Dearborn Brass

F. Flush Valves:
1. Sloan
2. Zurn
3. Geberit
4. Toto
5. Moen

G. Emergency Eye Wash & Showers:
1. Haws
2. Guardian
3. Bradley
4. Speakman
5. Acorn

2.2 FIXTURES

A. See Schedule on Drawings for fixture manufacture and model numbers and special requirements.

B. Toilets (WC): Manufactured of glazed vitreous china with an elongated bowl. Assemblies need to have a current Maximum performance (MaP) rating of 800 or more and be listed as a WaterSense approved fixture.

C. Urinals: Manufactured of glazed vitreous china.

D. Lavatory Sinks: Manufactured of glazed vitreous china or enameled cast iron (unless called out as stainless steel or solid surface on the plumbing fixture schedule).

2.3 FLOOR DRAINS (F.D.)

A. Cast iron body floor drain, with 5" nickel bronze adjustable strainer head, vandal proof screws, and trap primer connections. Size outlet to match pipe size shown on drawings. Where used for shower drain, provide with chrome plated strainer. Furnish with 6" diameter strainer and funnel where indicated.
B. Cast iron body floor drain, with Type 'N' 7" diameter, nickel bronze grate, vandal proof screws, and trap primer connections. Size outlet to match pipe size shown on drawings. Use in mechanical rooms and utility spaces.

C. Approved Manufacturers: J.R. Smith, Zurn, Wade

2.4 CLEANOUTS

A. Finish Floors:
   1. Zurn ZN-1400
   2. Smith #4023X
   3. Wade #W-6000
   4. Josam #55000-1

B. Resilient Flooring:
   1. Zurn ZN-1400-X
   2. Smith #4143
   3. Wade #W-6000-T
   4. Josam #55000-1-13

C. Finished Wall:
   1. Zurn Z-1468
   2. Smith #4472
   3. Wade #W8460R
   4. Josam #58600-PLG

D. Exposed Drain Lines:
   1. Zurn Z-1441
   2. Smith #4402
   3. Wade #W8560A
   4. Josam #58910

E. General Purpose:
   1. Zurn Z-1441
   2. Smith #4402
   3. Wade #W8550A
   4. Josam #55000

2.5 CARRIERS

A. WC carrier in stud wall with plumbing chase (Heavy duty type):
   1. J.R. Smith: 200 Series (Adjustable type)
   2. Zurn: Z-1200 Series (Adjustable type)
3. Wade: W300 Series (Adjustable type)

B. WC carrier in 2x8 stud wall:
   1. J.R. Smith: 500 Series
   2. Zurn: Z-1200 series
   3. Wade: W380

C. Urinal carriers in stud wall:
   1. J.R. Smith: 0637
   2. Zurn: Z-1222
   3. Wade: W400

D. Lavatory carriers in stud wall:
   1. J.R. Smith: 0700 (0700Z for 2x4 stud wall)
   2. Zurn: Z-1231
   3. Wade: W520

E. Lavatory carriers in plumbing chase wall:
   1. J.R. Smith: 0720
   2. Zurn: Z-1253
   3. Wade: W571

2.6 HYDRANTS

A. Wall Hydrants: Approved freeze-proof type with integral anti-siphon device, vacuum breaker device, self-draining, ¾ hose connection, loose key operated:
   1. Zurn: Z-1310
   2. Wade: W-8620 with union elbow
   3. Smith: 5609
   4. Josam: 71050
   5. Woodford: 65

B. Wall Box Hydrants: Freeze-proof type with integral anti-siphon vacuum breaker, ¾” hose connection, loose key operated, enclosed in a bronze box for flush wall installation with hinged door and key lock:
   1. Jay R. Smith: 5509QT
   2. Zurn: Z-1300
   3. Woodford: B 65

2.7 POINT-OF-USE THERMOSTATIC MIXING VALVE

A. Provide point-of-use thermostatic mixing valve with a temperature adjustment range between 90-140°F.
B. Mixing valve shall be rated for a minimum flow of 0.25 g.p.m certified to ASSE 1070 and a maximum pressure of 125 psi, and 200°F maximum hot water temperature.

C. Mixing valve body shall be comprised of lead-free bronze with locked temperature adjustment cap, and integral check valves on the hot and cold inlets.

D. Approved Manufacturers:

1. Leonard
2. Bradley
3. Watts

2.8 EMERGENCY FIXTURES

A. All emergency fixtures shall be certified to latest edition of ANSI/ISEA Z358.1.

B. Combination Shower and Eyewash:

1. Eyewash unit provided with aerated sprays for eyewash comfort and flip top dust caps. ABS plastic bowl, Stainless steel push handle activator.
   a. ½” NPT female inlet, 4.9 gpm @ 30psi flow.
   b. 1-1/4” NPT female waste.

2. Shower Unit provided with 8-inch plastic showerhead with 20 gpm restrictor flow. Powder coated yellow, aluminum triangular pull rod activator with ADA extension. IPS galvanize steel piping stanchion & fittings
   a. 1-1/4” NPTF female inlet located on top or side, 20 gpm @ 30psi flow.

C. Combination Shower and Eyewash:

1. Eyewash unit provided with aerated sprays for eyewash comfort and flip top dust caps. Stainless steel bowl, Stainless steel push handle activator.
   a. ½” NPT female inlet, 4.9 gpm @ 30psi flow.
   b. 1-1/4” NPT female waste.

2. Shower Unit provided with 8-inch stainless steel showerhead with 20 gpm restrictor flow. Powder coated yellow, aluminum triangular pull rod activator with ADA extension. IPS galvanize steel piping stanchion & fittings
   a. 1-1/4” NPTF female inlet located on top or side, 20 gpm @ 30psi flow.

D. Approved Manufacturers:

1. Speakman or approved equivalent
3.1 GENERAL

A. Installation: Install fixtures including traps and accessories with accessible stop or control valve in each hot and cold-water branch supply line.

B. Mounting: Verify mounting height with architectural elevations. Architectural elevations take precedence over these heights.

1. ADA Fixtures:
   a. Toilet: 17” to 19” to top of seat.
   b. Urinal: 16” from floor to bottom lip.
   c. Lavatory: 29” minimum clearance under fixture, maximum of 33” to rim.
   d. Drinking Fountain: Bubbler height shall be less than 36” from finished floor with 27” minimum clearance underneath.
   e. Shower Unit: Control height shall be 40” from finished floor.

2. Standard Fixtures:
   a. Elementary WC: 12” to rim from floor (Upon approval by District)
   b. WC: 14” to 16” to rim from floor.
   c. Elementary Urinal: 17” from floor to bottom lip.
   d. Urinal: 24” from floor to bottom lip.
   e. Lavatory: 29” from floor to top of apron.
   f. Drinking Fountain: Bubbler height shall be a minimum of 38” from finished floor.

C. Make fixture floor connections with approved brand of cast iron floor flange, soldered or caulked securely to waste pipe.

D. Make joints between fixtures and floor flanges tight with approved fixture setting compound or gaskets.

E. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point edges.

F. Install and connect all P-100 fixtures. Provide chrome plated brass waste, "Just" or equal.

G. Provide concealed arm supports for wall mounted china lavatories.

H. All exposed metal shall be chrome-plated brass.

I. Provide concealed heavy steel stanchion and supporting plate for lavatories and urinals.

J. Provide floor-mount fixture support for wall-hung water closets, and with 2” no-hub auxiliary inlet at each location of back to back water closet and urinal.

K. Flush valve supply pipe must be anchored and backed securely -- installation must be approved by engineer prior to concealing.

L. Provide flush valve supply support on all WC and urinal carriers.
M. Provide rear anchor support for all heavy-duty WC carriers.

N. All fixture mounting heights shall be verified or determined on site prior to installation. Coordinate with architectural drawings.

O. Provide trap primer and connection to p-trap of showers, floor sinks, floor drains, and service sinks.

P. ADA showers shall be installed with entrance lip flush with finish floor.

Q. On ADA water closets, provide flush valve handle or tank handle on side facing wheelchair turn around.

R. All ADA lavatory P-trap and angle stop assemblies shall be insulated with institutional A.D.A. insulator kit as manufactured by E.B.C. or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight. Use part 500RHS on offset P-trap if required.

S. Sensor Type Fixtures: Mechanical contractor to coordinate with electrical contractor for installation of all infra-red sensor type fixtures. Transformer kit provided and installed by mechanical contractor, all electrical connectors, wire connections, and testing by electrical contractor.

T. Hose Bibb: Install one (1) hose bibb in each toilet room with 2 or more water closets, urinals or a combination there of, mount at 18" under one lavatory.

U. Wall Hydrant: Install at 18" above finished grade, unless otherwise indicated.

V. Lavatory, Classroom, and Hand Sink Faucets: Set hot water delivery temperature at 105°F. Faucets without a mechanical temperature limit stop shall be provided with a point of use thermostatic mixing valve.

W. Fountain: Anchor bottom of fountain to wall. Bubbler height to be a maximum 36 inches above finish floor. Also, clear knee space between the bottom of the apron and the floor shall be at least 27 inches high.

3.2 ADJUSTING, CLEANING

A. Polish chrome finish at completion of Project.

B. Remove all manufacturers’ labels tags, and protective plastic.

C. Clean all fixtures.

D. Polish floor drain covers.
3.3 ENERGY CONSERVATION

A. Provide flow controls on all fixtures to limit flow as indicated:

<table>
<thead>
<tr>
<th>Fixture</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank-type WC</td>
<td>1.6 gal. (6.0 liters) per flush</td>
</tr>
<tr>
<td>Flushometer-valve WC</td>
<td>1.6 gal. (6.0 liters) per flush</td>
</tr>
<tr>
<td>Flushometer-tank WC</td>
<td>1.6 gal. (6.0 liters) per flush</td>
</tr>
<tr>
<td>Electromechanical hydraulic WC</td>
<td>1.6 gal. (6.0 liters) per flush</td>
</tr>
<tr>
<td>Urinals-manual operated flushometer</td>
<td>1.0 gal. (3.78 liters) per flush</td>
</tr>
<tr>
<td>Urinals-sensor operated flushometer</td>
<td>0.125 gal. (0.5 liters) per flush</td>
</tr>
<tr>
<td>Showerheads</td>
<td>2.5 gal. (9.5 liters) per minute</td>
</tr>
<tr>
<td>Lavatory Faucets (metered)</td>
<td>2.5 gal. (9.5 liters) per minute</td>
</tr>
<tr>
<td>Lavatory Faucets (non metered)</td>
<td>0.5 gal. (1.89 liters) per minute</td>
</tr>
<tr>
<td>Kitchen Faucets</td>
<td>2.5 gal. (9.5 liters) per minute</td>
</tr>
<tr>
<td>Public Lavatory Faucets (other than self-closing)</td>
<td>0.5 gal. (1.89 liters) per minute</td>
</tr>
<tr>
<td>Replacement Aerators</td>
<td>2.5 gal. (9.5 liters) per minute</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 230513 - MOTORS AND VARIABLE DRIVES

PART 1 - GENERAL

1.1 GENERAL
   A. Includes, but not limited to, motors 1/12 HP or larger used in Division 23.

1.2 RELATED SECTIONS
   A. General Conditions, Division 1
   B. Section 200000 – General Mechanical Requirements

1.3 SUBMITTALS REQUIREMENTS OF THIS SECTION
   A. All variable drives.
   B. Total harmonic voltage distortion calculation.

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   A. Check out sheet for each variable drive showing all programmed parameters. Date of check out, and name and company address of employee responsible for checkout.
   B. Programming manual explaining how to access and change all programmable points.
   C. International wiring diagram for each different unit.
   D. Parts diagram with replacement parts listed.
   E. Trouble shooting guide.

PART 2 - PRODUCTS

2.1 MOTORS
   A. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise. Motors used in fans serving dishwashing hoods shall be TEFC type.
   B. All motors shall be UL listed.
C. All motors used with variable frequency drives shall be premium efficiency inverter ready and shall be capable of running at least 85 Hz.

D. All motors 1 HP and larger shall be energy efficient type and shall meet the 2015 Washington State Energy Code requirements.

E. All fan motors 1/12 HP or greater and less than 1 HP shall be Electronically Commutated Motors (ECM) or shall have a minimum motor efficiency of 70 percent when rated in accordance with DOE 10 C.F.R. 431. These motor speeds shall be adjustable.

F. Motors shall not be smaller than indicated on drawings; however, motors shall be of adequate size to drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at any conditions encountered in actual operation. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. This Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.

G. ECM (Electrically Commutated Motors) shall conform to the motor requirements listed above. In addition, the Contractor purchasing the HVAC equipment that includes the ECM is responsible for ensuring the ECM motor control speed control is set to match the required component operation. The ECM motor control speed control may be preset by the HVAC equipment manufacturer. The Contractor purchasing the HVAC equipment shall provide documentation showing the appropriate ECM motor control board jumper pins, dip switches and/or multi-pin plugs settings for correct HVAC equipment component operation.

H. Approved Manufacturers:

1. General Electric
2. Westinghouse
3. Reliance
4. Allis-Chalmers
5. Gould
6. Century
7. Wagner
8. Baldor
9. U.S. Motors Marathon

2.2 VARIABLE FREQUENCY DRIVES (VFD UNDER 5 HP)

A. Variable Frequency Drives (VFD):

1. Description:
   a. Provide enclosed adjustable speed drives suitable for operating at the current, voltage, and horsepower indicated on the equipment schedule. Conform to requirements of NEMA ICS 3.1.
b. VFD shall not increase the voltage distortion above 5% at the input terminals of the VFD or line filters. The manufacturer shall make all modifications to the drive necessary to meet this requirement.

B. Ratings:

1. VFD must operate, without fault or failure, when voltage varies plus or minus 10 percent from rating and frequency varies plus or minus 5 percent from rating.
2. VFD shall be voltage as shown on schedule.
3. Operating Ambient Temperature: 14 degrees F to 104 degrees F.
4. Humidity: non-condensing to 95%.
5. Altitude: to 3300 feet, higher altitudes achieved by derating.
6. Starting Torque: 100% starting torque shall be available from 0.5 Hz to 60 Hz.
7. Overload capability: 110% of rated F.L.A. (full load amps) for 60 seconds; 150% of rated F.L.A., instantaneously.
8. The VFD must meet the requirements for Radio Frequency Interface (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.
9. In compliance with IEEE 519, the Total Harmonic Voltage Distortion for the VFD shall be no greater than 5%, the supplier of the VFD shall provide a dc bus choke or line reactors to ensure compliance. In order to estimate THVD the following is needed: Point of Common Coupling (PCC) and the KVA, and secondary voltage of the supply transformer. Assume 5.00% transformer impedance. If no transformer is present assume 50% of service demand.
10. VFDs must have a minimum short circuit rating of 65 Kamps RMS without additional input fusing.

C. Design:

1. VFD shall employ microprocessor-based inverter logic, isolated from all power circuits.
2. VFD shall include surface mount technology, with conformal coating.
3. VFD shall employ a PWM (pulse width modulated) inverter system, consisting of:
   a. Input Section:
      1) VFD input power stage shall convert three-phase AC line power into a fixed DC voltage via a solid-state full wave diode rectifier, with MOV (metal oxide varistor) protection.
   b. Intermediate Section:
      1) DC bus as a supply to the VFD Output Section shall maintain a fixed voltage with filtering and short circuit protection.
      2) DC Bus shall be interfaced with the VFD diagnostic logic circuit, for continuous monitoring and protection of the power components.
   c. Output Section:
      1) Insulated gate bipolar transistors (IGBT's) shall convert DC bus voltage to variable frequency and voltage.
      2) PWM sine coded output to the motor.
4. The VFD must be selected for operation at carrier frequencies at or above 5 kHz without derating to satisfy the conditions for current, voltage and horsepower as indicated on the equipment schedule.
5. VFD shall include one independent remote reference input. The input shall be 0 - 10 VDC or 4 – 20mA. Input shall respond to a programmable bias and gain.
6. VFD shall include a minimum of two digital input terminals:
   a. Reverse rotation direction
   b. Remote Reset

7. VFD shall provide terminals for remote contacts, to allow starting in the automatic mode.

8. VFD shall include one fully rated form “A” contact and one fully rated form “C” contact. The contact purpose is selectable and shall provide one of two functions:
   a. Drive Running
   b. Drive Faulted

9. VFD shall include a power loss ride of 2 seconds.

10. VFD shall include front mounted control operators that set the motor overheat drive shutdown, set the acceleration and deceleration, and set the output frequency limits. Operating mode (auto or manual) and speed setting functions shall also be provided.

11. VFD shall include electronic thermal overload protection for both the drive and motor. The electronic thermal motor overload shall be approved by UL. If the electronic thermal motor overload is not approved by UL, a separate UL approved thermal overload relay shall be provided in the VFD enclosure.

12. VFD shall include the following program functions:
   a. Auto restart capability.
   b. Stall prevention capability.
   c. Ability to close fault contact after the completion of all fault restart attempts.

13. VFD shall include factory settings for all parameters, and the capability for those settings to be reset.

14. VFD shall include the capability to adjust the following functions, while the VFD is running:
   a. Forward/Reverse direction.
   b. Acceleration adjustment from 0 to 3600 seconds.
   c. Deceleration adjustment from 0 to 3600 seconds.
   d. One preset speed.

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 230548 - VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. This section includes, but not limited to vibration isolation and seismic restraint installation for all equipment, ductwork, and piping as described here-in.

B. Seismic Restraints shall be bidder-designed. Seismic Design Criteria are to be established per the International Building Code and ASCE along with Project Structural drawings.

C. Items not included in this specification shall not relieve the contractor of the responsibility of providing seismic bracing that meets all the criteria required by the referenced codes and in accordance with the seismic design guidelines and the project structural drawings.

1.2 REFERENCED CODE AND STANDARDS

A. The latest adopted versions of the following codes and standards apply to this section.

1. International Building Code (IBC)
2. National Fire Protection Association (NFPA-13)
4. ASCE 7-10, American Society of Civil Engineers “Minimum Design Loads for Buildings and Other Structures”
5. Applicable Project Structural Drawings for Seismic Design Criteria
6. Applicable Manufacturer’s Seismic Design Guides for proprietary listed seismic bracing and mounting hardware
7. Where there is a conflict in requirements between these guidelines and above-mentioned codes the more stringent parameters shall prevail.

1.3 RELATED SECTIONS

A. General Conditions, Division 1 and Division 23

B. Section 200000 – General Mechanical Requirements

1.4 DESIGN CRITERIA

A. Occupancy Category of Structure (I-IV) per IBC or ASCE

B. Component Importance Factor (Ip) per ASCE

C. Mapped Acceleration Parameters (S1 and (Ss) per IBC and Project Structural Drawings

D. Site Class (A – F) per IBC and Project Structural Drawings
E. Site Coefficient (Fa) per IBC and Project Structural Drawings

F. Site Coefficient (Fv) per IBC and Project Structural Drawings

G. Seismic Design Category (A – D) based on Short Period Response Accelerations per IBC and Project Structural Drawings

H. Seismic Design Category (A – D) based on 1-Second Period Response Acceleration per IBC and Project Structural Drawings

I. Amplification Factor ap per ASCE

J. Response Modification Factor Rp per ASCE

1.5 SUBMITTAL REQUIREMENTS

A. Isolation Pads

B. Spring Isolators

C. Seismic Control:

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, seismic, and wind forces required to select vibration isolators, seismic and wind restraints.
   a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other sections for equipment mounted outdoors.

3. Seismic and Wind Restraint Details:
   a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraint to the restrained items and to the structure. Show attachment locations, methods, and spacing’s. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors.

4. Periodic Special Inspections: The mechanical contractor shall provide a list of components/systems requiring periodic special inspections per IBC.
5. Special Certification Requirements: Each contractor responsible for the construction of a “Designated Seismic System” for active mechanical equipment that must remain operable following the design earthquake, or components with hazardous contents certified by the manufacturer to maintain containment following the design earthquake shall submit a Manufacturer’s Certificate of Compliance for review and approval by the Registered Design Professional responsible for the design of the system. This information shall then be submitted to the AHJ.

6. All brace or restraint components, mounting devices, snubbers and anchors.

1.6 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 NEOPRENE ISOLATORS

A. Isolation Pads: Oil resistant neoprene pads, minimum ¼-inch thick, with cross-ribbed or waffle design. Size pads for not more than 50 psi or as recommended by vibration isolator manufacturer.

B. Floor Mounted Isolators: Double deflection type neoprene mounts, having minimum deflection of 0.35 inch. All metal surfaces shall be neoprene covered, base plate shall have mounting holes, and top shall have threaded steel plate or threaded steel insert. Element shall be color coded or labeled with molded symbols to identify capacity. Mason Series ND, Amber Booth "RV" or approved.

C. Suspension Isolators: Shall be double deflection neoprene type, with isolator encased in open steel bracket and minimum 3/8-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD, Amber Booth "BRD" or approved.

2.2 SEISMIC RESTRAINTS

A. General:

1. All seismic hangers and components shall be domestically made. Products designed domestically and fabricated in a foreign country are prohibited.

2. Products not permitted include: powder actuated anchors, gas actuated anchors, or anchors requiring epoxy.

3. Only Steel or Ductile Iron components shall be provided. No Cast Iron or Cast Aluminum components are allowed.

4. Steel shall be per ASTM A36; hangers and other devices shall be as shown in “SMACNA Seismic Restraint Manual” or approved manufacturers seismic design guidelines.
B. Seismic Bracing (rigid and cable):

   1. Approved Manufacturers:
      a. Tolco
      b. International Seismic Application Technology (ISAT)
      c. Mason Industries
      d. Cooper B-Line
      e. Kinetics Noise Control
      f. AFCON
      g. Gripple
      h. PHD
      i. Unistrut
      j. Anvil or prior approved equal.

C. Seismic Anchorages (for wood, steel and concrete):

   1. Approved Manufacturers:
      a. Hilti
      b. ITW Ramset/Red Head
      c. ITW Buildex
      d. Mason Industries
      e. Tolco, AFCON
      f. Simpson Strong-Tie
      g. Powers Fasteners, Inc. or prior approved equal.

D. Flexible Connectors:

   1. Approved Manufacturers:
      a. Mason Industries
      b. Metraflex
      c. Victaulic
      d. Kinetics Noise
      e. International Seismic Application Technology (ISAT) or prior approved equal.

E. Pipe Hanger Components:

   1. Approved Manufacturers:
      a. Tolco
      b. International Seismic Application Technology (ISAT)
      c. Mason Industries
      d. Cooper B-Line
      e. Kinetics Noise Control
      f. AFCON
      g. Gripple
      h. PHD
      i. Unistrut
      j. Anvil or prior approved equal
PART 3 - EXECUTION

3.1 VIBRATION ISOLATION

A. Motorized equipment shall be mounted on or suspended from spring vibration isolators either integral or external to the equipment. Floor mounted or suspended isolators.

B. Unless otherwise indicated, resilient mounts for motorized equipment shall be of the type and size to provide maximum ten percent transmissibility. Use unhoused, free-standing stable steel springs which are preferred over housed spring assemblies. The horizontal stiffness of the spring shall be approximately equal to its vertical stiffness. The spring deflection shall be selected based on the equipment power range (HP), speed range (RPM), and static deflection of the supporting structural floor. It is a specific recommendation that whenever a steel spring is used, two pads of ribbed waffle-pattern neoprene be used in series with the spring.

C. The design of vibration dampening shall consider lateral load as well as vertical load and be suitably snubbed against earthquake forces.

D. A list of isolators accompanied by certified transmissibility ratings for the required duty shall be submitted for each item of equipment.

E. Unless noted otherwise, all vibration isolating equipment shall be of the same make and shall be submitted as one group.

F. All piping in the mechanical equipment rooms connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.

G. Special equipment, such as boilers, etc., shall be selected on an individual basis.

H. Inertia bases shall be provided for all equipment with rotating or reciprocating parts when such equipment is located above occupied spaces and for equipment where the motor is separate from equipment. Bases shall be constructed of welded steel angles and channel frame filled solid with structural concrete with #4 rebar at 6 inches on center spanning short dimensions.

3.2 SEISMIC BRACING GENERAL REQUIREMENTS

A. Support and bracing from the structure to pipes, ducts and mechanical equipment shall conform to ASCE and the plumbing & HVAC industry standard SMACNA “Seismic Restraint Manual, Guidelines for Mechanical Systems” or approved manufacturer’s listed seismic assemblies.

B. Provide snubbers for all equipment that is supported on isolators and weighing over 400 lbs. including base. Provide minimum of four snubbers for equipment weighing less than 2,000 lbs., and eight snubbers for heavier equipment.

C. Curb-mounted rooftop units shall be provided with suitable bracing on four sides connecting unit with curb to prevent excessive movement in a seismic event. The contractor is responsible for proper seismic attachment of the rooftop curb to building structure.

D. Housekeeping pads shall be properly anchored to the roof deck or floor per ASCE.
3.3 SEISMIC BRACING GENERAL REQUIREMENTS - PIPING

A. When determining horizontal load requirements, consider all pipes full of water and maximum equipment heights unless calculated for other substances and equipment.

B. Seismic bracing shall not limit the expansion and contraction of the piping system. When thermal expansion or contraction is involved, longitudinal bracing shall be designed at the anchor point of the piping system. The longitudinal bracing and the connections must be capable of resisting the additional force induced by expansion and contraction.

C. Seismic bracing for fire sprinkler system piping and riser components shall be as specified per Division 21.

3.4 INSTALLATION

A. Installation of seismic restraints shall be as follows:

1. Upon completion of installation of all seismic restraint materials and before start up of restrained equipment, all debris shall be cleaned from beneath all protected equipment, leaving equipment free to contact snubbers.

2. All external utility connections to restrained equipment shall be designed to allow differential seismic motion without damage to the equipment or utility connections.

3. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following manufacturer’s written instructions.

4. After equipment installation is completed, adjust limit stops following manufacturer’s written instructions so they are out of contact during normal operation.

5. Adjust snubbers according to manufacturer's written instructions.

6. Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.

7. Attach piping to the trapeze per seismic restraint manufacturer’s design. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

8. Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer’s design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to rods.

9. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

3.5 SPECIAL INSPECTIONS

A. When required continuous or periodic special inspections of the equipment and systems designated on the list provided by the mechanical contractor shall be performed in accordance with the IBC and ASCE. The owner shall reserve the right to employ an approved special inspector.
B. Per the IBC, the registered design professional in responsible charge may designate members of the A&E team to act as special inspectors provided those personnel meet the qualification requirements of the IBC to the satisfaction of the building official.
SECTION 230593 - AIR SYSTEM TESTING AND BALANCING

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, testing, balancing and adjusting of air heating, cooling and exhaust systems.

1.2 RELATED SECTION(S)

A. General Conditions and Division 1 apply to this section.

B. Division 23 shall make changes in pulley, belts, and dampers as required for correct balance as recommended by Air Testing & Balancing Agency at no additional cost to Owner.

C. Division 23 shall repair leaks in ductwork at no additional cost to Owner.

1.3 SYSTEM DESCRIPTION (PERFORMANCE REQUIREMENTS)

A. Perform testing and balancing in complete accordance with the Associated Air Balancing Council (AABC), National Environmental Balancing Bureau (NEBB), or National Balancing Council (NBC) standards and procedures.

B. Air Testing & Balance Agency shall perform tests specified, compile test data, and submit copies of complete test data to Contractor for forwarding to Architect/Engineer for evaluation and approval.

1.4 SUBMITTALS REQUIRED BY THIS SECTION

A. Company information including Washington State Contractors’ license.

B. Key personnel and resumes.

C. AABC, NEBB, or NBC certifications.

D. Provide reference of five (5) completed jobs of similar size and complexity.

1.5 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Final air balance report shall be bound in the O & M Manual or provided under a separate volume.

B. Preliminary air balance report shall be submitted to the Architect/Engineer for approval. Preliminary report shall note all finished measured data.
C. Final Test Data:

1. Provide project name, name and telephone number of balancing firm, GC, MC, Architect, and Engineer in the cover (or first page) of report.
2. Provide a summary of air balance findings regarding airtightness of each ducted systems, deficiencies of equipment to meet design requirements, deficiencies of space pressure relationships, etc.
3. Cover sheet shall have a statement from the site project manager that reads, “The air system testing and balancing report contained here in is true and factual based on actual field measurements and adjustments. I have personally performed or witnessed a minimum of 5% of the airflow tests.”
4. Each page of test report to have a unique page number.
5. Provide fan curve or chart of each fan in system.
6. Provide final approved test report in PDF format on CD. Provide one more CD than hard copies of test report.
7. Obtain and provide a copy of the air barrier test (building tightness) whether or not the Air Balance Contractor produced the test.

1.6 QUALITY ASSURANCE (QUALIFICATIONS)

A. Mechanical Contractor shall procure services of an independent Air Testing & Balance Agency, which specializes in testing, and balancing of heating, ventilating, and cooling systems to balance, adjust, test air-moving equipment, air distribution, and exhaust systems.

B. Agency shall be approved in writing by Consultant.

C. Instruments used by Agency shall be accurately calibrated and maintained good working order.

D. If requested, conduct tests in presence of Architect/Owner/Engineer.

1.7 SEQUENCING & SCHEDULING

A. Mechanical Contractor shall award test and balance contract to approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.

B. Begin air testing and balancing upon completion of air cooling, heating, and exhaust systems including installation of all specialties and devices.

C. Mechanical Contractor shall put heating, ventilating, and cooling systems and equipment into full operation and continue their operation during each working day of testing and balancing.

PART 2 - PRODUCT (NOT USED)
3.1 FIELD QUALITY CONTROL

A. Testing Procedure: Air Testing & Balancing Agency shall perform following tests and balance system in accordance with following requirements at design conditions of supply and a minimum outside air CFM (not 100% return or 100% economizer).

1. Test, adjust, and record fan rpm to design requirements.
2. Test and record motor amperes at design conditions.
3. Make pitot tube traverse of main supply duct and obtain design cfm at fans. (systems of 1000 CFM or greater)
4. Test and record system static pressures: suction, discharge, and clean filters (if applicable; for systems of 2000 CFM or greater)
5. Test, adjust, and record system for design cfm air.
6. Test, adjust, and record system for design cfm outside air.
7. Test, adjust, and record each diffuser, grille, and register to within 10% of design requirements.
8. On a floor plan, identify each diffuser, grille, and register to location and area using a designation symbol unique to that page.
9. Identify and list size, type, and manufacturer of diffusers, grilles, registers, and testing equipment. Use manufacturer's rating on equipment to make required calculations.
10. In readings and tests of diffusers, grilles, and registers, include required cfm and test cfm after adjustments.
11. In cooperation with Division 23, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
12. Adjust diffusers, grilles, and registers to minimize drafts.
13. Identify at each volume damper with permanent mark, the position of actuator handle once final balance has been achieved.
14. Measure and record all pressure differential relationships as identified by the control’s diagrams (i.e. labs, kitchen, pharmacy, art rooms, building pressure, etc). These measurements are to be taken when all HVAC is running after full balance has been completed. Note the measured reference points to determine the pressure differential.
15. For any spaces with exhaust and supply to them where design airflows cannot be obtained, the systems shall be adjusted to produce a negative pressure to the adjacent space (i.e. workrooms, restrooms, labs, nurse rooms, etc.)
16. When reconciling supply, return, outside, and exhaust air quantities, priority shall be placed on outside air quantities (typically, return air quantities noted on plans are for duct sizing only).
17. Where duct pressure sensors are noted in controls diagrams (i.e. variable volume systems) adjust system to its minimum pressure point that still achieves full airflow to all terminals. Record this setpoint in test report and provide data to controls contractor.
18. For variable volume systems, adjust sheave package to produce maximum airflow (or diversity as applicable) at 60 Hz with simulated filter loading. If maximum airflow cannot be obtained at 60 Hz, increase frequency until maximum airflow is obtained as allowed by the equipment manufacturer and maximum motor amperes. Record final values.
19. Verify that all gravity backdraft dampers are moving freely, open in proper direction, and are unbound.
20. After balancing system, measure terminal CFM when system is in 100% economizer. If supply is greater than design, coordinate with controls contractor or MC to provide damper stops to provide design CFM during 100% economizer.

21. On All Motors with Variable Drives: Set maximum amperage safety to protect motor from over loading.

B. Final Inspection & Adjustments:

1. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of air balancing test report.
   a. Architect may choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building.
   b. Rebalancing shall be done in presence of Architect and subject to his approval.
   c. Spot balance and rebalance shall be performed at no additional cost to Owner.

2. System shall be completely balanced and all reports submitted to Architect prior to prefinal inspection.

3. Where equipment supplied to job site provides over 5% more air than schedule requirements, rooms supplied by that equipment shall have their supply air quantities increased by the ratio of actual total air quantity supplied to minimum air quantity required by schedule.

3.2 BALANCING FIRMS (APPROVED)

A. Hardin and Sons

B. Testing and Commissioning Services

C. Airtest Company, Inc.

D. American Air Balance Company

E. Advanced Mechanical Services, Inc.

END OF SECTION
SECTION 230713 - EQUIPMENT/DUCTWORK INSULATION

PART 1 - GENERAL

1.1 GENERAL
   A. This section describes the insulation requirement to meet or exceed the 2012 Washington State Energy Code. Lining installation is per 233113.

1.2 RELATED SECTION(S)
   A. General Conditions, Division 1
   B. Section 200000 - General Mechanical Conditions

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Wrap Insulation

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   Not Applicable

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
   Not Applicable

2.2 DUCTWORK INSULATION
   A. Manufacturers: Manville Corporation Owens Corning, Knauf Insulation, Manson Insulation, or approved equal.
   B. Flexible Fiber Glass Blanket (Wrap Insulation): Manville, Microlite Type 75 meeting ASTM C553, Type 1, Class B-2; flexible blanket.
      1. 'K' ('ksi') Value: 0.27 at 75°F (0.040 at 24°C) installed.
      2. Density and R-value:
         a. R-3.3: 1.0” inch of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.
         b. R-5.3: 2.0” inches of 0.75 lb/cu. Ft. or 1.5 inches of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.
c. R-7: 3.0 inches of 0.75 lb/cu. Ft. or 2.0 inches of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.

3. Vapor Barrier Jacket: FSK, aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward cinched expanded staples and vapor barrier mastic as needed.

C. Rigid Fiber Glass Board: Insulation Board meeting ASTM C 612 Type IA and IB; rigid.

1. ‘K’ (‘ksi’) Value: ASTM C 177, 0.22 at 75°F mean temperature.
2. Maximum Service Temperature: 450°F.
3. Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK or PSK conforming to ASTM C 1136 Type II.
4. Securement: Secured in place using adhesive and mechanical fasteners spaced a minimum of 12” on center with a minimum of 2 rows per side of duct. Insulation shall be secured with speed washers and all joints, breaks and punctures sealed with appropriate pressure-sensitive foil tape, or glass fabric and vapor retarder mastic.
5. Density and R-value:
   a. R-4.5: 1.0” of 6.0 lb./cu.ft.
   b. R-6.8: 1.5” of 6.0 lb./cu.ft.
   c. R-9.1: 2.0” of 6.0 lb./cu.ft.

D. Duct Insulation Protection:

1. Aluminum Jacket: 0.016-inch (.045 mm) thick sheet, smooth/embossed finish, with longitudinal slip joints and 2-inch (50 mm) lamps.
2. Manville Insulkote ET, a non-water-vapor retarder, non-burning, weatherproof coating for use over insulation where ”breathing” is required.
5. Self-Adhering Jacketing: Material to be VentureClad [1579CW] with a white finish. Jacketing material is to have a maximum flame spread/smoke developed index of 25/20 per UL 723, 1 0.0000 water vapor permeance rating per ASTM E-96, mold inhibitors incorporated, and be UV stable.

2.3 DUCTWORK LINING

A. See Section 233113 - Steel Ductwork.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that ductwork has been tested for leakage in accordance with SMACNA standards before applying insulation materials.
B. Verify that all surfaces are clean, dry, and free of foreign material.

C. External Ductwork Insulation:

1. Provide insulated ductwork conveying air below ambient temperature with vapor retardant jacket. Seal all vapor retardant jacket seams and penetrations with UL listed tapes or vapor retardant adhesive.
2. Provide insulated ductwork conveying air above ambient temperature with or without vapor retardant jacket. Where service access is required, bevel and seal ends of insulation.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.
4. The underside of ductwork 24 inches or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18 inches on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.
5. For ductwork exposed to physical abuse in unfinished and exposed spaces, finish with duct insulation protection.
6. For outdoor applications, provide insulation with a weather protection jacket. Manville Zeston 2000, VentureClad self-adhering or approved equal. Install per manufacturer’s instructions.

D. For installation of lining insulation, see Section 233113.

3.2 INSULATION SCHEDULE

A. Provide wrap insulation and duct liner for the duct systems indicated per the following table (R-value indicates the thickness to be provided as defined in Section 230713 for wrap insulation and Section 233113 for liner):

<table>
<thead>
<tr>
<th>DUCT TYPE AND LOCATION</th>
<th>LINER</th>
<th>WRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within Conditioned Space:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Supply Air</td>
<td>R - 3.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Return Air</td>
<td>R - 3.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Primary Air</td>
<td>Not Required</td>
<td>R - 3.31,2</td>
</tr>
<tr>
<td>- Relief Air</td>
<td>Not Required</td>
<td>R - 3.31,2</td>
</tr>
<tr>
<td>- Transfer Air</td>
<td>R-3.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Exhaust Air</td>
<td>R-3.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- HRU Exhaust Air</td>
<td>Not Required</td>
<td>R - 7.1,2</td>
</tr>
<tr>
<td>- HRU Return Air</td>
<td>R-3.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Outside Air</td>
<td>Not Required</td>
<td>R - 7.1,2</td>
</tr>
<tr>
<td><strong>In cold attic, in cold ceiling space, in cold wall, in cold garage, in cold crawl space:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Supply Air</td>
<td>R – 6.3</td>
<td>R – 6.3</td>
</tr>
<tr>
<td>- Return Air</td>
<td>R – 6.3</td>
<td>R – 6.3</td>
</tr>
<tr>
<td>- Relief Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Transfer Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Exhaust Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Outside Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
</tbody>
</table>
## DUCT TYPE AND LOCATION

<table>
<thead>
<tr>
<th>On exterior of building, on roof:</th>
<th>LINER</th>
<th>WRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Supply Air</td>
<td>R – 8³</td>
<td>R – 8³</td>
</tr>
<tr>
<td>- Return Air</td>
<td>R – 8³</td>
<td>R – 8³</td>
</tr>
<tr>
<td>- Relief Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Transfer Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Exhaust Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Outside Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In concrete, in ground:</th>
<th>LINER</th>
<th>WRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Supply Air</td>
<td>R - 5.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Return Air</td>
<td>R - 5.3</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Relief Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Transfer Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Exhaust Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>- Outside Air</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
</tbody>
</table>

**Table Footnotes:**
1. Where duct is exposed to view, provide wrap with paintable duct insulation protection.
2. Building level insulation is required from backdraft/motorized damper to louver or roof hood. See plans for additional details. Coordinate with GC for insulation.
3. Use liner or rigid fiberglass board.

### B. For purposes of the Insulation Schedule above, the following defines the duct systems:

1. Supply Air: Air that has passed through mechanical conditioning device, such as a furnace, coil, evaporative section, heat recovery device, etc. that is distributed to the conditioned space.
2. Return Air: Air from the conditioned space to an air handler.
3. Primary Air: See Section 233113 – Steel Ductwork.
4. Relief Air: Air from the conditioned space to the outdoors or to a large semi-conditioned or non-conditioned space.
5. Transfer Air: Air from one conditioned space to another conditioned space.
6. Exhaust air: Air from a space moved by a fan to directly outside. Also, air downstream of a heat recovery device to directly outside.
7. HRU Return Air: Return air from a grille to a heat recovery device.
8. HRU Exhaust Air: Exhaust air from heat recovery devise to directly outside.
9. Outside Air: Air from the outside to a mechanical conditioning device such as a furnace, coil, evaporative section, heat recovery device, etc.

**END OF SECTION**
SECTION 230900 - STAND ALONE CONTROLS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions and Supplemental Conditions for Washington State Facilities Construction.

B. The general Provisions of the Contract, including General, Supplementary, and Special Conditions, and Division 1- General Requirements, apply to work specified in this section. Subcontractor must familiarize himself with the terms of the above documents.

1.2 SCOPE OF WORK

A. Scope of Work: Under the base bids, the controls as specified under Section 23 09 00 will be added to the project scope of work as a separate bid and pricing package. The following Stand Alone Controls manufacturers are approved for use on this project. No substitutions of manufacturers other than those listed will be considered. Input and output devices are not restricted to these manufacturers. Systems approved for bidding are:

1. Approved Manufacturers:
   a. Honeywell.
   b. Trane.
   c. Carrier

1.3 RELATED DOCUMENTS

A. All work of this Division shall be coordinated and provided by the single Controls Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.

1.4 DEFINITIONS

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level each separated by a defined deadband. Digital Inputs and Digital Outputs are examples.

C. Controls Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary installer, commissioner and ongoing service provider for the Controls work.
D. Control Sequence: A pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

E. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the controls software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

F. Node: A digitally programmable entity existing on the controls network.

G. PC: Personal Computer from a recognized major manufacturer. PC “clones” assembled by a third-party Subcontractor is not acceptable. PC must also have documentation verifying that it has been tested and is completely compatible with all installed software and communicates with any peripherals such as modems, NEC cards, printers, hubs, zip drives, etc. that may be attached.

H. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the controls wiring and terminations.

I. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.

J. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the controls industry for real-time, integrated controls configurations.

K. The following abbreviations and acronyms may be used in describing the work of this Division:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC</td>
<td>Analog to Digital Converter</td>
</tr>
<tr>
<td>AI</td>
<td>Analog Input</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AO</td>
<td>Analog Output</td>
</tr>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
</tr>
<tr>
<td>CFM</td>
<td>Cubic Feet Per Minute</td>
</tr>
<tr>
<td>DAC</td>
<td>Digital to Analog Converter</td>
</tr>
<tr>
<td>DDC</td>
<td>Direct Digital Control</td>
</tr>
<tr>
<td>DI</td>
<td>(Binary) Digital Input</td>
</tr>
<tr>
<td>DO</td>
<td>(Binary) Digital Output</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electronically Erasable Programmable Read Only Memory</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
</tr>
<tr>
<td>FAS</td>
<td>Fire Alarm Detection and Annunciation System</td>
</tr>
<tr>
<td>HOA</td>
<td>Hand-Off-Auto</td>
</tr>
<tr>
<td>ID</td>
<td>Identification</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>MCC</td>
<td>Motor Control Center</td>
</tr>
<tr>
<td>NC</td>
<td>Normally Closed</td>
</tr>
<tr>
<td>NIC</td>
<td>Not in Contract</td>
</tr>
<tr>
<td>NO</td>
<td>Normally Open</td>
</tr>
<tr>
<td>OWS</td>
<td>Operator Workstation</td>
</tr>
<tr>
<td>OAH</td>
<td>Outdoor Air Humidity</td>
</tr>
<tr>
<td>OAT</td>
<td>Outdoor Air Temperature</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>RH</td>
<td>Relative Humidity</td>
</tr>
<tr>
<td>ROM</td>
<td>Read Only Memory</td>
</tr>
<tr>
<td>SPDT</td>
<td>Single Pole Double Throw</td>
</tr>
<tr>
<td>SPST</td>
<td>Single Pole Single Throw</td>
</tr>
<tr>
<td>TBA</td>
<td>To Be Advised</td>
</tr>
<tr>
<td>VAC</td>
<td>Volts, Alternating Current</td>
</tr>
<tr>
<td>VAV</td>
<td>Variable Air Volume</td>
</tr>
<tr>
<td>VDC</td>
<td>Volts, Direct Current</td>
</tr>
</tbody>
</table>

### 1.5 QUALITY ASSURANCE

**A. General:**

1. The Controls Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. This branch facility shall provide the work for this project. This support facility shall have spare parts and all necessary test and diagnostic equipment required to install, commission and service the stand alone controls.

2. As evidence and assurance of the Contractor’s ability to support the Owner's system with service and parts, the Contractor must have been in business for at least the last ten (10) years and have successfully completed three projects comparable to the value of this contract in the preceding five years.

**B. Quality Management Program:**

1. Provide a competent and experienced Controls Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Controls Contractor employees in order to provide professional management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor

### 1.6 REFERENCES

**A.** All work shall conform to the following Codes and Standards, as applicable:

3. Underwriters Laboratories (UL) listing and labels.
4. UL 916 Energy Management
5. NFPA 70 - National Electrical Code.
7. NFPA 92A and 92B Smoke Purge/Control Equipment.
8. Factory Mutual (FM).
10. National Electric Manufacturer’s Association (NEMA).
11. American Society of Mechanical Engineers (ASME).
12. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
14. Institute of Electrical and Electronic Engineers (IEEE).
17. Occupational Safety and Health Administration (OSHA).
20. Americans Disability Act (ADA)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.7 SUBMITTALS

A. Control Drawings, Product Data, and Samples:

1. The Controls Contractor shall submit a complete controls package divided in two sections. The first section shall be delivered within 30 days after the contract has been awarded and the second section shall be delivered within 60 days after the contract has been awarded.
2. Allow at least 15 working days for the review of each package by the Engineer.
3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the Controls Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

B. Submittal Section 1:

1. Product data sheets for all products including software.

C. Submittal Section 2:

1. Controller wiring diagrams and sequences. Control drawings shall be created on AUTOCAD software, version 14 or newer.
2. Detailed Bill of Material, identifying part number, quantity, description, and optional features.
3. Room Schedule including a separate line for each terminal unit showing system name, minimum/maximum cfm, box area, and number of reheat stages.
4. Details of all interfaces and connections to the work of other trades.

1.8 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the controls provided:
   a. Table of contents
   b. As-built Control Drawings using AutoCAD Version 14 or newer. Drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
   c. Manufacturer’s product data sheets for all products including software.
   d. System Operator’s manuals.
   e. Wiring termination diagrams (use AutoCAD version 14 or newer).
   f. Interfaces to all third-party products and work by other trades.
   g. Valve, Damper and Room Schedules
   h. Point to point checkout sheets with dates and checkout signatures
   i. Repair contact name and phone number.

1.9 WARRANTY

A. Standard Material and Labor Warranty:

1. Provide a one-year labor warranty on the Stand Alone Controls.
2. The controls components shall be free from defects in material and workmanship under normal use and service. If within one (1) year from the date of awarding of the Certificate of Occupancy any controls equipment is found to be defective, it will be replaced, repaired or adjusted by the Controls Contractor free of charge. The Controls Contractor is not responsible for the removal or reinstallation of any components that were originally installed by others, such as valves, dampers, wells, air flow stations, etc.
3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during Controls Contractor’s normal business hours unless there is an emergency.
4. Maintain an on-site record of all work done, all items removed from site, all items returned to site, all new replacement items installed and all remedial programming and database entry work undertaken including software revisions installed. Maintain a record of all re-calibrations required as a result of Warranty service.

1.10 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable
PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

Not Applicable

2.2 STAND ALONE CONTROLS DESCRIPTION

A. Each unit shall have individual stand alone controls that perform all the functions listed in the drawings. Stand alone controls described as programmable shall have 7-day programmable schedules with at least two cycles (off/on) per day and 10-hour battery back-up, one cycle including night setback. All programmable stand alone controllers shall have schedule override capabilities. All controllers shall have the ability to adjust the controlling variable setpoint. Units that control heating and cooling shall have a minimum 5°F heating and cooling deadband. Units shall have optimum start/stop. Unitary air-cooled heat pump controllers shall minimize supplemental heat usage during start-up, set-up and defrost, use compressor as first heat stage and indicate visually, when the supplemental heat is active.

B. The work of the single Controls Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents as are listed in Part 1 of this Section.

C. The controls work shall consist of the provision of all labor, materials, etc. as Specified in these Division documents which are required for the complete, fully functional and commissioned stand alone controls.

D. Provide a complete, neat and workmanlike installation. Use only employees who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided for this Project.

E. Manage and coordinate the controls work in a timely manner in consideration of the Project schedules. Coordinate cooperatively with the associated work of other trades so as to assist the progress and not impede or delay the work of associated trades.

2.3 NODES

A. HVAC Node:
   1. HVAC Node shall provide standalone direct digital control of HVAC systems.
   2. A dedicated HVAC Node shall be configured and provided for each primary HVAC system (air handler, chiller, boiler) and each terminal HVAC system (VAV Box, Unit Heater, Fan Coil Unit, Cabinet Heater, Heat Pump, Fan Powered Box, CV Box)
   3. Each HVAC Node shall retain its function and setpoint information in the event of a power failure, and shall return to normal operation upon restoration of power.
   4. Each HVAC system with an economizer shall have an economizer control module included as part of the HVAC node control package.
PART 3 - PERFORMANCE/EXECUTION

3.1 CONTROLS SPECIFIC REQUIREMENTS

A. Temperature Sensors:
   1. Office and classroom temperature sensors shall have pushbutton interface capabilities that allow for occupied/unoccupied override and adjustable setpoint unless otherwise specified on drawings. Sensors shall be capable of displaying room temperature and setpoint. Access to pushbutton override and setpoint adjustment shall be password protected.
   2. Gyms, hallways and other high traffic areas subject to abuse shall have stainless steel, flush mounted, plain front temperature sensors.
   3. Room temperature sensors shall be mounted 54” AFF unless otherwise specified on drawings. Verify locations with customer representative.

B. Actuation / Control Type:
   1. Primary Equipment:
      a. As a default, spring return is required in all equipment exposed to outside air and/or fail-safe situations.
      b. All air handling equipment damper and valve actuation shall be electric, spring return and proportionally controlled.
      c. Air handling equipment is defined as any unit with outside air intake.
      d. All valves associated with the main hydronic system and all valves directly processing outside air shall have mechanical override capabilities.
      e. All 120 VAC driven actuators shall have disconnects in accordance with electrical standards.
   2. Terminal Equipment:
      a. Terminal Air Boxes (VAV, etc.) shall have electric damper and valve actuation. 3 point floating actuation is acceptable.
      b. Hydronic Based Heaters shall have electric actuated valves with electric thermostat control.

C. Economizer Modules:
   1. Module shall operate from the space thermostat as first stage of cooling and shall have as a minimum, dry bulb temperature change over control, minimum damper position potentiometer and compressor staging relay functions. Economizer module shall be capable of enthalpy and CO2 control if required.

D. Adjust room numbers and floor plans as necessary to reflect actual conditions.
3.2 INSTALLATION PRACTICES

A. Stand Alone Controls Wiring:

1. All conduit, wiring, accessories and wiring connections required for the installation of the Stand Alone Controls, as herein specified, shall be provided by the Controls Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

2. All Controls wiring materials and installation methods shall comply with Controls manufacturer recommendations.

3. The sizing type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the Controls Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the Controls Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Wire/conduit ratios shall follow the same wire/conduit ratios included in Division 26.

5. Class 2 Wiring:
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit or be plenum rated and shall be installed in accordance with local code requirements.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Inaccessible locations such as “hard lid” ceilings require conduit.
   c. Wire supports and be installed per local wiring code requirements. As a default, wire shall be supported every 5’ from the building structure utilizing metal hangers designed for this application.
   d. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Engineer.
   e. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
   f. Provide firestopping for all penetrations used by dedicated Controls conduits and raceways using approved fire resistive sealant. All other project firestopping to be by other trade.
   g. All wiring passing through penetrations, including walls or other structure, shall be in conduit or enclosed raceway.
   h. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
   i. No penetrations in structural elements shall be made before receipt of written approval from the Structural Engineer.

6. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

7. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
   a. All circuits are continuous and free from short circuits and grounds.
   b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.
   c. All circuits are free from induced voltages.

8. Provide complete testing for all cables used under this Contract. Provide all equipment, tools, and personnel as necessary to conduct these tests.
9. Provide for complete grounding of all signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. Controls Line Voltage Power Source:

1. 120-volt AC circuits used for the controls shall be taken from panelboards and circuit breakers provided by Division 26. Coordinate circuit installation with Division 26. Division 26 shall be responsible for the installation of 120 VAC controls circuits.
2. Circuits used for the controls shall be dedicated and shall not be used for any other purposes.
3. Terminal unit controllers may use 120-volt AC power from motor power circuits.

C. Controls Identification Standards:

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node location.
2. Cable and/or conduit shall be labeled at suitable intervals with the controlled unit’s name. Labeling shall be sufficient to trace cable from device to unit.
3. Specify a different wire color for analog, digital, power and communication wiring. Include wiring color on control drawings legends.
4. Raceway Identification: All the covers to junction and pull boxes of the control’s raceways shall be labeled.
5. Wire Identification: All low and line voltage control wiring shall be identified by a number, as referenced to the associated shop drawing and as-built drawing, at each end of the conductor or cable. Identification number shall be permanently secured to the conductor or cable and shall be typed.

D. Stand Alone Node Installation:

1. The controls panels and cabinets shall be mounted at shoulder height wherever possible. All panels shall be accessible. Each cabinet shall be anchored per the manufacturer’s recommendations.
2. The Controls Contractor shall be responsible for coordinating panel locations with other trades and Electrical and Mechanical Contractors.

E. Input Devices:

1. All Input devices shall be installed per the manufacturer recommendation and shall be of the type and accuracy suitable for this specific application.
2. Locate components in accessible local control panels wherever possible.
3. The Mechanical Contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Outside Air Sensors:
   a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
   b. Sensors shall be installed with a rain proof, perforated cover.
5. Water Differential Pressure Sensors:
   a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
   b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
   c. The transmitters shall be installed in an accessible location.
   d. Installation of pipe taps and shut-off valves by Division 23.

6. Medium to High Differential Water Pressure Applications (Over 21” w.c.):
   a. Air bleed units, bypass valves and compression fittings shall be provided.
   b. Installation of pipe taps, valves and air bleed units by Division 23.

7. Building Differential Air Pressure Applications (-0.25” to +0.25” w.c.):
   a. Transmitter’s exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
   b. The interior tip shall be inconspicuous and located as shown on the drawings.

8. Duct Temperature Sensors:
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
   d. The sensor shall be mounted to suitable supports using factory approved element holders.

9. Low Temperature Limit Switches:
   a. Install on the discharge side of the first water or steam coil in the air stream.
   b. Mount element horizontally across coil in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.
   c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

10. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings, and air filter.

11. Water Differential Pressure Status Switches:
    a. Install with shut off valves for isolation.
    b. Installation of pipe taps and valves by Division 23.

12. Room Temperature Sensor:
    a. Install sensor with insulation if mounted on an exterior wall.

F. HVAC Output Devices:
   1. All output devices shall be installed per the manufacturer’s recommendation and shall be suitable in type and accuracy for this specific application. The Mechanical Contractor shall install all in-line devices such as control valves, dampers, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke.

3. Electronic Signal Isolation Transducers: Whenever an analog output signal from the controls are to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. It is the Controls Contractor’s responsibility to determine if isolation is necessary.

4. Relays: All relays used to start/stop any piece of mechanical equipment that does not have an HOA switch shall have a Closed-Open-Auto override switch located on the load side of the relay.

3.3 TRAINING

A. The Controls Contractor shall provide the following training services:

1. Provide one day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings and a walk through of the facility to identify panel and device locations. Training may be split into smaller sessions on different days if the Owner prefers.

2. Supply a list of available factory training classes and contact information.

3.4 COMMISSIONING

A. Controls Contractor shall provide the Commissioning Agent with a completed Acceptance Verification document prior to beginning point-to-point activities. Final Acceptance Verification document shall be included in the Commissioning Field Notebook. The commissioning agent may be an independent agent, the customer, or the Design Engineer.

B. Acceptance Verification Document is defined as a series of check sheets that include all stand alone controls and functions. Each point entry shall be signed and dated verifying that each point and function has been fully calibrated and tested.

C. The Controls Contractor shall provide qualified technician to support the commissioning requirements outlined in specification Sections 01 65 00 and 15995. The Controls Contractor shall provide support to the commissioning agent during the performance testing and shall provide trends as needed for their review.

D. Conduct functional performance tests to demonstrate that controls systems maintain setpoints and operates through the full range of operations. The commissioning agent will provide functional tests that the Controls Contractor shall review and provide comments on the tests for incorporation into the final test documents.

E. Provide all necessary specialist labor, materials and tools to demonstrate to the Engineer that the stand alone controls have been commissioned and are operating in compliance with the contract. Prepare a list of noted deficiencies signed by both the Engineer and the Controls Contractor.
F. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION
SECTION 231100 - NATURAL GAS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To: Furnish and install gas piping and fittings.

B. Related Sections:
   General Conditions, Division 01
   Section 200000 – General Mechanical Requirements
   Section 220548 – Vibration and Seismic Control
   Section 221116 – Domestic Water Pipe and Fittings

C. The above-mentioned Section applies to this section. Contractor is responsible for all service charges. Charges may be indicated by Architect on bid form.

1.2 QUALITY ASSURANCE

A. Qualifications: Welders shall be certified and bear evidence of certification 30 days prior to commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe

B. Fittings

C. Valves

D. Stops

E. Gas Regulators

F. Gas Solenoid Valve

G. Gas Seismic Valve

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Pressure reducing valve manufacturer’s data and pressure setting.

B. Solenoid valve manufacturer’s data.
PART 2 - PRODUCTS

2.1 PIPE

A. Meet requirements of ASTM A 53-87b, "Specification for Piping, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".

B. Schedule 40 black steel pipe.

C. Flex Connection: Corrugated 300 Series stainless steel tubing conforming to ASTM A240, ANSI LC-1, and UL Listed Through Penetration Firestop for one (1) hour to four (4) hours. Tubing to be rated for up to 25 psi. Tubing shall be protectively coated against accidental contact with substances shown to be caustic to 300 Series stainless steel. Coating shall be UV resistant.

D. Approved Manufacturers: Wardflex

2.2 FITTINGS


2.3 VALVES (GAS SHUT OFF VALVE)

A. 125 psi bronze body, square head cock, with bronze plug or CSA approved ball valve.

B. Approved Manufacturers: Apollo, Combraco, Nibco, red-white.

2.4 GAS REGULATORS

A. Provide gas pressure regulators, pressures and capacity as scheduled on Plans to reduce medium pressure gas to recommended equipment operating range. Furnish regulators with full size vents and VTR’s. Gas regulators shall be by Sensus or approved.

2.5 GAS SOLENOID VALVE

A. Solenoid operated gas shut-off valve shall be rated at 120V. Size valve as required to match supply pipe size. Valve shall operate at required flow rates without pressure drop. The valve shall trip closed when solenoid is de-energized, and shall be manually reset. Manual reset shall have a high visibility position indicator and shall not open until solenoid is energized.

B. Approved Manufacturers: ASCO Series 8044
2.6 GAS SEISMIC VALVE


B. Approved Manufacturers: Pacific Seismic Products

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe installed underground, through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other pipe may have screwed or welded fittings.

B. Machine apply coating and lay underground pipe in accordance with local gas utility company regulations and specifications.

C. Install gas shut off valves on lines serving all gas fired equipment adjacent to or on outside of equipment cabinet and easily accessible.

D. Install dirt leg with pipe cap, 6 inches long minimum, on each vertical gas drop to all gas equipment.

E. Gas piping installed under slab shall be provided in an airtight conduit sealed at floor level. The conduit shall be vented to the exterior. The piping and conduit shall be buried with a minimum of 12" of cover.

F. Paint all piping exposed to elements with 1 coat primer and 2 coats paint to match adjacent surfaces.

G. Provide at main and at each connection to equipment a gas shut-off valve. All risers taken off from main shall be furnished with gas lever shut-off valve. Provide regulators herein before specified complete with vent, enclosures, and shut-off valves for gas-fired equipment, including HVAC equipment and hot water tanks.

H. Furnish union joint as required for removal of each piece of gas equipment.

I. Coordinate gas solenoid valve locations and power requirements with electrical and fire system contractors.

J. Hang aboveground pipe with rods within 12” of structure. If pipe cannot be hung within 12” of structure, provide seismic bracing (including calculations, shop drawings, etc.) per code. Notify Engineer for special inspection of braces.

K. Pressure regulator vents shall be installed to prevent the entry of water, insects and foreign objects.

END OF SECTION
SECTION 232100 - SLEEVES AND SEALS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL
A. Includes sleeving and sealing of piping and ductwork.

1.2 RELATED SECTIONS
A. General Conditions, Division 1
B. Section 221116 – Domestic Water Pipe and Fittings

1.3 REFERENCES
A. ASTM E814: Fire Tests of Through-Penetration Fire Stops
B. UL 1479: Through-Penetration Fire Stop Systems.

1.4 SUBMITTAL REQUIREMENTS
A. Submittal requirements for this Section.
   1. Seals

1.5 OPERATION AND MAINTENANCE REQUIREMENTS FOR THIS SECTION
Not Applicable

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
A. Products shall comply with Section 200000, paragraph 2.1, Approved Manufacturers.
B. Fire Seals: 3M, Dow Corning, General Electric, Rectorseal Metacaulk.
2.2 PIPE SLEEVES

A. Size: Inside diameter of pipe sleeves shall be at least 1/2-inch larger than the outside diameter of the pipe or pipe covering, so as to allow free movement of piping.

B. Ends: Sleeve ends shall be cut flush with finished surfaces, except in rooms having floor drains where sleeves shall be extended 3/4-inch above finished floor.

C. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe.

D. Material - Non-structural: Sleeves through non-structural elements shall be fabricated from 18-gauge galvanized sheet metal or 24-gauge spiral duct.

E. De-burr pipe ends and smooth slab penetration (to accept final slab finish) from sleeves extending above finished floor.

2.3 DUCT SLEEVES

A. Size: Inside dimension of sleeves shall be at least ½" larger than the outside dimensions of the duct or duct covering on all sides.

B. Ends: Sleeve ends shall be cut flush with finished surface.

C. Material - Non-structural: Sleeves shall be fabricated from 20-gauge galvanized steel, shall be continuous around the interior without holes or openings, and shall match the configuration of the item being sleeved.

D. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe (round openings) and welded steel supporting elements (sizes/arrangement as shown on drawings) for other openings.

2.4 SEALS

A. Seals in Interior Fire Rated Assemblies: Shall be tested in accordance with ASTM E814 and shall be UL classified per UL 1479 as a through-penetration fire stop device.

B. Seals in Exterior Masonry Walls and Floors:

1. Piping: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute watertight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Thunderline "Link-Seal" or approved equal.

2. Ducts: Silicone type sealant, designed for use with duct material involved as weatherproof sealant and as specified in Section 079000.
C. Seals in Other Areas: Packed fiberglass or wool insulation, where no weatherproofing or adhesive properties are required; otherwise, sealants shall be silicone type, as specified in applicable Division 7 Specification Section.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE SLEEVES

A. Provide pipe sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the piping passes through the solid elements (e.g., solid wood stud, core drilled solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element.

B. Set sleeves plumb or level (or sloped as required for drainage pipe) in proper position, tightly fitted into the work.

C. Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

D. Seal around all pipes inside of pipe sleeve.

E. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

F. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

3.2 INSTALLATION OF DUCT SLEEVES

A. Provide duct sleeves for all round ducts less than 15 inches in diameter where the duct passes through any floors, walls, ceilings, partitions, or roofs and similar elements.

B. Provide duct sleeves for all square and rectangular ducts having their largest dimension 14 inches and less where the duct passes through any floors, walls, ceilings, partitions, roofs, and similar elements.

C. Round ducts larger than 15 inches in diameter, and square of rectangular ducts larger than 14 inches in any dimension, shall have framed openings where the duct passes through any element. Such framed openings shall be of the same type as the structural materials used in the wall and shall comply with materials specified for this project. Sleeves shall be provided in addition to the framed opening where any void space(s) occurs through the penetration (as through CMU walls, double walls, etc.).

D. Set sleeves plumb or level, in proper position and location, tightly fitted into the work.
E. Fill openings around outside of duct sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

F. Sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the duct passes through the element (e.g., precast concrete panels with pre-framed openings, core drilled/saw cut solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element however.

G. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

H. Sleeves for fire dampers shall be as specified for fire dampers and be in compliance with the damper UL listing.

3.3 INSTALLATION OF SEALS

A. Provide seals around all piping and ducts passing through walls, floors, roofs, foundations, footings, grade beams, partitions, and similar elements.

B. Seals shall be of material and workmanship to maintain the fire and smoke rating of element being penetrated. Seals ability to maintain the rating of the element being penetrated shall be listed in UL Laboratories Building Materials Directory or otherwise confirmed by an approved listing agency. It shall be the Contractor's responsibility to submit shop drawings and technical data showing seals and systems proposed, and corresponding agency approval. The Contractor shall also be responsible to submit any data as required by local agencies to satisfy them that the Contractor's proposed fire seals are satisfactory.

C. Seals shall be watertight where the penetration may be exposed to water or moisture.

D. Duct penetrations through roof or exterior wall assemblies shall be provided with flashings for a weathertight assembly in accordance with SMACNA HVAC Duct Construction Standards. Such openings shall be sealed to be weatherproof.

END OF SECTION
SECTION 233113 - STEEL DUCTWORK

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, furnishing and installing above-ground ductwork and related items specified below and shown on Drawings.

1.2 RELATED SECTIONS

A. General Conditions and Division 1 apply to this Section.
B. Section 200000 - General Mechanical Conditions
C. Section 230713 - Equipment/Ductwork Insulation
D. Section 233300 - HVAC Specialties

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Duct liner
B. Access doors
C. Motorized dampers
D. Duct Sealers
E. Duct Closure Collars

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Motorized dampers
B. Grease duct test report

1.5 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.
B. Low Pressure System: Velocities less than 2,000 fpm and static pressure in duct 2 inches w.g. or less.
C. Medium Pressure System: Velocities greater than 2,000 fpm or static pressure in duct up through 6 inches w.g.

D. High Pressure System: Velocities greater than 2,000 fpm or static pressure in duct over 6 inches w.g. and up to 10 inches w.g.

E. Primary Duct System: Any duct between an air handler and a terminal (capable of heating and/or cooling) in a variable air volume or induction terminal system.

F. Gauges: Steel sheet and wire are U.S. Standard Gauge; aluminum sheet is Brown and Sharpe Gauge.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

Not Applicable

2.2 DUCTS

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal, except as indicated. Fabricate of zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A 527-85, "Specification for Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with G 60 coating.

B. Construct T's, bends, and elbows with radius of 1-1/2 times width of duct on centerline. Where not possible, provide turning vanes.

C. Increase duct sizes gradually, not exceeding 30° divergence and 45° convergence.

D. Use crimp joints with or without bead for joining round duct sizes 8 inches (200 mm) and smaller with crimp in direction of airflow.

E. Fume hood exhaust ductwork shall conform to the IMC, Chapter 5.

2.3 DUCT JOINTS

A. General: Duct with sides or diameter up to and including 36 inches shall be as scheduled below.

<table>
<thead>
<tr>
<th>Max. Side Inches</th>
<th>Required Minimum Metal Gauges Steel, U.S. Standard Gauge</th>
<th>Type of Transverse Joint Connections</th>
<th>Bracing Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 13&quot;</td>
<td>26</td>
<td>S-drive, pocket or bar slips on 7 - 10&quot; centers</td>
<td>None</td>
</tr>
<tr>
<td>13&quot; to 24&quot;</td>
<td>24</td>
<td>S-drive, pocket or bar slips on 7-10&quot; centers</td>
<td>None</td>
</tr>
</tbody>
</table>
Max. Side Inches | Required Minimum Metal Gauges Steel, U.S. Standard Gauge | Type of Transverse Joint Connections | Bracing Required
--- | --- | --- | ---
25" to 30" | 24 | S-drive, 1" pocket or 1" bar slips on 7'-10" centers | 1"x1"x1/8" angles 4' from joints
31" to 36" | 22 | Drive 1"pocket or 1"bar slips on 7'-10" centers | 1"x1"x1/8" angles 4' from joints

B. Ducts with sides over 36 inches to 48 inches, transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection).

C. Ducts 48 inches and larger, Ductmates/35, Nexus, or WDCI (Heavy) (SMACNA "J" Type connection).

D. Proprietary duct connections may be used on other sizes, Ductmate, WDCI, or equal.

2.4 ROUND DUCT


B. Gauge Selection Table:

<table>
<thead>
<tr>
<th>Duct Diameter in Inches</th>
<th>Maximum 2&quot; w.g. Static Positive</th>
<th>Maximum 2&quot; w.g. Static Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spiral Seam Gauge</td>
<td>Longitudinal Seam Gauge</td>
<td>Spiral Seam Gauge</td>
</tr>
<tr>
<td>3 thru 8</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>9 thru 14</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>15 thru 26</td>
<td>26</td>
<td>24</td>
</tr>
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<td>27 thru 36</td>
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<td>37 thru 50</td>
<td>22</td>
<td>20</td>
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<tr>
<td>51 thru 60</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>61 thru 84</td>
<td>18</td>
<td>16</td>
</tr>
</tbody>
</table>

C. Provide insulation where required by the Insulation Schedule in Section 230713 - Equipment/Ductwork Insulation.
2.5 ACCESS DOORS IN DUCTS

A. At each backdraft damper and at each motorized damper, install factory built 1" insulated access door with hinges and sash locks. Locate doors within 6 inches of installed dampers. Construction shall be galvanized sheet metal, 22 ga. minimum frame and 24 ga. minimum door. Minimum door shall be 12x12. If duct is too small for 12" door, then maximum door size shall be installed in duct.

B. Access doors for fire damper shall have a minimum clear opening of 12"x12" or as specified on Drawings to easily service fire damper. Doors shall be within 6 inches of fire dampers.

C. Approved Manufacturers:
   1. Nailor - Hart Industries Inc.
   2. Cesco - Advanced Air
   3. AirBalance Fire/Seal
   4. Louvers & Dampers
   5. Kees Inc.
   6. Ductmate Industries Inc "Sandwich" Access Door
   7. National Controlled Air Inc.
   8. Greenheck
   9. Elmdor

2.6 FLEXIBLE EQUIPMENT CONNECTIONS

A. Provide flexible equipment connections between ductwork and equipment. See Section 233300 - HVAC Specialties.

2.7 MOTORIZED DAMPERS

A. General:
   1. Coordinate actuator type with Controls Contractor.
   2. Damper actuators and actuator linkages shall be mounted in the airstream for all rooftop fans and mounted external of the airflow at all other locations, unless specifically indicated otherwise on plans.
   3. Multi section damper assemblies shall be provided with a factory installed common jackshaft.
   4. Shall be Class IA.

B. Damper Blades:
   1. 18-gauge or equivalent galvanized steel or aluminum with replaceable rubber blade edges, 9 inches wide maximum.
   2. 18-gauge, 304 stainless steel when installed in ductwork serving a dishwasher hood.
   3. End seals shall be flexible metal compression type.
   4. Opposed blade airfoil type.
C. Performance:

1. Maximum leakage rate shall be 3 cfm/sq. ft. of damper area per 1.0-inch w.g. in accordance with AMCA Standard 500D.

D. Approved Manufacturers:

1. Honeywell
2. Johnson
3. Ruskin
4. Louvers & Dampers
5. Arrow OBDAF
6. American Warming
7. Greenheck

2.8 DUCT HANGERS

A. See Section 230529 - Hangers and Supports for HVAC Piping & Equipment.

2.9 DUCT SEALANT AND ADHESIVES

A. Duct Sealant technical makeup shall be water based, solvent-free and of the synthetic latex family. Sealants shall be UL 181 Listed, meet all SMACNA pressure and seal classes and be rated to ±15 inches water gauge. Sealants shall have flame spread of 0 and smoke development of 0 when tested in accordance to ASTM E-84. They shall be formulated to withstand working temperatures of -25°F to +200°F. All sealants shall exceed 500 hours under ASTM C-732 (Artificial Weathering) and pass ASTM C-734 (Low Temperature Flexibility after Artificial Weathering). All sealants shall be of an elastomeric nature, have a minimum weight of 12 pounds and a minimum solids content by weight of 66% ± 2%. Sealants shall be resistant to cracking, peeling, mold and mildew. Sealants shall also have excellent water and UV resistance. Sealants shall meet FDA, USDA and EPA standards as well as meet NFPA 90A and 90B requirements. Sealant shall be Design Polymerics DP 1010 or DP 1020 duct sealant or equal.

B. Solvent based duct sealant VOC shall be less than or equal to 50 g/l and be UL 723 Classified with a flame spread of 0 and a smoke development of 0. Sealant shall have passed 1000 hours of QUV accelerated outdoor aging testing. Sealant shall be Design Polymerics DP 1090 duct sealant or equal.

1. All traverse joints, longitudinal seams and penetrations in duct systems shall be sealed with duct sealant of the type specified. Spiral lockseams are not longitudinal seams and do not require duct sealant. All sealant shall be applied per the manufactures’ recommendations. Joints that are not fully welded shall be sealed. For spiral and flat oval duct slip connections; coat both the female and male ends. The slip connections should then be brushed over with an additional coat 2 to 3 inches wide 20 to 40 mils thick.
2. All conditioned air supply ducts, return ducts and fresh air intakes shall have all joints and seams sealed or welded, except spiral seams round and flat oval ducts, which are exempt.
3. Seal sealants and joint sealants shall not be used as a substitute for good workmanship. No ductwork will be covered or installed until inspected and pressure tested if necessary.

C. Gaskets for TDC, TDF and applied flange connections shall meet all SMACNA pressure and seal classes. The gasket shall meet UL 723, ASTME E-84, NFPA 90A and 90B requirements as well as FDA, USDA and EPA standards. The tape shall be 5/8 inches by 3/16 inches and applied according to the manufactures’ directions. Expanded or extruded foam gaskets are not acceptable. Gasket shall be Design Polymerics DP 1040 Butyl Gasket Tape or equal.

D. Exterior Ductwork: Sealant shall be Design Polymerics DP 1090, or equal.

2.10 DUCT CLOSURE COLLARS

A. General: Closure collars shall provide closure of opening between duct and opening in element penetrated and shall abut tight up to and overlap duct and shall consist of rolled angle material (for round ducts) and welded framed angles (for rectangular/round ducts).

B. Size: Closure collars shall be sized to match duct/opening applied to and shall have minimum 2-inch overlap on duct side and 2-inch overlap at opening/penetrated element side but shall completely cover opening in element penetrated with minimum 1-inch overlap to undisturbed element (i.e., wall, floor, etc.).

C. Material: Closure collars shall be fabricated of 20-gauge galvanized steel for ducts 15 inches diameter and less and shall be fabricated of 18-gauge galvanized steel duct for all larger ducts and all square and rectangular ducts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ducts:

1. Straight and smooth on inside with joints neatly finished unless otherwise directed.
2. Duct panels through 48-inch dimension having acoustic duct liner need not be crossbroken or beaded.
3. Crossbreak unlined ducts and duct panels larger than 48 inch or bead 12 inches on center.
4. Securely anchor ducts to building structure with screws.
5. Brace and install ducts so they shall be free of vibration under all conditions of operation.
6. Round, horizontal ducts shall be hung with bands, which extend the entire perimeter of the duct.
7. Ducts shall be braced and guyed to prevent lateral or horizontal swing.
8. Ducts shall not bear on top of structural members.
9. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on Drawings.
10. Ducts shall be large enough to accommodate inside duct liner. Dimension shown on Drawings are net clear inside dimensions after duct liner has been installed.
11. Properly flash where ducts protrude above roof.
12. Install internal ends of slip joints in direction of flow. Make joints airtight using specified duct sealer.
13. Cover horizontal and longitudinal joints on exterior ducts two layers of Hardcast tape installed with Hardcast HC-20 adhesive according to Manufacturer's recommendations.
14. Ducts installed on mechanical space floor or walkway where ducts may be subject to abuse shall have Ductmate/35 or (heavy) SMACNA "J" type connection on all joints.
15. Contractor shall obtain a signed statement from kitchen Contractor verifying ceiling height and hood configuration prior to hood ductwork fabrication.
16. Provide acoustic duct where indicated on the plans.
17. All exposed ducts shall be spiral.
18. Quick fit duct shall be used where called out on the plans or as called out in specialty exhaust specifications (i.e. 233513 Sawdust Collection System).
19. Provide duct transitions to equipment openings.

B. Flexible Connections: See Section 233300 - HVAC Specialties.

C. Balancing Dampers:
   1. Provide each take-off with an adjustable volume damper to balance that branch.
   2. Anchor dampers securely to duct.
   3. Install dampers in main ducts within insulation.
   4. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

D. Motorized Dampers:
   1. Motorized dampers shall be installed in all outside air intakes, exhaust outlets, and relief outlets per WSEC and as shown on drawings.

E. Grilles, Registers, and Diffusers: Install and anchor securely.

F. Adjustable Lock Splitter Dampers:
   1. Dampers in equipment rooms shall be complete with locking quadrant.
   2. Other dampers shall have concealed ceiling damper regulator with plate.

G. Painting of Ductwork: Paint ductwork visible through registers, grilles, and diffusers flat black.

H. Ductwork Leakage Criteria:
   1. All transverse joints and longitudinal seams shall conform to SMACNA's Class A sealing requirements as defined on page 1-6 of the 1985 SMACNA Manual, First Edition.
   2. Constant Volume Systems/Supply Ductwork
      a. Allowable Leakage – per SMACNA
   3. Constant Volume Systems/Return Ductwork
      a. Return Ductwork – per SMACNA
   4. Variable Air Volume Systems/Supply Ductwork
      a. Fan to VAV Boxes -- 1% of design cfm
      b. VAV Boxes to Registers -- 2% of design cfm
5. Variable Air Volume Systems/Return Ductwork  
   a. Return Ductwork -- 2% of design cfm

I. Ductwork Leakage Criteria:

1. All transverse joints and longitudinal seams shall conform to SMACNA's Class A sealing requirements as defined on page 1-6 of the 1985 SMACNA Manual, First Edition.
2. Constant Volume Systems/Supply Ductwork  
   a. Allowable Leakage – per SMACNA

3. Constant Volume Systems/Return Ductwork  
   a. Return Ductwork – per SMACNA

4. Variable Air Volume Systems/Supply Ductwork  
   a. Fan to VAV Boxes -- 1% of design cfm  
   b. VAV Boxes to Registers -- 2% of design cfm

5. Variable Air Volume Systems/Return Ductwork  
   a. Return Ductwork -- 2% of design cfm

J. Ductwork Leakage Testing:

1. Duct leakage testing is required for all duct systems constructed to a pressure class of 3” water column or greater per the 2015 Washington State Energy Code, Section C403.2.8.3.3.
2. Installed ductwork shall be tested prior to installation of access doors, take-offs, insulation, etc.
3. All leak testing shall be witnessed by the Engineer or representative of the Engineer. The Contractor shall give the Engineer 72 hours notice prior to testing. Any testing not witnessed by the Engineer or his/her representative, shall be considered invalid and will be redone.
4. Ductwork shall be tested in accordance with the requirements outlined in the SMACNA HVAC Air Duct Leakage Test Manual and shown to have a (CL) less than or equal to 4.0.
5. Duct leakage, in excess of SMACNA HVAC Air Duct Leakage Manual, shall be repaired and have the test re-performed until the leakage rate is within acceptable levels.
6. Submit leakage test report identifying on a plan all the ducts tested and tested leakage rate.

K. Duct Cleanliness Criteria: Unless otherwise specified, the delivery, storage, and installation of all un-lined ductwork shall comply with the intermediate duct cleanliness level of SMACNA Duct Cleanliness for New Construction Guidelines. All lined and acoustic duct shall comply with the advanced level.

END OF SECTION
SECTION 233300 - HVAC SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes, but not limited to, furnishing and installing specified material as described in Contract Documents.

B. Filters used in air handling units and heat pumps.

C. Flexible ductwork from supply air branch duct runouts to diffusers where indicated on drawings.

D. Furnishing and installing fire dampers, ceiling radiation, and fire/smoke dampers at penetrations of fire rated walls, floors, and ceiling membranes, at ducts, registers, grilles, or louvers as indicated on drawings. Installation shall be complete with sleeves, angles, and all other accessories as required by UL installation instructions, local codes, and reviewing authorities.

E. Section Includes:

   1. Hood exhaust specialties.
   2. Backdraft dampers.

1.2 RELATED SECTIONS

A. General Conditions

B. Division 01

C. Section 200000 - General Mechanical Requirements

D. Section 233113 - Steel Ductwork

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Backdraft dampers

B. Flexible ductwork

C. Flexible equipment connections

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Backdraft dampers
B. Filters (Summarized list including equipment tag and size and quantity of filter per unit.)

C. Provide dates or projected dates of extra filter replacement.

D. Air Filter gauge pressure drop

E. Fire and/or smoke dampers

F. Airflow station maintenance and calibration.

G. Duct smoke detectors

H. Hoods

1.5 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies:
   1. Bear the AMCA seal and UL label, NSF approved.
   2. Fire and fire/smoke dampers to conform to UL Standards 555, 5558, and 555C and NFPA requirements as required and bear the correct UL label for the damper's application.
   3. Fire and fire/smoke dampers shall be approved by State Fire Authorities where so required.
   4. Fabric duct shall be UL listed in accordance with the 25/50 flame spread/smoke developed requirements of NFPA-90-A.

1.6 SPARE PARTS

A. Deliver with O&M Manuals six fusible links of each type used on the project where replaceable link-type dampers are furnished.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

Not Applicable

2.2 BACKDRAFT DAMPERS (COUNTER BALANCED)

A. General: 0.125 inches extruded aluminum frame, 0.07 inches aluminum blades with extruded vinyl edges, synthetic bearings, counterbalance, adjustable zinc plated bar on blades.
B. Backdraft dampers are to be factory set to open at 0.01" w.c. of building pressure and shall have a maximum static pressure drop of 0.05" w.c. at 700 fpm per AMCA Standard 500. Backdraft dampers shall have a leakage rate at no more than 20 CFM/sq. ft. at 1" w.c. of static pressure with a dimension of 24” or greater and 40 CFM/sq. ft. at 1” w.c. of static pressure with dimension smaller than 24” per AMCA Standard 500D.

C. Approved Manufacturer:
   1. Ruskin
   2. Greenheck

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

      1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

   A. Backdraft Dampers: Provide access doors to backdraft dampers.

END OF SECTION
SECTION 233423 - EXHAUST FANS

PART 1 - GENERAL

1.1 GENERAL
   A. Includes, but not limited to, furnishing and installing specified material as described in Contract Documents.

1.2 RELATED SECTIONS
   A. General Conditions and Division 1 apply to this Section.
   B. Section 200000 - General Mechanical Conditions.
   C. Section 233113 – Steel Ductwork.

1.3 QUALITY ASSURANCES (REQUIREMENTS OF REGULATORY AGENCIES)
   A. Bear AMCA seal, UL 507 (for continuous operation), and UL 705 (volume control by speed control on direct drive units).

1.4 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Exhaust Fans

   B. Fan curves showing system curve, and a fan curve with the maximum operation point with maximum motor size (limited by maximum shaft speed of and/or surge point).

1.5 OPERATION AND MAINTENANCE OF THIS SECTION
   A. Submittal Data including Curves.

   B. Exhaust Fan Operation and Maintenance Manual

PART 2 - PRODUCTS

2.1 IN-LINE CABINET FANS
    A. General:
     1. Acoustically insulated housings.
     2. True centrifugal wheels.
3. Suitable ground motors and mounts on rubber-in shear vibration isolators.
4. Motor and drive assembly shall be accessible through removable side panels.

B. Approved Manufacturers:

1. Carnes
2. Cook
3. Greenheck
4. Jenn
5. Penn Barry
6. Twin City Fans

2.2 PROPELLER FANS

A. Propeller fans shall be direct drive type with wire basket rear guard. Blades shall be statically and dynamically balanced. Resilient mounted motor. Furnish with combination louver/shutter.

1. Approved Manufacturer:
   a. Breidert
   b. Carnes
   c. Cook
   d. Greenheck
   e. Jenn
   f. Penn Barry
   g. Twin City Fans

2.3 CEILING MOUNTED EXHAUST FAN

A. General:

1. Acoustically insulated housings.
2. Include chatterproof integral back-draft damper with no metal contact.
3. True centrifugal wheels.
4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
5. Suitably ground motors and mount on rubber-in shear vibration isolators.
6. Provide roof cap or wall cap as required.

B. Approved Manufacturers:

1. Penn Barry
2. Cook
3. Greenheck
4. Twin City Fans
2.4 SPEED CONTROL

A. Use manufacturer’s recommended speed control, which varies speed from 50 to 100% of full speed.

B. All fan motors 1/12 HP or greater and less than 1 HP shall be Electronically Commutated Motors (ECM) or shall have a minimum efficiency of 70 percent when rated in accordance with DOE 10 C.F.R. 431. These motor speeds shall be adjustable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or curb.

B. Extend all internal wiring to box on exterior of unit.

C. Factory mount speed control on outside of case on in-line fans, including wall propeller fans, and underneath weather casing for rooftop fans.

D. Grease hood exhaust fan. Up-blast discharge shall be a minimum of 40" from top of fan to roof. Provide with vented curb and replaceable grease termination receptor.

END OF SECTION
SECTION 233700 - AIR TERMINALS

PART 1 - GENERAL

1.1 SUMMARY

   A. Includes But Not Limited To:

      1. Furnish and install complete, all air terminals described in Contract Documents.
      2. Ceiling diffusers with damper.
      3. Louvers connected to ductwork.
      4. Roof hoods.

1.2 RELATED SECTIONS

   A. General Conditions and Division 1 apply to this Section.
   B. Section 200000 - General Mechanical Conditions.

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

   A. Louvers
   B. Wall caps

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

   Not Applicable

PART 2 - PRODUCTS

2.1 LOUVERS

   A. Provide stationary type with 4” frame, drainable blades, and aluminum bird screen. Frame and blade shall be 6063-T-5 aluminum alloy. Blades shall be at 37.5° angle and supported by hidden mullions. Intermediate support mullions shall not interrupt blade exterior appearance. Louvers shall receive finish color coating of modified fluoropolymer baked enamel following cleaning and pretreatment of metal. A 50% Kynar resin shall provide approximately 0.3” total dry film thickness when baked at 450°F. Color shall be as selected by the Architect. Provide appropriate frame type for installation type.
B. Louvers shown are minimum sizes for airflow requirements. Refer to Architectural elevations for exact size and location of louvers. This contractor is to provide full size louver as shown on the plans or Architectural elevations (whichever is larger), including but not limited to: hidden mullions, louver extensions, and louver shapes. Any louver area not used for ductwork shall be blanked off with sheet metal. The General Contractor to provide insulation for blanked off sections.

C. Louver performance shall be as follows:

1. Maximum S.P. drop of 0.15" at 800 ft./min.
2. Minimum beginning point of water penetration at 0.01 oz/sq. ft. is 800 feet per minute (48”x48” size at 15-minute test period).
3. Minimum AMCA rated free area of 54% (48”x48” size).
4. Approved Manufacturers:
   a. Ruskin (ELF 375DX)
   b. American Warming
   c. Wonder Metals
   d. Greenheck
   e. Metal Form
   f. United Enertech

2.2 WALL CAPS

A. Wall caps shall be constructed of extruded aluminum, with bird screen, sizes and model numbers as indicated on plans.

B. Dryer vent caps shall be of aluminum construction with integral backdraft damper. Nutone No. 885 or approved.

2.3 MISCELLANEOUS

A. Bird Screen: 1/2-inch mesh, constructed of either 0.051-inch aluminum wire or 19-gauge galvanized steel wire.

B. Insect Screen: 14 x 18, 0.009” galvanized steel mesh.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The interior of duct connection including opposed blade damper and all visible duct interiors at connection shall be painted matte black.

B. Each air terminal shall be installed with a spun rubber gasket between the flange and the frame or wall.
C. Each air terminal with flexible duct connection shall have a square-to-round transition adapter box.

D. Anchor securely into openings.

E. All air terminals that supply, return, and/or exhaust air, which are not required to have an OBD, shall be provided with a volume damper.

F. Provide round neck to flex duct reducers as required.

G. Provide bird screened openings (1/2" mesh) on all duct openings where indicated and where openings do not have grilles or registers.

H. All outlet and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness.

I. Provide blank-off panels on louver portion not connected to a duct. Blank-off panels to be painted flat black.

J. Install louvers level and plumb.

K. Secure louver frames in openings with concealed fasteners.

L. Provide insect screen where indicated on drawings.

M. Install roof caps in accordance with manufacturer’s recommendations.

N. Provide louvers with motorized dampers on all ductless, through wall relief penetrations unless otherwise noted on the drawings.

END OF SECTION
SECTION 235119 - FLUES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To: Furnish and install water heater, furnace and other flues as described in the Contract Documents.

B. Related Sections:
   1. General Conditions, Division 01
   2. Section 200000 – General Mechanical Requirements

1.2 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Flues

B. Vent Caps

1.3 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

Not Applicable

2.2 FLUES (B-VENT TYPE)

A. Double-wall, prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.
2. Size and install flues from equipment according to local codes, except as follows:
3. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).
4. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.
5. Every portion of flue connector shall have rise of 1 inch per foot minimum from appliance to vertical flue.
6. Length of horizontal flues or flue connectors shall not be longer than 75% of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet.

7. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at a higher level. Do not enter flue connectors in same horizontal plane.

8. For hot water tanks and furnaces flue shall be constructed of aluminum.

9. For boiler stacks, inner liner shall be stainless steel; outer jacket shall be aluminized steel; provide with exit cone.

10. For boiler stacks, install a thermometer "Terice" B85600, 0 to 1000°F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Ameri-vent
2. Dura-vent
3. Selkirk/Metalbestos
4. Metal-FAB

2.3 FLUES (CATEGORY III)

A. Double-wall, prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.
2. Size and install flues from gas-fired equipment according to local codes, except as follows:
3. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).
4. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.
5. Every portion of flue connector shall have rise of 1 inch per foot minimum from appliance of vertical flue.
6. Two or more flue connections are prohibited to enter common vertical flue.
7. For boiler stacks, provide double wall flue pipe with inner wall constructed of 304 stainless steel and an outer wall constructed of aluminized steel. Material shall be as recommended by boiler manufacturer. UL listed as category III flue.
8. For boiler stacks, install a thermometer “Terice” B85600, 0 to 1000°F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Selkirk Metalbestos
2. American Metal Products
3. Selkirk/Metalbestos
4. Metal-Fab, Inc.
2.4 FLUES (CATEGORY IV)

A. Double-wall, prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.
2. Size and install flues from furnaces according to local codes, except as follows:
3. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).
4. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.
5. Every portion of flue connector shall have rise of 1 inch per foot minimum from appliance of vertical flue.
6. Two or more flue connections are prohibited to enter common vertical flue.
7. For boiler stacks, provide double wall flue pipe construction of AL 29-4C stainless steel. Material shall be as recommended by boiler manufacturer. UL listed as category IV flue.
8. For boiler stacks, install a thermometer “Terice” B85600, 0 to 1000°F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Selkirk Metalbestos
2. Metal-Fab, Inc.

2.5 VENT CAPS

A. Non-backdraft type for installation on top of flue, aluminum construction.

B. Approved Manufacturers:

1. Ameri-cap
2. Breidert Type L
3. Triangle AFL
4. Acme Mastervent Type MVR
5. Selkirk/Metalbestos
6. Metal-Fab, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide flues complete with offsets, elbows, rain caps, expansion devices, cleanout section with door, breeching connectors, flashing and counter flashing, guyed and anchored per manufacturers recommendations.

B. Provide B-vent type flue for all negative or neutral flue gas systems unless specifically called out differently on plans.
C. Provide category III type flue for all positive flue gas systems as required by the gas-fired equipment manufacturer unless specifically called out differently on plans.

D. Provide category IV type flue for all positive flue gas systems as required by the fired equipment manufacturer unless specifically called out differently on plans.

E. For boiler stacks, install barometric dampers provided with boiler.

END OF SECTION
SECTION 235533 - GAS FIRED HEATERS

PART 1 - GENERAL

1.1 GENERAL
   A. Includes But Not Limited To: Furnish and installing specified equipment and materials as described in the Contract Documents.

1.2 RELATED SECTIONS
   A. General Conditions and Division 1 apply to this section.
   B. Section 200000 – General Mechanical Conditions
   C. Section 231100 – Natural Gas
   D. Section 235119 – Flues

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. All gas-fired units including options provided.
   B. Burner efficiencies
   C. Fan curves for all centrifugal and plenum fans.

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   A. Submittal Information
   B. Operation and Maintenance Manual

PART 2 - PRODUCTS

2.1 UNIT HEATER (SEPARATED COMBUSTION)
   A. Heat Exchanger:
1. The heater shall be equipped with a multicell, 4 pass serpentine style steel heat exchanger. Heat exchanger tubes shall be press fabricated of (titanium stabilizer corrosion resistant aluminized steel) (409 stainless steel) (316 stainless steel). All heat exchangers shall be fabricated with no welding or brazing, only tool pressed mechanical joints. All heat exchanger cells shall be designed with an aerodynamic cross section to provide maximum airflow.

B. Burner:

1. The units shall incorporate a single, one-piece burner assembly with a single orifice. The burner shall have a continuous wound close pressed stainless-steel ribbon separating the flame from the burner interior. All units shall have a single venturi tube and orifice supplying fuel to a one-piece burner housing. Each heat exchanger cell shall use balanced draft induction to maintain optimum flame control.

C. Controls:

1. Controls shall include a (single stage) (two stage) gas valve; direct spark multi-try ignition with electronic flame supervision with 100% lockout integrally controlled via a printed circuit control board. The control board shall also incorporate diagnostic lights, DIP switches for fan overrun settings, and a relay for fan only operation. All units shall be equipped with a safety limit switch.

2. All controls shall be enclosed in the unit housing to protect them from accidental damage that could be caused by factors in the building that would adversely affect external controls.

D. Combustion Air and Venting:

1. The unit shall have a factory-installed power vented device to draw combustion air through an inlet in the rear of the cabinet. The combustion air/venting system shall include a vibration isolated power venter motor and wheel assembly and a combustion air pressure switch. Unit shall include a flame rollout switch. Provide unit with vertical vent terminal.

E. Electrical:

1. Operation shall be controlled by an integrated circuit board that includes LED diagnostic indicator lights. Supply voltage connections are made at the circuit board. 24-volt control connections are made on an externally mounted terminal strip with connections (W1, W2, R, and G). All internal wiring, both line and control voltages, shall be terminated by insulated terminal connectors to minimize shock hazard during service.

F. Cabinet:

1. The cabinet shall be low profile with a pre-coat or powder-coat RAL 1001 white paint finish. Finish shall be a minimum 80 gloss on G30 galvanized steel. The cabinet shall be constructed so that screws are not visible from the bottom, front, or sides, except for service panel and accessories. Unit construction shall incorporate a beveled front corner on control side for additional cabinet rigidity. All units shall be manufactured with a tooled drawn supply air orifice on the rear panel to reduce fan inlet noise.
2. The unit shall be designed for ceiling suspension featuring 3/8" – 16 female threads 4-point locations with no additional adapter kits.
3. The cabinet shall be equipped with painted, roll-formed horizontal louvers. Louvers shall be spring held and adjustable for directing airflow. (Vertical louvers) (dowturn nozzles) (dowturn nozzles with vertical louvers) shall be available.
4. The cabinet shall be equipped with a full safety fan guard with no more than ½ inch grill spacing. The (open dripproof) (enclosed) motor and fan assembly shall be resiliently mounted to the cabinet to reduce vibration and noise.
5. The unit shall be designed with a full opening service access panel complete with screw closure attachment and lifting handle for removal. All components in the gas train, all standard electrical controls, and the power venter shall be within the service compartment.

G. Approved Manufacturers:

1. Modine
2. Reznor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Radiant Heaters (Low–Intensity):

1. All equipment shall be installed per applicable codes to the satisfaction of the governing authorities.
2. Installation shall be per manufacturer’s requirements and recommendations.
3. Supplier shall provide a manufacturer’s written warranty covering all components for a period of three (3) years.

B. Radiant Heaters (High Intensity):

1. All equipment shall be installed per applicable codes to the satisfaction of the governing authorities.
2. Installation shall be per manufacturer’s requirements and recommendations.
3. Supplier shall provide a manufacturer’s written warranty covering all components for a period of three (3) years.
4. Heaters may be mounted at angles from 0 to 30 degrees. The gas manifold must be located on the low end of the K Series. DO NOT mount over 30 degrees as this will waste radiant energy by directing it to the opposite wall and will not meet A.G.A. requirements.
5. Where permissible, chain mounting is recommended. Number 1/0 Tenso chain (200# working load) is recommended. “S” hooks should be a minimum ¼” in diameter wire and the ends must be closed after installation. Heaters located in aircraft hangers or near overhead doors must be rigidly mounted to prevent swinging. THE INSTALLER is responsible for adequately fastening the chain or other mounting to the overhead building structure. The overhead structure, in turn, must be adequate to support the weight of the heater. UNDER NO CIRCUMSTANCES should either the gas supply line or the electrical supply line to the heater be used to provide any assistance in the suspension of the heater. DO NOT run any gas or electric service lines above or below the heater or near the path of the flue products from the heater.

6. Clearances to combustibles shall be maintained. It is strongly recommended that more distance than the minimum clearance is maintained above the unit whether the construction is combustible or not. This will reduce and/or eliminate hot spots and staining of painted ceiling surfaces. If the unit must be close to the roof, or ceiling, interpose a non-combustible baffle (twice the size of the reflector) between the unit and the roof or ceiling. Allow at least 2” between the roof or ceiling and the non-combustible baffle. Allow at least 12” between the non-combustible baffle and the top of the heater.

7. Either piping or mounting shall be flexible (to prevent fatigue failure from vibration or thermal expansion).

8. Adequate clearances from heaters to sprinkler heads shall be maintained. Coordinate with Fire Sprinkler Contractor.

9. Piping:
   a. Provide a 1/8” N.P.T. plugged tap, accessible for test gauge connection, immediately upstream of the gas supply connection to the heater.
   b. An approved flexible connector with shut-off gas cock is suggested as a convenient method of connecting Infra-Red heaters to the gas supply (local codes permitting).
   c. Use pipe joint compound resistant to the action of LP gas and provide a ground joint union ahead of the controls to permit servicing the heater(s).
   d. Ensure that the pressure regulator (if packed loose) is installed in the gas line to the heater.
   e. Provide a drip leg in the gas supply line.

10. Electrical:
    For wiring of controls on each heater see the wiring diagram included with each heater. Heaters shall be energized by 24 volts AC, by connection to control system.

C. Furnace (Zero Clearance):

1. Provide start-up by an authorized factory representative.
2. Set unit level to promote condensate drain.
3. Provide traps for condensate drains per manufacturer requirements.
4. Provide connections to multiple condensate outlet as required. Drain condensate to the nearest floor drain or as indicated on the plans.
SECTION 238239 - ELECTRIC HEATERS

PART 1 - GENERAL

1.1 SUMMARY
   A. Includes but not limited to: Furnishing and installing specified material as described in the Contract Documents.
   B. Related Sections:
      1. General Conditions and Division 1 apply to this section.
      2. Section 200000 – General Mechanical Requirements.

1.2 QUALITY ASSURANCE
   A. Units to be UL listed.
   B. Shall conform to NEC and NFPA requirements.

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION
   A. Electric Heaters

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION
   A. Operation and Maintenance Manual

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS
   A. Not Applicable

2.2 FAN FORCED WALL HEATERS
   A. Provide recess mounting in stud wall and surface mounting in block wall unless otherwise stated on plans.
   B. 20-gauge minimum sheet metal casing.
   C. Heating element shall be encased in steel finned casting and protected by thermal switch.
D. Fan motor shall be heavy duty enclosed and permanently lubricated.
E. Fan shall be precision balanced and fan motor assembly mounted to be vibration free.
F. Units shall be controlled automatically by integral thermostat when heater is in “ON” position unless otherwise stated on plans.
G. Heater shall have built-in fan delay.
H. Finish shall be baked-on enamel.
I. Bi-metallic limit turns the element off when an over temperature condition occurs. Automatically resets when the normal temperature returns.
J. Approved manufacturer:
   1. Berko
   2. King
   3. Markel

2.3 UNIT HEATERS
A. Furnace shall be factory assembled unit, with blower, heaters, steel casing and completely wired.
B. Cabinet: 22-gauge minimum cold rolled steel with baked enamel finish. Interior of cabinet around electric heating elements shall be lined with ½ inch thick 1-1/2 lb density fiberglass insulation.
C. Blower:
   1. Propeller type, dynamically and statically balanced.
   2. Unit shall be direct drive.
D. Heaters:
   1. High mass, all steel finned and tubular heating element.
   2. Each set of heaters shall be equipped with limit control with fixed temperature “OFF” setting and automatic reset with supplemental thermal cut-off safety fuses.
   3. Provide fan time delay relay and circuit breakers.
   4. Furnaces shall have manually reset transformer.
E. Approved Manufacturers:
   1. Indeeco
   2. Lennox
   3. Markel
   4. Trane
2.4 DUCT HEATERS

A. Heaters:

1. Eighty (80%) percent nickel, 20% chromium resistance coils insulated by floating ceramic bushings and supported in an aluminized steel frame.
2. Bushing shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2 inches maximum center to center.
3. Coils shall be machine crimped into stainless steel terminals and insulated with phenolic bushings.
4. Heaters shall be listed by UL for zero clearance to combustible surfaces.
5. Heater casings shall be of flanged type for attachment to external duct flanges and shall be made to accommodate internally insulated ducts with insulation thickness as specified.

B. Furnish disc-type thermal cutouts for primary and secondary protection.

1. Automatic reset primary cutout shall be suitable for scheduled voltage operation.
2. Manual reset secondary cutouts shall be factory wired directly in series with each circuit.
3. Non-reusable thermal links are not acceptable.

C. Voltage, phase and number of heating stages to be furnished are shown on Drawings. Limit step controller to eight steps.

1. Three phase heaters shall have equal, balanced circuits.
2. Circuits shall be rated at 48-amps maximum.
3. Heating elements shall be de-rated to 35-watts per sq. ft. of element surface.
4. Test heaters di-electrically at 2,000 volts before shipments.

D. Each heater shall have following built-in components which shall be wired to terminal blocks for field connections. Internal wiring shall be suitable for 105°C.

1. Mercury contactors shall disconnect circuits.
2. Control transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary winding to be factory fused.
3. Door mounted unfused disconnect switch, snap acting, industrial type to be built into access door. Hinged, latched disconnect switch and door cover shall lock in closed position when switch is on.
4. Built-in fuses properly sized complete with fuse block.
5. Air-flow switch wired in series with automatic reset thermal cutout.
6. Provide heaters of 100 KW capacity or greater with recycling relay to prevent all steps from simultaneously energizing after power interception.

E. Approved Manufacturers:

1. Indeeco
2. Trane
3. Markel
2.5 ELECTRIC FURNACES

A. Furnace shall be factory assembled unit, with blower, heaters, steel casing and completely wired.

B. Cabinet: 22-gauge minimum cold rolled sheet with baked enamel finish. Interior of cabinet around electric heating elements shall be lined with ½ inch thick 1-1/2 lb density fiberglass insulation.

C. Blower:
   1. Centrifugal type, dynamically and statically balanced.
   2. Unit shall be belt driven or direct drive.
   3. Direct driven blower shall have a factory installed and wired speed controller providing at least three blower speeds.

D. Heaters:
   1. Nickel-chrome and staged.
   2. Each set of heaters shall be equipped with limit control with fixed temperature “OFF” setting and automatic reset with supplemental thermal cut-off safety fuses.
   3. Provide fan time-delay relay and circuit breakers.
   4. Furnaces shall have manually reset transformer.
   5. Provide at least two stages.

E. Filter: See Section 233300 – HVAC Specialties.

F. Approved Manufacturers:
   1. Carrier
   2. Lennox
   3. Trane

2.6 BASEBOARD HEATER

A. 20-gauge minimum sheet metal casing. 18-gauge front cover. Junction boxes and element hangers to be welded to baseboard case.

B. Heating element shall be encased in steel finned casting.

C. Continuous sensor to extend the full length of the baseboard for thermal protection. Shall automatically reset after tripping when normal temperature returns.

D. Finish shall be baked-on enamel.

E. Manufacturers:
   1. King
   2. Markel
2.7 CEILING RADIANT HEATING PANELS

A. Face to be white finish.

B. Provide surface mount kit as indicated on equipment schedule. Surface mount trim color to be as selected by Architect.

C. Furnish thermostat kit.

D. Provide with clear, Lexan thermostat guard.

E. Approved Manufacturer:
   1. Aztec

PART 3 - EXECUTION (NOT USED)

END OF SECTION
CITY OF PACIFIC - PUBLIC WORKS FACILITY
BCE PROJECT NO. 217-365.00
NOVEMBER 12, 2019

Notice:

The following list of specifications and drawings represents those documents that were prepared under the provisions of the Revised Code of Washington RCW 18.43, by BCE Engineers, Inc. of Tacoma, Washington. The sealing of this specification and drawings list is provided in accordance with Washington Administrative Code WAC196-23-020.

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SECTION 260000 - ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

A. Conform to the General Conditions, Supplementary Conditions, and related work in other Divisions for all work in Division 26. See Division 1 for sequence of work.

1.2 WORK INCLUDED

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein. Equipment and devices furnished and installed under other divisions of this specification (or by the Owner) shall be connected under this division. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions, and has determined that these documents do sufficiently describe the scope of construction work required under this Contract.

1.3 SCOPE OF BASIC BID

A. Included in Division 26 work is all work and related items necessary to provide all electrical installations except as specifically excluded. In general, this includes all labor, equipment, tools, etc., to complete the electrical work.

1.4 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

1.5 RELATED WORK

A. Temporary Power and Lighting – Division 1

B. Mechanical Control Wiring – See Division 23

C. Cutting and Patching - See Division 1
D. Trenching, backfill and asphalt work – See Division 2

1.6 STANDARDS AND REGULATIONS

A. The work shall comply with the latest edition of the applicable Standards and Codes of the following:

1. ASTM American Society for Testing and Materials
2. NBFU National Board of Fire Underwriters
3. NEC National Electrical Code
4. --- State Electrical Code
5. NESC National Electrical Safety Code
6. NEMA National Electrical Manufacturers Association
7. NFPA National Fire Protection Association
8. U.L. Underwriters Laboratories Inc.
9. IPCEA Insulated Power Cable Engineers Associated
10. CBM Certified Ballasts Manufacturers
11. --- Federal, State and Local Building Codes
12. ETL Electrical Testing Laboratories

B. If any conflict occurs between Government adopted Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.7 PERMITS & FEES

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection.

B. The Contractor shall consult with and follow the requirements of the local fire, power, telephone, and television utilities serving the area and shall coordinate his work with them.

C. Utility connection and hook-up charges for power, telephone and television shall be paid by the Owner directly to the utility. The Electrical Contractor is required to provide any and all coordination necessary to support the utility connection, file for application of service (or assist the Owner in filing for application of service) and coordinate dates for service with the utilities.

1.8 DEFINITIONS

A. When "Provide" is used, it shall be interpreted as "furnishing and installing complete in operating condition".

B. When "Drawings" is used, it shall be interpreted as "all Contract Drawings for all Disciplines".
C. When "Contractors" is used, it shall be interpreted as the Electrical Contractor.

1.9 INTENT OF DRAWINGS

A. The electrical drawings are intended to serve as working drawings for general layout. The equipment layout is diagrammatic and unless specifically dimensioned or detailed, does not indicate all fittings, hardware or appurtenances required for a complete operating installation.

B. Anything shown on the drawings but not covered in the specifications, or anything covered in the specifications but not shown on the drawings, shall be as if covered in both. In case of conflict between the drawings and specifications, the Engineer will select the method to be used. The Contractor shall be responsible for verifying all measurements before proceeding with the work.

C. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of outlets. Raceway and outlet locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

D. The contractor shall review the manufacturer provided installation instructions for each piece of equipment prior to rough-in. Any conflict between the drawings, specifications and installation instructions shall be brought to the Engineer's attention immediately. The contractor will not be paid for any reinstallation required due to failing to comply with manufacturer's recommendations or requirements unless specifically directed by the engineer, in writing, after the conflict has been identified.

1.10 PROTECTION

A. The Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance. See Division 1 for detailed requirements.

1.11 HOUSEKEEPING

A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.

B. All marred surfaces shall be refinished and painted after installation.

C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.12 TEMPORARY USE

A. Temporary or interim use of any and all portions of the electrical system shall be under the supervision of the Electrical Contractor.
B. Temporary power and lighting for use during construction shall be provided per the requirements of the Division 1 specifications.

1.13 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to any reference drawings, an as-built set of prints, on which all deviations from the original design shall be drafted in a neat, legible manner with red colored pencil. This red lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions. The Contractor is responsible to revise panel schedules and load calculations as required.

B. Drawings shall show locations of all concealed raceway runs larger than 1", giving the number of conductors and size of raceway. Underground ducts shall be shown with cross section elevations. All pipe, raceway, manholes or lines of other trades shall be included.

C. The Contractor shall update all references to specific products to indicate products actually installed on project. This shall include, but not be limited to, lighting fixtures, lighting controls, etc.

D. Upon completion of the Division 26 work, the Contractor shall deliver the red lined drawings and one set of neatly drafted as-built drawings on electronic media in AutoCAD R-2013 format and full-size pdf to the Engineer for transmittal through the Engineer to the Owner.

1.14 WARRANTY

A. Provide a written warranty that the Division 26 work is free from mechanical and electrical defects. Contractor shall replace and repair, to the satisfaction of the Engineer, any parts of the installation which may fail within a period of 12 months after the certificate of final acceptance, provided that such failure is due to defects in material or workmanship, or failure to follow the specifications and drawings.

1.15 INSTRUCTIONS AND MANUALS

A. Operation and maintenance data shall be submitted in accordance with Section 017823.

B. Manuals shall contain shop drawings, wiring diagrams, operating and maintenance instructions, replacement parts lists, and equipment nameplate data for all equipment and systems installed under the project. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation. Manuals shall contain original brochures supplied by manufacturers. Xerox copies of originals will not be accepted.
C. Each type of device provided shall be identified in the O & M Manual using the same identification as shown on the drawings and specifications. The information included must be the exact equipment installed not the complete "line" of the Manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier is not acceptable. The following information shall be provided for each device:

1. Manufacturer's name, address and phone number.
2. Local supplier's name, address and phone number.
3. Complete parts lists including quantities and manufacturer's part numbers.
4. Installation instructions.
5. Recommended maintenance items including maintenance procedure and recommended interval of maintenance listed in hours of operation, calendar unity or other similar time unit.

D. The O & M Manual shall be assembled as detailed in Section 017000. As a minimum, the following sections shall be broken out:

1. Light Fixtures
2. Panelboards
3. Motor Controls
4. Low Voltage Lighting Control Systems
5. Surge Protection Device (SPD)

E. Wiring Diagrams for each system shall be complete for the specific system installed under the Contract. "Typical" Line Diagrams will not be acceptable unless properly marked to indicate the exact field installation.

1.16 WORK NOT INCLUDED

A. Indicated motors, controls, and equipment as described in other divisions shall be furnished by other trades, but shall be moved, set and wired to electrical controls and power supply by the Electrical Contractor.

B. Work to be included under this Contract shall be defined on drawings and in these specifications. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

1.17 INSTRUCTION PERIODS

A. Upon completion of the work and after all tests and final inspection of the work by the authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and supplier’s representatives when so specified.
B. Scheduled Instruction periods shall be:

1. Low Voltage Lighting Control Systems 1/2 day
2. Daylighting Control Systems 1/2 day

C. Costs for time involved by Contractor shall be included in the bid.

1.18 COMPLETION OF WORK

A. Upon completion of the Division 26 work, the Contractor shall comply with requirements of Section 017000 for project closeout.

B. Arrange for and obtain all required inspections and certificates pertaining to the Division 26 work and deliver the certificates to the Engineer in triplicate.

C. Prior to or at the time of final inspection, the Contractor shall, as outlined in detail in the specifications, complete the delivery of all the following items:

1. Completion Letter
2. Certificate of Final Inspection, in triplicate form.
3. Warranty to Owner (with copy for Engineer)
4. Marked Set, Electronic Media Set on CD in AutoCAD R-2013 Format, and Mylar Set of “As-Built” Electrical Drawings
5. Motor Current Readings
6. Phase Current Readings
7. OHMIC Test Readings
8. Ground Fault Settings
9. Panelboard and Special Equipment Shop Drawings and Final Approved List of Materials Installed
10. Certificate of Feeders Torque Results
11. * Receipt from person to whom delivered the following spare glasses, plastic diffusers, lamps, and ballast fuses.

Electrical Inspector
Fire Department

Completion of Work
260000 – 1.17

Supplementary General Conditions
260000 – 1.13

General As-Built Drawings
260000 – 1.12

Wires and Cables
260519

Materials, General
260000 – 2.3

Lighting Fixtures
265000

General, Tests
260519 – 3.03(D)

General, Tests
260519 – 3.3 (E)

General, Tests
260519 – 3.3 (B)
12. * Receipt from person to whom delivered the following: Spare Elements for Fire Detectors, Fuses for Switches, Spare Keys for Panelboards, receptacles switches, plugs, etc.

FUSES – 262813
PANELBOARDS – 262416
SWITCHES & RECEPCTABLES – 262726

13. Wiring diagrams, Maintenance Manuals, Operation Instructions, and Brochures (5 sets minimum)

* Secure delivery instructions from Architect for delivery to Owner.

1.19 SHOP DRAWING SUBMITTALS

A. This Contractor shall submit to the Architect as described in Section 016000. When shop drawings are submitted electronically, they shall be submitted as described in Paragraph B below.

1. Manufacturer's Catalog Data.
2. Complete Physical and Technical Data.
3. Wiring Diagrams.
4. Detailed Reference (written or highlighted) noting compliance with the appropriate specification section and applicable item numbers within that section.
5. Other Descriptive Data as required by the Architect/Engineer.

B. The Contractor shall submit to the Architect electronic shop drawings in PDF format. Electronic Shop Drawings that are submitted without following the format as outlined below will be returned for corrections without any further review.

1. A separate PDF file shall be submitted for each Division including All submittal items for that Division as outlined below:
2. Division 26 – Electrical
3. The contractor shall provide either a digital or hardware method of transporting the electronic submittal to the Architect. Files larger than 10Megabytes shall not be sent via email and shall be transferred via an FTP or similar file transfer protocol, PC compatible CD or PC compatible Thumb Drive. Divisions shall not be broken up into separate files for transfer via email.
4. Each Specification PDF shall be submitted with the following format and salient attributes:
   a. Cover page including:
      1) Project Title as indicated on the plans
      2) Project Location including Address, City, State, Country
      3) Prime Contractor name, phone number, and email address
      4) Sub-Contractor name, phone number, and email address
      5) Specification Division Number and Title
b. Index Page outlining each specification section included in the submittal. This list shall be linked to a corresponding Specification Section Divider for each section. This link shall enable the reviewer to jump to a specification section by clicking the item in the list.

c. Specification Section Divider: Shop Drawings shall be divided by specification section and each section shall begin with a Divider Page outlining the Specification Number, Title, and a list of Submittal Items for the section. In the upper right-hand corner of the divider page, a Link shall be provided returning the reviewer to the Index Page.

d. Each Submittal Item listed on the Specification Section Divider shall be linked to the specific item being submitted. Each Submittal Item shall be hi-lighted Yellow with a Note Reference to the specific paragraph giving the submittal requirements.

e. Each page of the submittal shall be numbered in the Bottom Right corner of the page. Page numbering shall be Roman Numerals for all pages before the First Specification Section. Each Specification Section page shall be numbered with the Specification Section number, a dash, and the page number in the Specification Section.

f. Specification items shall be specifically hi-lighted as they apply to the project rather than hi-lighting an entire product family. Items that do not apply to this project shall be crossed out with a Red X.

g. The PDF file shall be not be protected to prevent printing, selecting of text within the document, or extracting of pages from the document.

C. Shop drawings shall be submitted complete, at one time and each item indexed with dividers and separated per specification section and shall be, but not limited to the items of equipment listed below:

1. All panelboards, showing breaker arrangement with circuit numbers, relays, and panel skirts.
2. Motor starters and controls designating where items are intended to be used and equipment being controlled.
3. Surge Protection Device
4. Disconnect Switches
5. Fuses and spare fuse cabinet
6. Lighting Fixtures (Complete)
7. Low Voltage Lighting Control Systems
8. Wiring Devices
9. Back Boxes
10. Coverplates
11. Raceways and Connectors
12. Copper Wire
13. **All Specialty Systems not listed above**
14. Any other items requested by Engineer.

D. Within 10 working days after the date of the letter rejecting any items of equipment, lighting fixtures, or materials as not in accordance with the specifications, Contractor shall submit a new list of items he proposes to furnish and install in place of those items rejected. If the Contractor fails to submit this new list within the above specified time, or if any items on this second list are rejected as not being in accordance with these specifications, the Engineer may select the items which the Contractor shall furnish and install without change in Contract price or time of completion.
E. The acceptance of a manufacturer’s name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents. The Contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer’s review.

F. Electrical Drawings for the project have been developed by the Engineer using AutoCAD™ Revision 2013 software. These drawing files will be made available to the Contractor for development of shop drawings and/or “As-Builts” with a signed waiver of responsibility.

1.20 SCHEDULE OF VALUES

A. Provide Schedule of Values per Division 1 and related project requirements.

B. Division 26 Breakdown: Provide schedule of values for the following categories (as a minimum):

1. Electrical Mobilization
2. Electrical Submittals
3. Electrical General Project Management, General Design, General Coordination
4. Branch Circuit Materials Rough-in
5. Branch Circuit Materials Rough in – Labor
6. Branch Circuit Trim – Materials
7. Branch Circuit Trim – Labor
8. Service Materials
9. Service Materials – Labor
10. Feeder Materials
11. Feeder Materials - Labor
12. Panelgear, Disconnects, Starters
13. Panelgear, Disconnects, Starters – Labor
14. Light Fixtures
15. Light Fixtures – Labor
16. Commissioning
17. Electrical Punchlist, Closeout, and Owner Training

C. The dollar value for “Electrical Punchlist, Closeout, and Owner Training” shall in no case be less than 2% of the total dollar value of the Division 26 work (or as indicated in Division 1, whichever is higher).

D. The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. “Electrical Punchlist, Closeout, and Owner Training”), as specified above and in Division 1, the Owner reserves the right to withhold 10% of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested and adjusted.
PART 2 - PRODUCTS

2.1 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified. However, any manufacturer not listed as an accepted Bidder for a specific item must be submitted for acceptance in writing in accordance with Section 016000.

2.2 MANUFACTURER/EQUIPMENT PRIOR APPROVALS

A. Any manufacturer/equipment not listed as an approved substitute for a specified item must be submitted for acceptance in accordance with Section 016000, in writing, with detailed information to include:

1. Manufacturer's Catalog Data
2. Complete Physical and Technical Data
3. Wiring Diagrams
4. Detailed reference (written or highlighted) noting compliance with the appropriate Specification Section and all applicable Specification item numbers within that Section
5. Complete type written index cross referencing all proposed substitutes and specified items
6. Detailed reference to specified items (written or highlighted) noting equal quality and performance of proposed substitute equipment
7. Other descriptive data, as required by the Engineer

B. If substitute material is determined to be acceptable by the Engineer, it will be included in a subsequent Addenda prior to bidding. The acceptance of a manufacturer’s name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents.

C. Only materials which are specified or published in addenda as acceptable shall be used.

2.3 MATERIALS

A. All materials must be of the quality herein specified. All materials shall be new, of the best quality and free from defects. They shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

B. Each type of material shall be of the same make and quality. The materials furnished shall be standard products of the manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

C. All materials shall be U.L. or E.T.L. listed for the purpose for which they are used.
D. Equipment in compliance with U.L. standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory the unit shall be field evaluated per the Washington State Administrative Code (WAC) and the electrical inspector’s requirements.

2.4 COMPLETE SYSTEM

A. All the systems mentioned shall be complete and operational in every detail except where specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.5 NAMEPLATES

A. Provide nameplates constructed of plastic (black on white) laminated material engraved through black surface material to white sublayer (attach with screws on NEMA 1 enclosures). EXCEPTION (1): Emergency distribution system component labeling - white letters on red background. Exception (2): Series rated systems shall be yellow background with white letters.

1. Service Entrance Label: Refer to Section 262413
2. Panelboard Labels: Refer to Section 262416
3. Switch and Receptacle Labels: Refer to Section 262726
4. Motor Starter and Disconnect Labels: Refer to Section 262816
5. Special Equipment/Outlet Labels: Refer to Appropriate Sections.
6. Under 600 Volt Feeder Tags: Refer to Section 260519.

PART 3 - EXECUTION

3.1 GENERAL

A. Careful consideration shall be given to clearances under and over beams, pipes and ducts, to provide proper headroom in all cases. Check drawings to determine heights of all suspended ceilings and size of pipe shafts where raceway and wire-ways shall run. Coordinate installation of Division 26 wiring and equipment with Division 23 and other trades. Where insufficient room for proper installation appears, obtain clarification from Engineer before any installation is begun.

B. Cutting and Patching:

1. Obtain permission from the Architect and/or Owner’s Representative prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills except where space limitations prevent the use of such drills.
2. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.
3.2 COORDINATION

A. The Contractor is responsible for accomplishing Division 26. The work shall coordinate with that of the other Contractors and/or other trades doing work in the building and shall examine all Drawings, including the several Divisions of Mechanical, Structural, Civil and Architectural, for Construction Details and necessary coordination. Specific locations of construction features and equipment shall be obtained from the Contract Documents, field measurements, and/or from the trade providing the material or equipment. No extra costs will be allowed for failure to obtain this information.

B. All conflicts shall be reported to the Engineer in writing before installation for decision and correction. Special attention is called to the following items:

1. Door swings to the end that switches will be located on "Strike" side of the door.
2. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
3. Location of cabinets, counters and doors so that electrical outlets, lighting fixtures and equipment are clear from and in proper relation to these items.
4. Type and height of ceiling.
5. All device measurements referenced on drawings or specifications are to be centered of device unless noted otherwise.

C. The Contractor will not be paid for work requiring reinstallation due to lack of coordination or interference with other Contractors or trades. This includes, but is not limited to, removing, replacing, relocating, cutting, patching, and finishing.

D. The Contractor shall review the installation manual for each device to be installed. If a conflict appears to occur between the manufacturer’s recommended installation practices and the plans or specifications, notify the Engineer immediately. Final determination shall be by the Engineer. The Contractor will not be paid for reinstallation due to failure to comply with manufacturer instructions or design documents.

E. Device and fixture locations may be changed within 15 feet without extra charge if so desired by the Engineer, before installation.

3.3 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response for RFIs regarding Division 26 work. To further expedite this process, where a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete.

3.4 CLEANING AND PAINTING

A. All equipment, whether exposed to the weather or stored indoors shall be covered to protect it from water, dust and dirt.
B. After installing, all metal finishes shall be cleaned and polished, cleaned of all dirt, rust, cement, plaster, grease and paint.

C. All equipment with a primer coat of paint shall be given two (2) or more coats of a finish enamel and scratched surfaces be refinished to look like new. Markings, identification and nameplates shall be replaced.

3.5 EQUIPMENT IDENTIFICATION

A. Provide identifying engraved bakelite nameplate on all equipment, including pull boxes, to clearly indicate its use, area served, circuit identification, voltage, and any other useful data.

B. Each auxiliary system, including communications, shall be clearly labeled to indicate its function.

3.6 DEVIATION

A. Deviation from the shop drawings in construction or installation of equipment shall not be made unless Shop Drawings showing proposed deviations are submitted to and approved by the Engineer. If any equipment is furnished under this or other divisions with current, voltage or phase ratings that differ from those shown on the drawings, the Contractor shall notify the Engineer in writing immediately and shall not connect said equipment until instructed as to required changes by the Architect. No extension of time will be granted as a result of such changes.

3.7 EXCAVATIONS

A. All excavations are to be so conducted so that no walls or footings shall be disturbed in any way.

B. Remove all surplus earth not needed for backfilling and dispose of same as directed.

3.8 WIRING METHODS

A. All low voltage wiring shall be in Raceway with Junction Boxes and Fittings where concealed in walls, in inaccessible ceiling space, or where exposed in finished or unfinished areas.

B. All branch circuit wiring shall be installed in raceway with junction boxes and fittings.

C. Provide access panels as needed for pull boxes and equipment located above ceiling or behind walls.

D. Multiple feeder runs shall be rod hung, using a strut type channel with individual one-hole clamps, back plates and machine screws.

E. Any low voltage cables that are not terminated at both ends shall be tagged and labeled per code.
F. See Section 270000 for additional requirements of low voltage systems.

3.9 PENETRATIONS OF FIRE RATED ELEMENTS
   A. Must be made such as to retain that rating.

3.10 HANGERS AND SUPPORTS
   A. Provide hangers, brackets, and suspension rods and supplementary steel to support equipment.
   B. Hangers provided under other divisions shall not be used for support of Division 26 equipment unless permitted by Architect/Engineer.

3.11 CHASES AND OPENINGS
   A. Provide to the masonry and concrete trades all templates and details of chases, openings in floors and walls as required for Division 26 equipment installation.

3.12 PAINTING
   A. Painting in general will be covered under another division of this specification, except items furnished under Division 26 that are scratched, marred in shipment or installation, shall be refinshed by the Division 26 Contractor.

3.13 WORKMANSHIP AND OBSERVATION
   A. Workmanship shall be of the best quality and none but competent workers shall be employed under the supervision of a competent foreman. All completed work shall represent a neat and workmanship like appearance.
   B. All work and materials shall be subject to observation at any and all times by representatives of the Engineer.

3.14 MISCELLANEOUS
   A. Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment, as required by the International Building Code.
   B. Conduits that cross seismic separations shall be installed with flexible connection suitable to accommodate conditions. Secure raceways on each side of a separation and provide a minimum of 36” length of flexible conduit to span separation.
3.15 CABLE AND WIRING ROUTED UNDERGROUND OR UNDERSLAB

A. All cables and conductors, both line voltage and low voltage, routed underground or underslab shall be U.L. listed for installation in wet locations per NEC and WAC codes.

END OF SECTION
SECTION 260010 - EXCAVATION AND BACKFILL FOR ELECTRICAL UNDERGROUND UTILITIES

PART 1 - GENERAL

1.1 GENERAL INCLUDES

A. Excavation and Associated Grading.
B. Trenching and Trench Protection.
C. Backfilling and Compaction.
D. Verification of Existing Utilities.
E. Protection of Utilities.

1.2 RELATED SECTIONS

A. Section 260000 – Electrical General Conditions
B. Section 260533 - Raceways
C. Section 265000 - Lighting

1.3 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

1.4 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and notify the General Contractor in writing of unsatisfactory conditions or work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:

1. International Conference of Building Officials, "International Building Code".
2. Local requirements for all utility work.
3. OSHA and WISHA regulations.
4. APWA Standard Specifications.

1.5 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings, specifications, local codes and standards, proper construction coordination with work of other trades, and protection and worker's safety. Contractor shall advise Engineer of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Commencement of work shall indicate Contractor's acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

B. American Society of Testing and Materials (ASTM) publications:

1. D 422-63 Particle Size Analysis of Soils.
4. D 1557-78 Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inches (457 mm) Drop.
5. D 2167-66 Density of Soil In-Place by the Rubber Balloon Method.

PART 2 - MATERIALS

2.1 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for backfill use. Materials classified as SP-SM, GP-GM, GM, GC and ML are also satisfactory for backfill use provided that they contain moisture contents suitable for the intended use and are reasonably free of organic matter. Native material, not considered unsatisfactory as specified below, may comply. Except that no material shall have any object with a dimension exceeding 2 inches and no object shall be sharply angular.
2.2 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moisture contents which are not suitable for the intended use, or having objects with dimensions exceeding 2 inches (boulders, etc.).

2.3 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility conduit or appurtenance structure, and material identified as unsuitable in the National Electrical Code 300-5(F).

2.4 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to provide backfill, or replace unsuitable soil, shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve, and not contain discrete particles greater than 2 inches in diameter.

2.5 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Method D. Minimum compaction requirements shall be as specified in PART 3.

2.6 DRAINAGE GRAVEL

A. Shall be 3/4-inch washed gravel with no more than 2% passing 1/2-inch sieve opening.

2.7 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8-inch washed pea gravel.

PART 3 - EXECUTION

3.1 EXCAVATION

A. If workers enter any trench or other excavation four or more feet in depth that does not meet the open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW.
B. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

C. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.

D. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials, or be disposed of in such a manner as to interfere with subsequent borrow operations.

E. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled in accordance with paragraph 3.05 BACKFILLING at no additional cost to the Owner.

F. The Contractor shall provide dewatering as required for installation of underground work.

3.2 TRENCH EXCAVATION

A. The trench excavation shall meet the requirements of the National Electrical Code and local utility standards.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the conduit and for bedding. Stones of 2 inches or greater in any dimension, or as recommended by the conduit manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unsuitable Material: Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph 3.05 BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.
D. Bedding: The bedding surface for the conduit shall provide a firm foundation of uniform density throughout the entire length of the conduit. The conduit shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular conduit or to the lower curved portion of conduit arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Provide bedding using pea gravel where noted on the drawings.

3.3 EXCAVATION FOR APPURTEINANCES

A. Excavation for manholes, handholes or similar structures below grade shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.4 JACKING, BORING, AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the raceway, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections.

3.5 BACKFILLING

A. Backfill material shall be compacted to 6" layers and as specified in Paragraph 3.06-Compaction.

1. Trench Backfill: Trenches shall be backfilled to finish grade.
2. Replacement of Unstable Material: Unstable material removed from the bottom of the trench of excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.
3. Bedding and Initial Backfill: Bedding shall consist of satisfactory materials. Initial backfill shall be in 6-inch lift.

3.6 COMPACTION

A. Each layer of fill, or the excavated subgrade, shall be compacted to at least 95%, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or another approved compaction equipment.
3.7 PROTECTION

A. Newly graded excavated or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION
SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all wire, cable, and terminations complete.

1.2 RELATED DOCUMENTS

A. Section 260000 – Electrical General Conditions

1.3 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCT

2.1 WIRE AND CABLE (COPPER, 600-VOLT)

A. Interior and Above Grade: All wires to be Type THW or RHW. Type THWN/THHN or XHHW wire may be utilized at Contractors option, subject to code requirements. Wire and cables shall be brought to project in original containers bearing the underwriters label. Provide Type AVA wire where conductors are subject to temperature above 167 Degrees F.

B. Underground: All conductors to be type USE. Increase Raceway size when necessary to accommodate conductors per code. Exception: Underground conductors completely contained in code recognized Raceway and boxes may be Type THW, THWN or XHHW.

2.2 SPLICES

A. Above Grade: Solderless type only. Preinsulated "twist-on" type (limited to size #10 and smaller). Bolt on compression type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape acceptable for all sizes.

B. Below Grade: Splices below grade shall be in handholes and shall be made watertight with epoxy resin type splicing kits similar to Scotchcast.

2.3 TERMINATIONS

A. Compression set, bolted or screw terminal.
B. Conductors #12 and smaller shall utilize eye or forked tongue type compression set terminator when termination is to a bolted or screw set type terminal block or terminal cabinet.

2.4 PLASTIC CABLE TIES

A. Nylon or Equivalent, locking type.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all wiring in Raceway unless shown or specifically authorized otherwise.

3.2 WIRE SIZE

A. No. 12 AWG minimum for power and lighting circuits.

B. Provide solid wire for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger (600) volts.

3.3 TESTS

A. In addition to the factory testing of all equipment and cable, the Contractor shall test all wiring connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500V minimum DC "Megger" type tester. If tests indicate faulty insulation (less that 2 megohms), such defects shall be corrected and tested again. Contractor shall provide all apparatus to make tests and shall bear all expenses of required testing. Routine operation tests shall be made on all pieces of equipment to demonstrate that working parts are in operating condition. Results of all tests shall be recorded and submitted to the Owner. The Contractor shall immediately replace all parts, which fail to pass the test.

B. Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with reference to "Earth Ground" using the "Multiple Ground Rod Fall-In-Potential" method and suitable instruments. Maximum resistance to ground shall be less than 10 ohms. If this resistance cannot be obtained with the ground system shown, notify the Owner immediately for further instructions. Provide OHMIC test results to Engineer.

C. All circuits both in and out of the building shall test out free of grounds, short circuits and other defects.

D. Check and record catalog number and ampere size of controller overload heaters installed, nameplate full-load amperes, and actual operating amperes of each motor. IMPORTANT: Submit recorded data in triplicate to the Engineer. Check proper load balance on the electrical system, direction of rotation, lubrication, and overload protection of all motors before placing in operation.
E. Provide a log of ampere reading for all panels from phase to neutral for 4 wire panels and from phase to phase for 3 wire panels. These readings shall be taken with all loads activated.

F. The final test of all equipment shall be made on dates designated by the Owner/Engineer and all readings shall be made in his presence.

G. Feeders shall be checked to ensure all phases are energized before connecting to their respective motors. Each motor shall rotate in the proper direction for its respective load. Prior to rotation test, all bearings shall be inspected for proper lubrication.

H. Minimum megger test for equipment shall be as follows:

<table>
<thead>
<tr>
<th>Equipment Voltage Rating</th>
<th>Maximum Resistance</th>
<th>Minimum Test Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000-Volts or less</td>
<td>2 Megohms</td>
<td>2 Megohms</td>
</tr>
</tbody>
</table>

I. Provide certification of torque values for feeder and service entrance conductors per equipment manufacturer's recommendation.

3.4 CONDUCTOR SIZES, REFERENCED ON PLANS

A. Copper, type THW or RHW unless noted.

3.5 PULLING

A. Use no mechanical means for pulling No. 8 AWG conductors and smaller. Powdered soap stone or approved spray cream shall be the only lubricant used.

3.6 STRIPPING INSULATION

A. Do not ring the cable, always pare or pencil.

3.7 TAPPING

A. If used shall be half lapped synthetic tape.

3.8 CONDUCTORS IN PANELS AND SWITCHBOARDS

A. Conductors in panels, switchboards, and terminal cabinets shall be neatly grouped and formed in a manner to "Fan" into terminals with regular spacing.

3.9 CABLE SUPPORTS

A. Provide conductor support devices as required by code in vertical cable runs.
3.10  RACEWAY SIZES REFERENCED ON DRAWINGS

A. Raceways are sized for copper, type THW, unless otherwise noted. Size all Raceways per code unless specifically noted to be larger on the drawings.

END OF SECTION
SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. A grounding system shall be provided for neutral ground and equipment ground as required by code.

1.2 RELATED DOCUMENTS

A. Section 260000 – Electrical General Conditions

1.3 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Copper, code size, with physical protection where subject to damage. Bare or green insulated.

2.2 GROUND RODS

A. 3/4" x 8'-0" copper clad steel.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all grounding for electrical systems and equipment as required by codes and as specified herein.

3.2 GROUND RODS

A. Provide as shown and/or required. Connect the ground conductor to each rod.
3.3 SIZE OF GROUND WIRE
A. As required by code. Where ground wire is exposed to physical damage or is used outside of building, protect with conduit.

3.4 GROUND CONNECTION OF WATER PIPING
A. Metal internal piping shall be grounded, as part of this Contract. This includes jumpers for dielectric fittings.

3.5 GROUND CONNECTION OF BUILDING STEEL
A. Structural metal shall be grounded, as part of this Contract.

3.6 CONNECTION TO THE GROUND BUS
A. Provide connections in accordance with the codes; including but not limited to raceway systems, switchboard/panelboard frames, service neutral, separately derived systems, electrically operated equipment and devices. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

3.7 METHOD OF CONNECTION
A. Make all ground connections and ground cable splices by thermal welding. Grounding lugs, where provided as standard Manufacturer's items on equipment furnished, may be used.

3.8 FLEXIBLE RACEWAY
A. Shall not be used for grounding. Install separate ground conductor in all flexible raceway.

3.9 PVC RACEWAY
A. Install separate ground conductor in all PVC raceway as required per code.

3.10 DROP CORDS
A. Shall have a grounding wire and be connected with a grounding type plug and receptacle.

END OF SECTION
SECTION 260532 - OUTLET AND PULL BOXES

PART 1 - GENERAL

1.1 WORK INCLUDED
   A. Provide outlet and pull boxes to enclose devices, permit the pulling of conductors and for wire
      splices and branches.

1.2 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.3 INFORMATIONAL SUBMITTALS
   A. Buy America: Certification that all steel, iron and manufactured components are provided in
      compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 INTERIOR WIRING
   A. General: Outlet and pull boxes shall be pressed drawn steel, zinc coated with plaster ring where
      applicable. Welded boxes not allowed. Four-inch size minimum. Large pull boxes shall be
      fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained
      cover.
   B. Surface Metal Raceway: Boxes of same Manufacture and to match Raceway. Boxes to
      accommodate standard devices and device plate.
   C. Concrete and Masonry: Boxes for casting in concrete or mounting in masonry walls shall be the
      type specifically designed for that purpose.
   D. Install pull boxes so as to be accessible after completion of building construction.
   E. Ceiling outlet boxes shall be galvanized octagonal 4 inch, 1-1/2-inch-deep (without fixture
      stud), 2-1/8 inches deep (with fixture stud).

2.2 EXTERIOR WIRING
   A. Above Grade: Outlet and junction boxes shall be cast or malleable iron or shall be cast of
      corrosion resistant alloy compatible with Raceway to which it is connected. Pull boxes shall be
      fabricated of heavy gauge steel and hot dipped galvanized. All boxes shall have gasketed
      covers.
B. Below Grade: Where exposed to earth, boxes (handholes) shall be constructed of precast concrete with size, configuration, cover, grates and reinforcing as required by the particular installation. Manufacturer: Similar to Utility Vault 3030LA with base or Fogtite J11 Type 2 with base. Lid shall be H-20 rated where installed in traffic areas. Where not exposed to earth shall comply with Paragraph 2.2.A above.

C. Exterior outlet boxes shall be weather resistant and rain tight, with appropriate covers, gaskets and screws.

PART 3 - EXECUTION

3.1 ANCHORING

A. All boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be so attached so that they will not "Rock" or "Shift" when devices are operated.

3.2 FLUSH MOUNTING

A. Except for surface mounted boxes or boxes above accessible ceilings, all boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling.

3.3 ELECTRICAL OUTLETS

A. General: Coordinate the work of this section with the work of other sections and trades. Study all Drawings that form a part of this Contract and confer with various trades involved to eliminate conflicts between the work of this section and the work of other trades. Check and verify outlet locations indicated on Architectural Drawings, door swings, installation details, layouts of suspended ceilings and locations of all plumbing, heating and ventilating equipment.

B. Centered on Built-In Work: In the case of doors, cabinets, recessed or similar features, or where outlets are centered between such features, such as between a door jamb and a cabinet, make these outlet locations exact. Relocate any outlets which are located off center.

C. Vertical and Horizontal Relationships: Where more than one outlet is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such outlets (including lighting, receptacle, power signal and thermostat outlets) which are not so installed, at no additional cost to Owner.

D. Device Outlet Height: Measure from the finished floor.
   *Switches 4 Feet, Set Vertically, to Top of Box
   *Receptacles, 18 Inches, Set Vertically to Centerline Telecommunications Other As Noted or as Directed by Owner
   * Heights may vary. See Drawings for additional information
E. Ceiling Location: For acoustical material locate outlet either at the corner joint or in the center of a panel, whichever is closer to the normal spacing. Locate all outlets in the same room in the same panel location.

F. Installed in Sound Walls: Boxes installed in sound walls shall not be installed back to back. All boxes shall be separated by one stud space and shall be interconnected with flex conduit with a 90° loop. Where stud space separation is not possible, utilize sound attenuating mastic around each box. 3M Fire Barrier Moldable Putty Pads MPP+ (2.54 mm minimum) or similar.

3.4 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

A. Provide as shown and/or specified. Provide templates, where required, to other trades for drilling and cutting to ensure accurate location of electrical fixtures (outlets and devices) as verified with the Owner. Provide all wiring, devices, plates and connections required by said fixture.

3.5 CONNECTION TO EQUIPMENT

A. For equipment furnished under this or other Divisions of the Specifications, or by others. Provide outlet boxes of sizes and at locations necessary to serve such equipment. An outlet box is required if the equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring used. Study equipment details to assure proper coordination.

3.6 BLANK COVERS

A. Provide blank covers or plates over all boxes not covered by equipment.

3.7 JUNCTION OR PULL BOXES

A. Pull and junction boxes shall be installed as shown, and to facilitate pulling of wire and to limit the number of bends within code requirements. Boxes shall be permanently accessible and shall be placed only at locations approved by the Owner.

B. In suspended ceiling spaces, boxes shall be supported from the structure independently from ceiling suspension system.

C. The Drawings do not necessarily show every pull or Junction Box required. The Contractor is permitted to provide boxes deemed necessary by him for his work when installed in accordance with these Specifications.

3.8 ELECTRIC WATER COOLER

A. Conceal the Electrical Outlet behind the unit housing as provided for by the Manufacturer.
3.9 BOXES CONTAINING MULTIPLE DEVICES

A. Boxes containing emergency and normal devices are permitted only with steel barriers manufactured especially for the purpose of dividing the box into two completely separate compartments.

B. Device Boxes Containing Multiple Devices and Wiring Rated Over 150 Volts to Ground and Over 300 Volts Between Conductors are permitted only with steel barrier manufactured especially for the purpose of dividing the box into separate compartments for each device having exposed live parts.

3.10 BOXES IN EARTH

A. Provide for all wire splices and as required to pull conductors. Boxes (handholes) shall be set in place on a 3" sand bed. Coverplates shall be flush to, and match the slope of, the final surface grade.

3.11 COLOR CODING

A. All Junction Boxes installed in accessible spaces and exposed in unfinished areas shall be color coded using spray paint or tape on the box and cover as applicable in the following manner:

120/208-Volt .................................. Gray
Intrusion Alarm ................................. Yellow
Telephone ................................. Dark Blue
Public Address ........................ Silver
Television .......................... Rust

B. The colors shall match the colors used on the Raceway - See Section 260533.

3.12 NAMEPLATES

A. For all line voltage junction boxes, provide engraved nameplate indicating circuit numbering of all wiring in junction box.

END OF SECTION
SECTION 260533 - RACEWAY

PART 1 - GENERAL

1.1 WORK INCLUDED
   A. Provide Raceway System complete.

1.2 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.3 INFORMATIONAL SUBMITTALS
   A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 GALVANIZED RIGID STEEL CONDUIT (GRS)
   A. General: Hot dipped galvanized.
   B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.2 INTERMEDIATE METAL CONDUIT (IMC)
   A. General: Hot Dipped galvanized.
   B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.3 ELECTRICAL METALLIC TUBING (EMT)
   A. General: Hot dipped galvanized.
   B. Fittings: Raintight; steel or malleable iron type using a split corrugated compression ring and tightening nut or stainless-steel locking disc. Steel set screw fittings are acceptable for dry locations. Indenter, drive-on and pressure cast or die cast type set screw are not acceptable.
2.4 FLEXIBLE METAL CONDUIT (FMC, LFMC)
   A. Dry Locations:
      1. General: Galvanized flexible steel for dry locations only.
      2. Fittings: Malleable iron or steel, Thomas and Betts "squeeze" type or equal.
   B. Damp and Wet Locations:
      1. Liquid Tight: Polyvinyl chloride (PVC) weatherproof cover over flexible steel conduit.
      2. Fittings: Thomas and Betts "liquid tight" or equal.

2.5 SURFACE METAL RACEWAY
   A. Formed steel or aluminum type. Standard factory finish. Where color choice is available, consult Owner/Engineer for selection prior to ordering.

2.6 RIGID NON-METALLIC CONDUIT (PVC)
   A. Schedule 40 rigid polyvinyl chloride type unless otherwise noted.

2.7 RIGID ALUMINUM CONDUIT
   A. Permitted only in specified locations.
   B. Fittings copper free cast aluminum.

PART 3 - EXECUTION

3.1 GENERAL
   A. Install Raceway concealed in construction unless noted otherwise on the Drawings or specifically approved in writing by the Owner/Engineer.
   B. Cut Raceway ends square, ream and extend maximum distance into all couplings and connectors.
   C. Provide and install manufactured end caps on all Raceway ends during construction to prevent the entrance of water or dirt. Tape, as a cover, not permitted.
   D. Swab out all Raceways before pulling wires.
   E. All elbows for GRS and PVC Raceway shall be factory radius bends. For all other Raceway, use factory radius bends of 1-1/4" and larger diameter.
   F. Raceway shall not penetrate sheet metal ducts unless permission is granted by Owner/Engineer. All sleeves shall be provided for Raceway installation.
G. Provide 2 - 3/4" C.O. stub into accessible ceiling space from all recessed panelboards or systems terminal boxes.

3.2 GALVANIZED RIGID STEEL CONDUIT

A. All Connections shall be watertight. Install for all Raceways in concrete or where subject to damage.

3.3 INTERMEDIATE METAL CONDUIT

A. Intermediate metal conduit is permitted as a substitute for galvanized rigid steel conduit except where GRS is required by code.

3.4 ELECTRICAL METALLIC TUBING

A. Install for wiring in masonry, frame construction, furred ceilings and above suspended ceilings. May be used for exposed work in unfinished areas where not subject to damage. Where construction involves masonry work, surface cut masonry units wherever such masonry units are to remain unplastered or uncovered in complete construction.

3.5 RIGID ALUMINUM CONDUIT

A. May be used in lieu of galvanized rigid steel conduit where Raceway is run above grade or inside of buildings; rigid aluminum conduit not permitted where Raceways are encased in or attached to concrete or are below grade.

3.6 RACEWAYS UNDERGROUND

A. Galvanized rigid steel conduit - painted with two coats of bitumastic paint - or galvanized rigid steel conduit with 15 mil. polyvinyl chloride (PVC) jacket (repair abrasions with PVC base paint or PVC)

B. PVC Raceways may be used for underground runs when permitted by code. Field bends, when necessary, shall be formed only with factory recommended heater. Penetrations through floor and walls shall be galvanized rigid steel conduit. PVC, if used, shall be increased in size from that shown to include code required ground wire. Bends in excess of 10 degrees shall be GRS.

C. Arrange and slope Raceways entering building to drain away from building.

D. Ground wires shall be provided in all PVC Raceway.

3.7 INSERTS, SHIELDS AND SLEEVES

A. Furnish and set in place, in advance of pouring slabs and walls, all inserts and sleeves needed to execute Division 26 equipment installation.
B. Where supports in slabs are required after wall has been poured, use a drilled-in threaded insert, installed as recommended by Manufacturer.

C. Sleeves shall be provided for all wall penetrations.

3.8 RACEWAYS THAT STUB UP THROUGH FLOOR

A. Install at such depth that the exposed Raceway is vertical and no curved section of the elbow is visible.

B. PVC Raceway shall not be stubbed through floors.

3.9 SEALING OF RACEWAY PENETRATIONS

A. Exterior Wall Surfaces Above Grade: Seal around all penetrations with caulking approved by Engineer. For concrete construction above ground level, cast Raceway in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement.

B. Exterior Surfaces Below Grade: Cast Raceway into wall (or floor) or use manufactured seal assembly (such as O.Z. type "FSK") cast in place.

C. Roofs: Provide mopped, lead, roof jack where Raceway penetrates roof membrane.

D. Fire Rated Floors, Walls, Ceiling/Roofs: Concrete or masonry, seal around Raceway penetration with Dow Corning 3-6548 silicone RTV foam or approved equal. Plaster or gypsum wallboard, seal around Raceway penetration with plaster, fire tape per local Fire Marshal's requirements.

3.10 SEALING OF RACEWAYS

A. Seal interior of all Raceways which pass through buildings roofs, floors or through outside walls of the building, above or below grade. Seal on the end inside the building using duct sealing mastic, non-hardening compound type, specially designed for such service to maintain the integrity of the seal of the wall, floor or roof. Pack around the wires in the Raceways.

3.11 HANGERS FOR RACEWAYS

A. In suspended ceiling spaces Contractor may, at his option, attach 1/2" or 3/4" EMT Raceways to the ceiling suspension system where such system is structurally suitable on independent wire secured at both ends; in which case, provide clips manufactured for the purpose.

B. When more than two Raceways will use the same routing, group together on a patented channel support system (such as Unistrut).
3.12 SURFACE METAL RACEWAY

A. Install parallel to building surface (i.e., wall, ceiling, floor). Fasten to surface as recommended by Manufacturer. Mount so Raceway is in the least obvious location. Shall be used in lieu of conduit in finished areas.

3.13 FLEXIBLE CONDUIT

A. Flexible conduit shall be used only for connection to motors and equipment subject to vibration with 90 degrees loop minimum to allow for isolation and for lay-in fluorescent fixtures above T-Bar ceilings. For fixture installations, one end of flex must terminate in rough-in junction box. Flex conduit shall not be installed over 6' long or used to connect from fixture to fixture. Use liquid tight for pumps, equipment which is regularly washed down, and equipment in damp locations. Provide ground wire.

3.14 COLOR CODING

A. General: Provide color bands of tape or paint one inch (25 mm) wide for Raceways up to two inches (51 mm) in diameter and one-half the Raceway diameter for larger Raceways, applied at panel and pullbox locations within each room, and 50 ft. (15.25 m) on centers within an area.

B. Color Banding:

120/208 Volt .............................................. Gray
Telephone ................................................. Dark Blue
Intrusion Alarm .......................................... Yellow
Television .................................................... Rust
Low Voltage Switching .............................. Black
Public Address .......................................... Silver

C. The colors shall match the colors used on the boxes - See Section 260532.

3.15 PULL CORDS

A. Nylon type shall be included in all installed empty Raceway.

END OF SECTION
SECTION 260923 - LIGHTING CONTROL PANEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Section 260000 – Electrical General Conditions

1.2 INTRODUCTION
A. The work covered in this section is subject to all of the requirements in the general conditions of the specifications. Contractor shall coordinate all of the work in this section with all the trades covered in the other sections of the specification to provide a complete and operative system.

1.3 DESCRIPTION OF WORK
A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.
B. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

1.4 QUALITY ASSURANCE
A. ETL Approvals: The control panels shall be tested and listed under the UL 916 Energy Management Equipment standards by a nationally recognized testing laboratory.
B. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.
C. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.
D. Component Pre-Testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.
E. System Checkout: A factory-trained technician or factory-authorized personnel or Contractor shall functionally test the control system and verify performance after installation.
F. Manufacturer: Manufacturer shall have a minimum of 10 years’ experience in control systems. These specifications are based on the Control Keeper as manufactured by Greengate. Substitutions of the specified equipment will be considered providing sufficient documentation is provided to the Engineer which certifies that the equipment qualification meets the requirements of this specification.
1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data on lighting control system and components.

B. Shop Drawings: Submit drawings of lighting control system and accessories including, but not necessarily limited to, the low voltage relay panels, power wiring, and switch inputs.

1. Riser Diagram/System Diagram
2. Switch Input Wiring

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. System Description:

1. The lighting control system shall consist of low voltage relay control panels with up to 32 relays.
2. Each low voltage lighting control panel shall be microprocessor controlled with LCD display and programming keypad.
3. Programmable intelligence shall include Time-Of-Day control, 32 holiday dates, a Warn Off to warn occupants of an impending OFF, preset control, local control, and astronomical clock with offsets.
4. Each control panel shall provide a Warn Off (flash the lights) to inform the occupants of an impending OFF command. The Warn Off command will allow 10 extra minutes for the occupants to override their lights or exit the premises.
5. Control panels shall permit lighting to be overridden ON for after-hours use or cleaning. These overrides shall be hard-wired inputs or voice-guided touch-tone telephone control.
6. Control panel enclosures shall offer a maximum of either 16 or 32 relays.
7. Programming the control system shall be through the local integral keypad or through a PC running the Supervisor software.
8. Each panel shall have at least 32 programmable switch inputs. Switch inputs can be configured to accept a momentary, maintaining, or toggle type switch. Each switch input can be programmed to control any of the output relays.
9. The control system shall provide networking between lighting control panels. One network may support a maximum of 127 control panels. Panels shall support data sharing for global control. All inputs are transferable over the network to create any switching pattern required.

B. Hardware Features:

1. Operator Interface: The interface for programming the control panels shall reside in firmware resident within the control panel. The programming shall consist of a circuit board mounted keypad capable of programming all switch inputs and relay outputs to switch assignments. Systems that utilize blocking diode technology for relay assignment shall not be acceptable.
   a. The integral keypad and LCD display shall provide access to all programming features. The keypad shall permit the user to manually command any or all relays individually.
b. Each panel shall control its own loads from internal memory. A control system that relies on a central control computer/processor or external time clocks shall not be permitted.

2. Contact Inputs: The control system shall allow dry contacts for override purposes. Momentary or maintained contacts shall be supported as three-wire (momentary) or two-wire (SPST) inputs respectively. Inputs shall be dry contacts (24 VDC @ 12 mA, internally supplied to the inputs). An input shall be software linkable to any number of relays for override control. The control system shall accept 32 dry contact switch inputs.
   a. Software linking of inputs between panels shall eliminate the use of blocking diodes. Up to five control panels may share switch inputs.

3. Time-Of-Day (TOD) Control: The programmable low voltage lighting control panels shall support TOD scheduling. Each controller shall provide 32 TOD schedules for relay control. Software shall permit the user to create ONs and OFFs, or ONs only, or OFFs only. The control panels shall provide default times and group linking for rapid programming. The controller shall provide 12 programs for Monday-Friday, seven programs for Saturday, seven programs for Sunday, and six programs for holidays.

4. Photocell Control: The controller shall accept user-adjustable ambient light sensors. Sensors shall provide for both outdoor and indoor applications. The sensor shall provide user-adjustable deadband control.

5. Preset Control: Each input shall provide the ability to perform presets from switch inputs. Relays commanded from a switch input shall provide various switching patterns based on programming. One input may command certain relays ON and other relays OFF.

6. Warn Off: The Warn Off option shall provide a blink and a 10-minute delay OFF timer to the selected output when the linked output proceeds to the OFF state. This option occurs with the switch inputs, telephone override control and the Time-Of-Day schedules.

7. Relay Type: The system shall utilize control relays that are rated to at least 20 amps at 277 VAC. The relays shall be magnetically held. Relays that are latched or mechanically held are not acceptable. A limited 10-year warranty shall be provided on the individual relays.

8. Modular Design: The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick-release spring pins that shall permit an entire change out of the processor and input board in less than one minute.
   a. All connections for the switch inputs shall incorporate modular connectors. The relay board shall be modular and designed for rapid field replacement or upgrading. Systems that do not employ modular connectors shall not be acceptable.

9. Hardware Output Features:
   a. Lighted Switch Card (LSC): The controller shall provide for pilot light wall switch annunciation. A modular card shall connect into the ControlKeeper logic board and shall provide power to illuminate pilot light switches. This shall confirm relay operation. When a relay is in ON position, the pilot light switch shall be illuminated.
b. Remote Relay Card (LRC): Control Keeper shall provide for remote placement of the control relays. A modular card shall connect into the relay compartment of the Control Keeper controller. Twisted (three) conductor cable shall power and control the remote-mounted relays. Maximum distance is 500 feet with 18 awg wire.

c. Two Pole Relay Card (TPRC): The controller shall provide for two pole relay control. The Two Pole Relay Card shall offer the feature of controlling two pole voltages such as 208, 240 and 480 VAC lighting loads at 20 amps. The relays should be modular in design and offer manual hand override control. A visual indication of relay status shall be provided. The 208, 240 VAC version shall provide 8 relays per card whereas the 480 VAC version shall provide 4 relays per card. Combination of relays shall be permitted since relays shall snap into location.

d. Automatic Relay Card (ARC): The system shall utilize hybrid control relays that are rated to 20 amps at 277 VAC. The hybrid relay shall combine a high-speed electronic switch with a mechanical relay to create a unique switching device. The hybrid design shall look at each AC phase and shall close the electronic switch precisely as the absolute zero crossing. The mechanical relay in parallel shall follow and close after the in-rush current condition. The relay shall provide an integral switch for both manual hand operation and visual indication of relay status.

e. Dimming Ballast Card (DBC): The controller shall provide for fluorescent dimming control. The fluorescent dimmer card shall provide sixteen 1-10-volt signal outputs per controller. Each output shall drive an entire lighting circuit ballast load. The outputs may be programmed to provide time of day dimming with adjustable fade rates. Photocell inputs may provide thresholds to create dimming setpoints and fade rates.

10. Diagnostic Aids: Each control panel shall incorporate diagnostic aids for confirmation of proper operation or, in case of failure, to guide the individual in rapid troubleshooting of the system.
a. The control panels shall employ Light Emitting Diodes (LEDs) that visibly indicate: POWER SYSTEM OK ON/OFF STATUS OF EACH RELAY SYSTEM CLOCK AND DATE PROGRAMMING CONFIRMATION (TOD, Holiday, ON/OFF and PRESET)
b. Control systems that do not provide visual self-help diagnostics shall not be acceptable.

11. Battery Back-Up: The system shall utilize a memory back-up device that is system integrated and shall be non-serviceable. The data in RAM shall be protected against power interruptions lasting as long as 7 days. The power interrupt protection circuit shall be entirely maintenance free.

12. Multi-Tapped Transformer: The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltages of 120 and 277 VAC shall be available with each standard control panel.
13. Status Indication of Relays: The system shall provide visible status indication of all relays through the window of each control panel. The visual indication shall disclose ON/OFF status and relay number.

14. Service Override: The control panel shall provide a three-position service override for the entire panel. The service override shall not be accessible from the exterior. The master service override provides a single three position switch with the option of “ALL ON”, “AUTO”, and “ALL OFF” respectively. This master switch shall operate all of the relays in the controller and shall override and supersede all commands from the logic board. The controller shall remember the last command of the individual relays and return then to that state upon return of the switch to “AUTO.”

15. Lockable Enclosure: Each control panel shall be enclosed in a lockable NEMA Class 1 enclosure. The enclosure shall be manufactured out of 1/16-inch steel and shall provide a pre-punched knockout for efficient installation.

16. Panels: The low voltage control system shall consist of panels that may be configured in groups of eight. A control panel may be configured to have 8, 16, 24, and 32 20-amp rated relays at 277 VAC.

17. Telephone Overrides (TIM): The control system shall provide intelligent software for the Telephone Interface Module (TIM) option. The TIM unit shall allow modem communications and touch-tone overrides from any touch-tone phone. The control system shall permit one TIM per lighting control panel.
   a. Touch-tone interface shall permit the control panel to override the preassigned control points ON/OFF accordingly. All user interface shall be through the 12 touch-tone keys on the telephone. All entries into the override system shall be prompted by a digitized voice. Systems are employing voice-guided override instruction are not acceptable.
   b. The TIM shall provide individual control passwords. Each password shall allow a preset group control for after-hour overrides.

18. PC-Based Interface (Supervisor): Provide PC based programming software. PC based software shall enable any MS-DOS PC to program any lighting control panel connected to the network. The PC connection shall be an RS-232 direct connection to the lighting control panel at 9600 baud. The optional software package shall allow individual panel programming to be executed locally or remotely through a 1200/2400 baud modem. The central programming software shall permit the user to modify the control panel programming or configuration on an "OFF-LINE" mode. This software package shall store all programmed data and archive for future use. Systems using third party software are not acceptable.
   a. The following features shall be standard in the PC based software:
      1) Standard Software Features:
         a) Real Time Relay Status Monitoring
         b) Alpha-Numeric Descriptors
         c) Telecommunications
         d) Network Status Indication
         e) Global Software Modifications
         f) Manual Relay Commands
         g) Remote Pattern Commands
         h) Preset Options
      2) File Maintenance:
         a) Archive Programs
         b) Data Base Restoration
         c) Uploading and Downloading of Programs
19. The Supervisor software package shall be capable of operating on any MS-DOS (3.0 or greater) operating system. Minimum computer requirements shall be an RS-232 asynchronous serial port, printer port, monitor, keyboard, 640K of internal RAM, and a hard disk, 20 MEG is recommended. Software package shall permit the PC to be utilized for other functions (i.e. word processing, data-base, etc.) besides solely for lighting control programming. Software is 100% IBM PC compatible. Systems which require an "on-line" dedicated computer for control system operation shall not be acceptable.

20. PC Interface (RS-232 port): The controller shall permit PC programming through provided software. The controller shall provide a RJ-11 connection for RS-232 programming. Programming shall be permitted through either a local connection or remotely through a modem. PC software shall permit multiple file storage for data archival and for seasonal facility requirements. Operator commands may be issued directly from the PC keyboard.
   a. The controller shall provide either a DB25 or a RJ-11 (6 wire) connector for RS-232 communications.

21. Network (RS-485): The control system shall have panel-to-panel communications over a high-speed hard-wired data network. The network shall consist of twisted pair of wire utilizing the RS-485 communication standard. The network shall communicate a 19.2K baud and employs circuit protection. The network shall support a maximum of 127 control panels. This communication standard and baud rate shall allow a maximum distance of 2000 feet for panel-to-panel communications. The recommended wire is Belden #9843 or equivalent.

22. Low Voltage Switches and Wiring:
   a. Switches:
      1) Momentary contact switches shall be Leviton Momentary Contact Decoratye-5657-2W with matching 302 stainless steel covers.
      2) Momentary contact switches shall be GE type push button switches #RS2-32 non-lighted, RS2-32-P lighted with stainless steel plate #RP2-116/RPB2-1 for single-gang, 1 switch, #RP2-126/RPB2-1 for single-gang, 2 switches, #RP2-236/RPB2-2 for two-gang, 3 switches, #RP2-246/RPB2-2 for two-gang, 4 switches.
      3) Momentary contact switches shall be GE type single pole, double throw, center off heavy-duty toggle switches #GE-5935-2G with matching 302 stainless steel covers.
      4) Wiring: Wiring to each low voltage switch shall be shielded multi-conductor cable with (3) #20 AWG solid conductor wires. With lighted switch card add extra conductor.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation: The control system shall be installed and fully wired as shown on the plans by the installing Contractor. The Contractor shall complete all electrical connections to all control circuits and override wiring.
B. Documentation: The Contractor shall provide accurate "as-built" drawings to the Owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals as related to the design of the control system.

3.2 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the Owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment. The factory shall maintain toll-free numbers for technical support for their customers.

3.3 SYSTEM ACCEPTANCE

A. The Contractor is responsible for complete installation of the system according to strict factory standards and requirements. The following items shall be included requirements:

1. All system equipment shall operate in accordance with specification and industrial standard procedures.
2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.
3. Demonstration of program integrity during normal operation and pursuant to a power outage.
4. Contractor shall provide a minimum of three hours training on the operation and use of the control system. Additional support services shall be negotiated between the Contractor and the building Owner or manager.

3.4 WARRANTY

A. Warranty: Manufacturer shall supply a two-year warranty on all hardware and software. A limited 10-year warranty shall be provided on the standard relay card.

END OF SECTION
PART 1 - GENERAL

1.1 INTRODUCTION

A. Section 260000 – Electrical General Conditions

1.2 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.

B. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

1.3 QUALITY ASSURANCE

A. UL & ULC Approvals: The control panels shall be tested and listed under the UL 924 Standard for Emergency Lighting and Power Equipment and UL 916 Energy Management Equipment standards by a nationally recognized testing laboratory.

B. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.

C. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.

D. Component Pre-Testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

E. System Checkout: A factory-trained technician or factory-authorized personnel or Contractor shall functionally test the control system and verify performance after installation.

F. Manufacturer shall have a minimum of 10 years’ experience in control systems. These specifications are based on the Digital Lighting Management (DLM) System by Wattstopper. Substitutions of the specified equipment will be considered providing sufficient documentation is provided to the Engineer which certifies that the equipment qualification meets the requirements of this specification.

G. Similar systems manufactured by Sensor Switch (nLight Network Control System), Encellium, and Lutron are acceptable. The listing of any manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for devices and systems which meet or exceed the specifications included herein.
1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data on lighting control system and components.

B. Shop Drawings: Submit drawings of lighting control system and accessories including, but not limited to, the low voltage relay panels, power wiring, and switch inputs.
   1. Complete layout of every space with the parts identified and wire routing
   2. Riser Diagram/System Diagram
   3. Switch Input Wiring

C. Example Contractor Startup/Commissioning Worksheet

D. Hardware and Software Operation Manuals

1.5 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting controls with BAS (building automation system) either through IP based intercommunication of system or hardwired auxiliary relay outputs.

C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.6 WARRANTY

A. All devices in lighting control system shall have a 5-year warranty.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts:
   1. Intelligent lighting control devices
   2. Standalone lighting control zones
   3. Network backbone for remote or time-based operation.
2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a WattStopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Task Lighting / Plug Loads: Provide automatic shut off of non-essential plug loads and task lighting in spaces as required by the applicable energy code. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.

3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
   c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.


4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

7. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

8. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.

9. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

10. Features of the DLM local network include:
   a. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   c. Push n’ Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

11. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

12. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n’ Go applications. Control units include the following features.
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.

3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.

4. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status

5. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable

6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100 percent
   b. Turn off
   c. Turn on to last level

7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)

8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable
   d. Room occupancy status
   e. Total room lighting and plug loads watts
   f. Electrical current
   g. Total watts per controller
   h. Total room watts/sq ft.
   i. Force on/off all loads

10. UL 2043 plenum rated

11. Manual override and LED indication for each load

12. Zero cross circuitry for each load

13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
   a. Each load shall have an independently configurable preset on level for Normal Hours and After-hours events to allow different dimmed levels to be established at the start of both Normal Hours and After-hours events.
   b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
   c. The following dimming attributes may be changed or selected using a wireless configuration tool:
      1) Establish preset level for each load from 0-100 percent
      2) Set high and low trim for each load
      3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
   d. Override button for each load provides the following functions:
      1) Press and release for on/off control
      2) Press and hold for dimming control
   e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
   f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
   g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
   h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:
   1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
   2. One or two relay configurations
   3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
   4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
   5. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
   1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277-volt models rated for 20A total load; 347-volt models rated for 15A total load
   2. Built in real time current monitoring
   3. One, two or three relays configurations
   4. Smart 250 mA switching power supply
   5. Four RJ-45 DLM local network ports. Provide integral strain relief
   6. One dimming output per relay
   a. 0-10V Dimming - Where indicated, one 0-10-volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10-volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

D. Plug Load Controllers shall include:

1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
2. One relay configuration with additional connection for unswitched load.
3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10-minute additive delay in a space with a 20-minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
4. Factory default operation is Auto-on/Auto-off, based on occupancy.
5. Real time current monitoring of both switched and un-switched load (LMPL-201 only).
6. Switching power supply
   a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
   b. Smart 250mA (LMPL-201)
7. RJ-45 DLM local network ports
   a. Three RJ-45 ports (LMPL-101)
   b. Four RJ-45 ports (LMPL-201)
8. WattStopper product numbers:

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:
   a. Sensitivity, 0-100 percent in 10 percent increments
   b. Time delay, 1-30 minutes in 1-minute increments
   c. Test mode, Five second time delay
   d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
3. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      1) Ultrasonic and Passive Infrared
2) Ultrasonic or Passive Infrared
3) Ultrasonic only
4) Passive Infrared only
5) Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. One or two RJ-45 port(s) for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
6. Device Status LEDs, which may be disabled for selected applications, including:
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding

7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity: 0-100 percent in 10 percent increments
      b. Time delay: 1-30 minutes in 1-minute increments
      c. Test mode: Five second time delay
      d. Detection technology: PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
2. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
   d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      1) Ultrasonic and Passive Infrared
      2) Ultrasonic or Passive Infrared
      3) Ultrasonic only
      4) Passive Infrared only

3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. Two RJ-45 ports for connection to DLM local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.

6. Device Status LEDs including
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding

7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.

8. Assignment of local buttons to specific loads within the room without wiring or special tools

9. Manual override of controlled loads

10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic
   4. Button state
   5. Switch lock control
   6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:

1. Left button
   a. Press and release - Turn load on
   b. Press and hold - Raise dimming load

2. Right button
   a. Press and release - Turn load off
   b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:

1. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active

2. The following button attributes may be changed or selected using a wireless configuration tool:
   a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
   b. Individual button function may be configured to Toggle, On only or Off only.
   c. Individual scenes may be locked to prevent unauthorized change.
   d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   e. Ramp rate may be adjusted for each dimmer switch.
   f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
   g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
   b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

7. All wall switches and coverplates shall be black.

B. BACnet object information shall be available for the following objects:

   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.

   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
   7. DIGITAL DAYLIGHTING SENSORS

F. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to ensure that proper light levels are maintained as changes to reflective materials are made in a single zone.

G. Digital daylighting sensors shall include the following features:

1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2. Sensor light level range shall be from 1-6,553 foot-candles (fc).

3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.

5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

9. Configuration LED status light on device that blinks to indicate data transmission.

10. Status LED indicates test mode, override mode and load binding.

11. Recessed switch on device to turn controlled load(s) ON and OFF.

12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
   a. Light level
   b. Day and night setpoints
   c. Off time delay
   d. On and off setpoints
   e. Up to three zone setpoints
   f. Operating mode - on/off, bi-level, tri-level or dimming

13. One RJ-45 port for connection to DLM local network.

14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

15. Any load or group of loads in the room can be assigned to a daylighting zone.
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).

17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

H. Closed loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.

2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.

3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.

4. WattStopper Product Number: LMLS-400, LMLS-400-L.

2.7 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.

2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.

3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
   a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
   b. Individual terminal block, override pushbutton, and LED status light for each relay.
   c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
   d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
   e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
      1) 30 amp ballast at 277V
      2) 20-amp ballast at 347V
      3) 20amp tungsten at 120V
      4) 30 amp resistive at 347V
      5) 1.5 HP motor at 120V
      6) 14,000-amp short circuit current rating (SCCR) at 347V
      7) Relays shall be specifically UL 20 listed for control of plug-loads
   b. Mechanical:
      1) Replaceable, 1/2-inch KO mounting with removable Class 2 wire harness.
      2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      4) Tested to 300,000 mechanical on/off cycles.

5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.

6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.

8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery backup for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
1) Scheduled ON / OFF
2) Manual ON / Scheduled OFF
3) Astro ON / OFF (or Photo ON / OFF)
4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)

f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.

g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.

a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.

e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hour’s mode. Commanding 0 or NULL shall put the relays into the after-hours mode.

f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.

2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after-hours schedule control.

3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.

4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)

i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

j. Lockout of all digital switch buttons connected to a given panel shall be commandable via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:

12. Use the same intelligence board as the LMCP relay panel.
   a. Shall not include relay driver boards or relays.
   b. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
   c. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
   d. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

13. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n’ Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.

B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface, the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven-day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven-day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100. Provide two (2).

2.8 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:

1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after-hours modes. Modes include: No Action, Follow Off Only, Follow on Only, follow on and Off, Follow on Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, follow on and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1 second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered on of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
   a. Set, copy/paste an entire project site of sensor time delays.
   b. Set, copy/paste an entire project site of sensor sensitivity settings.
   c. Search based on room name and text labels.
   d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
   e. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
   b. Mass firmware update of specifically selected rooms or areas.
   c. Mass firmware upgrade of specific products.

F. WattStopper Product Number: LMCS-100, LMCI-100
PART 3 - EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer’s representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades.

B. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

C. Adjust time delay so that controlled area remains lighted while occupied.

D. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

E. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner’s requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.2 COMMISSIONING SUPPORT SERVICES

A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician’s time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent’s responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer’s technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.3 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation: The control system shall be installed and fully wired as shown on the plans by the installing Contractor. The Contractor shall complete all electrical connections to all control circuits and override wiring.

B. Documentation: The Contractor shall provide accurate "as-built" drawings to the Owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals as related to the design of the control system.

3.4 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the Owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment. The factory shall maintain toll-free numbers for technical support for their customers.

3.5 START-UP & SUPPORT FEATURES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

D. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

E. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

F. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
G. All system devices shall be capable of being given user defined names.

H. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

I. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

3.6 SYSTEM ACCEPTANCE

A. The Contractor is responsible for complete installation of the system according to strict factory standards and requirements. The following items shall be included requirements:

B. All system equipment shall operate in accordance with specification and industrial standard procedures.

C. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.

D. Demonstration of program integrity during normal operation and pursuant to a power outage.

E. Contractor shall provide a minimum of three hours training on the operation and use of the control system. Additional support services shall be negotiated between the Contractor and the building Owner or manager.

END OF SECTION
SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED
   A. Provide all panelboard equipment, complete; dead front type.

1.3 INFORMATIONAL SUBMITTALS
   A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 PANELBOARD TYPE
   A. Panelboards shall be rated at proper voltage and current for intended use with busbars of copper or aluminum. Panels shall be 3-phase, 4-wire, 100% neutral, unless noted otherwise. Where aluminum is utilized, all lugs shall be of an approved compression type. Provide multiple lugs where conductors in parallel or "feed through" are shown on the Drawings.

   B. Conductor Connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Feeder conductor connectors shall be rated for 75 Degree C. wire when 75 Degree C. wire is indicated. Where aluminum conductors are utilized for feeders or branch circuits the connectors shall conform with Section 260519.

   C. Panelboards shall have a separate ground bus bonded to the panelboard frame.

   D. Where 120-Volt, 15- or 20-Amp breakers are intended for switching loads they shall be of type rated for switching duty labeled "SWD."

2.2 ACCEPTABLE MANUFACTURERS
   A. General Electric
   B. Square-D
   C. Cutler-Hammer
2.3 CIRCUIT BREAKERS

A. The following interrupting capacity, 10,000 AIC Symmetrical shall be considered minimum. Other ratings shall be as specified on panel schedules shown on the Drawings. Series rating of breakers is not allowed.

B. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Bolt in type only. Provide common trip on all multiple pole breakers.

C. Where noted, provide spare breakers, complete for future connection of wiring circuits. Where "Space" is indicated for breakers, provide all bus sizing and breaker mounting hardware in the panelboard, provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are removed, provide breakers in such spaces or approved coverplates. Open spaces are not permitted.

D. For multi-wire branch circuits, provide approved breaker handle ties where required by NEC 210.4.

2.4 CABINET FOR EACH PANELBOARD

A. Flush or surface, as indicated; tight closing doors without play, when latched. Where two cabinets are located adjacent to each other in finished areas, provide matching trim of the same height. Where a remote-controlled switch or contactor is mounted in any panelboard, mount on same frame as panelboard interior with screw retained access door in dead front shield; common door over circuit breakers and remote-controlled device. Where flush mounted, provide (2) 3/4" conduits to accessible ceiling space for future expansion.

B. All conduits for future expansion shall stub into a junction box, where located above grade, and shall be sealed in the panel.

C. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on panel schedules.

D. Provide cabinet front with full-height hinged door. One door over the interior and an additional hinged dead front cover over interior and wireway (door-in-door). Full-height front cover hinged to box with concealed trim clamps. Provide flush door locks.

E. Provide lock for each cabinet door. All Electrical Distribution Equipment Locks shall be keyed identically. Key system shall match existing. Supply Owner with minimum six keys.

F. Fasten panelboard front with machine screws with oval counter-sunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall be hinged at right side in addition to hinged door over dead front.

G. Finish: Provide factory prime coat for cabinets to be located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color, shall be substituted for factory prime coat.
2.5 SYSTEM OF NUMBERING AND BUS ARRANGEMENT

A. Shall be as shown on the Panel Schedules on the Drawings.

2.6 PANELBOARD NAMEPLATE

A. Provide engraved and filled (or color layer - engraved through outer layer) plastic nameplate with ½-inch high characters (for panel name); attached with screws to each NEMA 1 panelboard front. White on black, include voltage, phases, wires and minimum A.I.C. Rating in 3/8-inch characters.

B. Nameplate color shall be:

1. Emergency System: White letters on red
2. Normal System: White letters on black

C. Provide a service entrance label nameplate on the main panelboard which includes the following:

1. Owner
2. Electrical Consultant
3. Electrical Contractor
4. Date of Installation
5. Service Voltage & Bus Amperage Rating
6. Symmetrical Short Circuit Current Rating
7. Year of Manufacture

D. Provide a riser diagram drawing using non-fading ink and mylar installed under glass and attached to the exterior of the main panelboard showing feeder runs, panels, transformers and raceway sizes.

PART 3 - EXECUTION

3.1 MOUNTING

A. Secure in place with top of cabinet at 6'-0", unless otherwise noted. Top of cabinet and trim shall be level. Firmly anchor cabinets directly or with concealed bracing to Building Structure. When panels are not located in or directly on a wall, provide a support frame of formed steel channel which is anchored to the floor and Ceiling Structure. Interiors shall not be installed until Structure is totally enclosed. Where panels are mounted adjacent to each other, the top edges shall be at the same height.
3.2 CIRCUIT INDEX

A. For each branch circuit panelboard provide a typewritten index listing each circuit in the panelboard by number with its proper load designation. Mount with a transparent protective cover inside cabinet door. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers used shall be final room numbers used in the building as verified with the Owner, and not room number assigned on Plans.

3.3 CABINET PAINTING

A. Cabinets furnished as prime painting shall be field painted to match color of adjacent wall. (See Division - Painting).

3.4 SPACE

A. Verify space available with equipment sizes and Code Required Working Clearances prior to Submittal of Shop Drawings.

3.5 GROUNDING

A. Provide separate ground busbar for all panels supplying isolated ground circuits.

3.6 FEED THROUGH AND DOUBLE LUGS

A. Provide feed through or double lugs with amperage equal to the incoming feeder amperage unless shown as larger.

END OF SECTION
SECTION 262419 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED

A. Work under this section includes all requirements for motor controls to be furnished under the electrical portion of the work on all electrical motor driven equipment. Individually mounted starters shall be provided by Division 26 Contractor. Motor controls shall conform to NEMA Standards for each specific purpose.

B. The Division 26 Contractor shall furnish all motor controllers not included with equipment furnished under other divisions of these specifications or by Owner. The Division 26 Contractor shall install all motor controllers including all controllers not factory assembled into equipment furnished under other divisions of these specifications or by Owner.

1.3 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

1.4 MOTOR VOLTAGE INFORMATION

A. Voltages available are 208 Volt, 3 Phase, and 115 Volt Single Phase.

B. Circuits are designed (in general) for motors as follows:

1. Smaller than 1/2 H.P. - 115 Volts, Single Phase 1/2 H.P. and larger – 208 Volts, 3 Phase

C. Verify motor sizes and voltages provided under other divisions and notify General Contractor immediately if any discrepancies are noted.

1.5 REGULATORY REQUIREMENTS

A. Provide motor protection switches of the appropriate NEMA size. For units not using NEMA rating, use equivalent NEMA size.
PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Magnetic Motor Starters: Unless noted otherwise, shall be full voltage non-reversing with three overloads sized to suit nameplate amperes of motor served, motor "On" and "Off" pilot lights, "Hands-Off-Auto" switch, and auxiliary contacts for interlocking.

B. Combination Motor Starter/Disconnect: Shall be fused switch type with all features of Paragraph A above. In addition, provide disconnect switch auxiliary contacts for disconnection of externally powered control circuits where applicable. Fuses shall be sized in accordance with motor manufacturer's requirements.

C. Manual Starters: Shall be toggle switch or push-button type, lockable in the "Off" position, with overload relays, pilot light and enclosure pursuant to Paragraph D below. Manual starters shall only be used where specifically shown or called out on the drawings and only for single phase, fractional horsepower motors.

D. Enclosures: All motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted, and shall be weatherproof when exposed to weather.

E. Overload Devices: Shall be melting alloy or bimetallic type. One overload shall be provided for each phase. Provisions shall be made for resetting the overload devices from outside the starter enclosure. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.

2.2 ACCEPTABLE MANUFACTURERS

A. Square D
B. Allen Bradley
C. General Electric
D. Cutler-Hammer

2.3 NAMEPLATES

A. Pursuant to Section 260000, Paragraph 2.5, provide nameplates permanently attach (with screws on NEMA 1 enclosures) on each controller, nameplates with the following information: Load served, voltage, phase, short circuit rating, panel/circuit number and where applicable fuse size and type.
2.4 FAN SHUTDOWN RELAYS
   A. Contractor shall provide relay(s) with sufficient contacts to shutdown all fans over 2000 cfm upon receipt of Fire Alarm. Coordinate coil voltage with Fire Alarm System Supplier.

2.5 POWER FACTOR CORRECTION
   A. Provide power factor correction capacitors for all motors 25 horsepower and above. Capacitor size when indicated on the drawings is an approximation only. Final size shall be determined by the Contractor based on the recommendations of the motor manufacturer to bring the power factor to between 0.9 and 0.95. All capacitors are to be fused, with blown fuse indicators mounted on the front of the unit. Provide discharge resistors when required by code.

PART 3 - EXECUTION

3.1 FINISHED AREAS
   A. In finished areas, mount motor protection switches flush and install suitable coverplates.

3.2 HEATERS
   A. Install heaters co-related with full-load current of motors provided.

3.3 OVERLOADS
   A. Set overload devices to suit motors provided.

3.4 SUPPORTS
   A. Securely mount to equipment, wall or acceptable mounting frame.

3.5 FAN SHUTDOWN Wiring
   A. Provide wiring interlock connections for all (over 2000 cfm) fan starter control circuits via Division 23 furnished fan shutdown relay to shutdown fans upon receipt of Fire Alarm.

3.6 FAN SHUTDOWN Wiring
   A. Provide wiring interlock connections for all (over 2000 cfm) fan starter control circuits via a relay to shutdown fans upon receipt of Fire Alarm.
3.7 CONNECTION TO MECHANICAL EQUIPMENT ON ROOFS

A. The Contractor shall coordinate all roofing penetrations with the general contractor and roofing contractor to assure that the roofing warranty is maintained.

B. Attachment of conduits to the roof to serve mechanical equipment and devices shall comply with Section 260533.

3.8 MECHANICAL EQUIPMENT NAMEPLATE RATINGS

A. The Division 26 Contractor shall verify that the nameplate ratings of the mechanical equipment, when they arrive on site, are consistent with the ampacity called out on the drawings. The Contractor shall bring any discrepancies to the Engineers attention prior to installation of conduit and wiring.
SECTION 262726 - SWITCHES AND RECEPTACLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED
   A. Provide all wiring devices and plates.
   B. No push-in friction, spring type terminals allowed.
   C. All wall-mounted devices and coverplates color shall be black, unless otherwise noted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
   A. Hubbell
   B. Pass & Seymour
   C. Leviton
   D. Cooper
   E. Acuity Brands

2.2 SWITCHES
   A. "Industrial Specification Grade", quiet type, rated 277-volt, 20 amp, unless noted, with plastic handle. Single pole, double pole, 3-way, or locking type as required. Meets Fed. Spec. WS-896 Provide matching styles and colors in other devices as required for the conditions of installation. Hubbell CS1221, Cooper CSB120, Leviton 1221, and P&S 20AC1
   B. Interchangeable type shall be rated same as above.
   C. LED Dimmer: LED 0-10V dimmer switch shall be compatible with supplied LED board and driver. Dimmer switch shall have vertical slide with a positive “on/off” button. Dimmer shall have high and low end, field adjustable trim setting. Provide with associated power pack for control. Lutron Diva or approved equal.
D. Timer Switch: Provide electronic light timer switch where indicated on drawings. The timer switch shall be connected to the room lighting and fan. The timer switch shall be programmable for time-out from 5 minutes to 2 hours. Set timer for standard 20 minutes time-out period, time scrolls up, flash off, beeper on. Manufacturer: Watt Stopper – Inteli-switch Digital Time Switch.

E. Motor Rated Switches: Switches serving as motor disconnecting means shall be horsepower rated with overload relays and meet requirements as stated above. See manual starters in Section 262419, ‘Motor Controllers’.

F. Device plates shall be Hubbell and Cooper black nylon covers.

2.3 RECEPTACLES

A. In All Finished Areas & Occupied Spaces: Provide heavy duty specification grade; general purpose 20 amp. 125-volt, Nema 5-20R, 2P, 3W decora plus duplex receptacle, straight blade, commercial grade, self-grounding, back & side wired. Leviton 16352T.

B. Self-Testing Ground-Fault Circuit-Interrupter Duplex Receptacles: 20A. 125V AC; 2-pole, 3 wire grounding; 10,000 amps current interrupting; green light indicator when power is ‘on’; red light indicator when device is in the tripped position; Red “EOL” (end of life) indicator with rapid flash when the unit has reached end of life and/or cannot provide GFCI protection. Provide GFI receptacles where required by code.

C. Tamper resistant, Duplex NEMA 5-20R configuration. Hubbell BR20ITR, Leviton 5362-SGI, and Cooper TR8300.

D. Switched/Controlled Receptacles: Switched receptacles shall be ‘black’ in color, smooth nylon face, with permanently marked for use with automatic control systems, back and side wired, decora style.

E. Weather Resistant (WR) / Ground Fault Circuit-Interrupter (GFCI) Outdoor Duplex Receptacles: NEMA 5-20R. Hubbell GFTR201 or equal, for 20 Amp, 125-Volt AC.

F. Special Purpose Receptacles: For special purpose receptacles, see drawings for voltage, amperage, and phase. Provide with matching plug delivered to the Owner.

2.4 OCCUPANCY SENSORS

A. Provide self-adjusting occupancy sensor light switching devices for control of lighting in all rooms and offices shown on drawings. Sensors shall be ceiling or wall mounted to provide adequate coverage. Occupancy sensors shall be “Leviton”, Model OSC20-M0W for ceiling mounting, OSW12-M0W for wall mounting, complete with OSP20-RD0 power pack and associated mounting hardware. Provide “Leviton” ODSOD-ID wall switch sensors where shown. Sensors shall be wired to maintain switching and circuits shown on drawings.
2.5 DEVICE PLATES

A. Interior: Plates for receptacles other than NEMA 5-20R shall have ampere rating, voltage and phase engraved in the plate. Plates for recessed boxes shall be Hubbell and Cooper black nylon cover. Attachment screws shall match finish of plate. Plates for surface mounted boxes shall be of pressed stainless steel with size to fit exactly the box used.

B. Exterior: Intermatic # WP1010MC, for vertical mount and # WP1010HMC for horizontal mount, or equivalent for receptacles. Metal cover shall be raintight while-in-use.

2.6 LABELING

A. For NEMA 5-20R receptacles, each device shall be identified with a clear label with black typing stating the panel & circuit number.

B. For receptacles other than NEMA 5-20R, the cover plate shall have ampere rating, voltage and phase engraved on a phenolic label and attached to the cover plate.

2.7 MULTIOUTLET ASSEMBLY (WHEN SHOWN)

A. Provide assemblies complete, including necessary fittings and hardware with circuits as indicated on Plans and outlet spacing as indicated. All assemblies shall contain ground wire. Wiremold or equal.

2.8 SPARE DEVICES

A. Provide the following spare devices:

<table>
<thead>
<tr>
<th>Device</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplex receptacle</td>
<td>2</td>
</tr>
<tr>
<td>Dedicated duplex receptacle</td>
<td>2</td>
</tr>
<tr>
<td>GFI receptacle</td>
<td>2</td>
</tr>
<tr>
<td>20A, single-phase equipment connection</td>
<td>1</td>
</tr>
<tr>
<td>20A, three-phase equipment connection</td>
<td>1</td>
</tr>
</tbody>
</table>

B. Each spare device shall include 100 feet of conduit, wire, faceplate and labor; all as required for a complete installation. Location of these units to be determined by the Owner’s representative at the site. Unused devices shall be turned over to the Owner.

PART 3 - EXECUTION

3.1 MOUNTING

A. Rigidly fasten each device to the outlet box at proper position with the wall to bring receptacle flush with plate or switch handle the proper distance through the plate.
3.2 ORIENTATION
   A. Set Switches vertical with handle operating vertically, up position "ON".
   B. Set Receptacles vertical with ground slot down.

3.3 DEVICE PLATES
   A. Shall be black nylon for each new wiring device and for each telephone and signal equipment outlet, except where equipment mounted thereon covers the outlet box completely.

3.4 DIMMER SWITCHES
   A. Provide a separate neutral for each phase.

3.5 RECEPTACLE GROUNDING
   A. Provide bare bonding wire between receptacle grounding terminal and box. Plaster ear screws connecting frame to the box will not be acceptable for grounding.
   B. Provide green insulated grounding conductor in all branch circuits supplying ground-fault circuit-interrupter type receptacles.

3.6 HANDICAPPED ACCESS
   A. Comply with requirements of Washington State Handicapped Access Code.

END OF SECTION
SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED
   A. Provide all fuses as required. Provide three (3) spare of each size and type required. Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the jobsite or from water that may contact the fuse before the equipment is installed. Final tests and inspections shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening, and review of all electrical connections and inspection of all grounding conductors. All fuses shall be furnished by the Electrical Contractor. All fuses shall be of the same manufacturer.

1.3 INFORMATIONAL SUBMITTALS
   A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 MAINS, FEEDERS, AND BRANCH CIRCUITS
   A. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN Low-Peak Time-Delay Fuses KRP-C. Fuse links shall be pure silver links (99.9% pure), delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s.

   B. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1 to maintain the Engineered protection of the system components.
C. Motor Circuits: All individual motor circuits with full load amperes ratings (FLA) of 480 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). Larger H.P. motors shall be protected by BUSSMANN Type KRP-C Low-Peak Time-Delay Fuses of the ratings shown on the drawings. All other motors, (such as 1.0 service factor motors) shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings of approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 Dual Element Time Delay or Class L.

D. Fluorescent fixtures shall be protected by BUSSMANN Fuses GLR or GMF installed in HLR Holder. They shall have individual protection on the line side of the ballast. A fuse and holder shall be mounted within or as part of the fixture. Size and type of fuse to be recommended by the ballast manufacturer.

2.2 SPARE FUSES
A. Spare fuses shall be provided with a minimum of three of each ampere rating. See Section 265000 for quantities of spare fusing required for ballasted light fixtures.

2.3 ACCEPTABLE MANUFACTURERS
A. Bussman
B. Little Fuse

PART 3 - EXECUTION

3.1 FUSES
A. Install in all fusible devices provided under this Contract.

END OF SECTION
SECTION 262816 - DISCONNECTS AND FUSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED
   A. Provided all disconnects, fused and unfused, required by code for equipment furnished under this and other divisions of these specifications and as shown on the drawings.

1.3 INFORMATIONAL SUBMITTALS
   A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
   A. General Electric
   B. Square-D
   C. Siemens
   D. Cutler-Hammer

2.2 DISCONNECTS
   A. Switch shall be heavy-duty type, shall be quick-break and shall be horsepower rated. Switch shall have blades as required to open all ungrounded conductors and shall be single throw unless noted.
   B. Enclosure shall have interlocking cover to prevent opening door when switch is closed. Door interlock shall include a defeating scheme, shall be padlockable in the "Off" position.
   C. Enclosure shall be suitable for environment in which mounted. All exterior enclosures shall have a minimum raintight rating.
2.3 FUSED SWITCHES (OR FUSED DISCONNECTS)

A. Shall be as above with addition of fuse space and clips to accept only fuses as noted in Section 26 28 13.

B. Fuses shall be sized in accordance with manufacturer's requirements of protected equipment.

2.4 NAMEPLATES

A. Provide nameplates on all enclosures and include the following information: Load served, voltage, phase, panel and circuit number. Construct and attach in accordance with Section 260000, Paragraph 2.5.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Secure solidly to wall or approved mounting frame. Disconnects supported only by Raceway are not acceptable.

3.2 SPLICES

A. Wiring space within enclosure shall not be used as a junction box.

3.3 INSTALLATION

A. All material installation shall be in accordance with manufacturers’ recommendations and the provisions of applicable codes.

B. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION
PART 1 - GENERAL

1.1 SCOPE

A. It is the intent of this specification to secure a transfer switch that has been prototype tested, factory built, production tested and site tested. A transfer switch with the number of poles, voltage and current ratings shown on the plans and specified herein shall be provided.

1.2 CODES AND STANDARDS

A. The automatic transfer switch shall conform to the requirements of:

1. UL 1008: Underwriters Laboratories standard for automatic transfer switches
2. CSA: C22.2 No. 178 certified
3. IEC: 947-6-1 certified at 208 VAC
4. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
5. NFPA 99: Essential electrical systems for health care facilities
6. NFPA 101: Life safety code
7. NFPA 110: Standard for emergency and standby power systems
9. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
10. NEMA ICS10: AC automatic transfer switch equipment
11. UL 50/508: Enclosures
12. ICS 6: Enclosures
13. ANSI C33.76: Enclosures
14. NEMA 250: Enclosures
15. IEEE 472: (ANSI C37.90A): Ringing wave immunity
16. EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
17. EN61000-4-2: (Level 4): ESD immunity test Class B
18. EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity
19. EN61000-4-4: Electrical fast transient/burst immunity test
20. EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50\(\Omega\), 5 & 8 kV)
21. EN61000-4-6: (ENV50141): Conducted immunity test
22. EN61000-4-11: Voltage dips and interruption immunity

1.3 APPROVED MANUFACTURES

A. The automatic transfer switch shall be as manufactured by GE Zenith Model ZTS. Alternate manufactures shall submit a request (10) days prior to bid and include a written list of deviations from this specification to be considered for approval.
B. Pre-Approved Manufacturers: Asco, General, Thompson Technologies

PART 2 - PRODUCTS

2.1 PERFORMANCE AND CONSTRUCTION

A. The automatic transfer switch shall be of double throw construction operated by a reliable solenoid driven mechanism. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.

B. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.

C. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability will not be considered.

D. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.

E. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Each ATS shall be in strict accordance and listed to UL 1008 withstand standards, including 3 cycle ratings.

F. A dielectric test at the conclusion of the withstand and closing tests shall be performed.

G. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.

H. All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.

I. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.

J. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.

K. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.
L. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to NEMA temperature rise standards.

M. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.

N. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.

O. The switch shall be mounted in a NEMA 1 enclosure.

2.2 CONTROL

A. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:

1. Easy-to-view 4x20 LCD display with long lasting LED indicators.
2. Control panel shall display voltage and frequency of both sources.
3. The user shall be able to view the last 16 recorded events.
5. Adjustments to all settings shall be made from the front of the panel
6. without opening the door.

B. The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.

C. All programmable and control functions shall be pass code protected and accessible through the keypad.

D. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.

E. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.

F. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.

G. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.
PART 3 - OPERATION

3.1 SEQUENCE OF OPERATION

A. The ATS shall incorporate adjustable three phase under/over voltage and frequency sensing on the normal source.

B. When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.

C. The ATS shall incorporate adjustable three phase under/over voltage and frequency sensing on the emergency source.

D. When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within 95% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.

E. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be retransferred to the normal source after a time delay of 0 to 60 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.

F. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.

3.2 STANDARD ACCESSORIES

A. Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.

B. Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.

C. A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.

D. An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and be programmed to anticipate the zero-crossing point to minimize switching transients.

E. An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.
F. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.

G. A set of customer contacts shall be provided to indicate both emergency and normal source position.

H. An adjustable over/under frequency and voltage sensor for both emergency and normal sources.

I. Indication of switch position and source acceptability shall be provided for both emergency and normal sources.

J. An engine start contacts with an adjustable cool down timer.

K. A three phase Voltage Imbalance Monitor shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

L. The following optional Exerciser Package shall be included:

1. Additional Auxiliary Contact (A3) - Closed when the transfer switch is in Source 2 position.
2. Additional Auxiliary Contact (A4) - Closed when the transfer switch is in Source 1 position.
3. Programmable Clock Exerciser (CDP) – This will replace the timer exerciser and allow for a 365-day cycle.

M. The following additional accessories shall be included:

1. Communications interface card (ZNETM) – RS-485 Modbus
2. Test Switch (6A) - Maintained
3. Inhibit transfer (Q3) – Provides additional relay (specify voltage) to inhibit transfer to Emergency.
4. Load Shed (R15) – Provisions to transfer source 2 or Emergency to normal or neutral (delayed switches only) position. Specify voltage.
5. Prime Source Selector (SW3K) – Provide a keyed source selector switch that selects source 1 or source 2 as the preferred source.
6. Automatic or Manual Selector (S12) – Provide ability to manually transfer to Normal or Emergency sources.

PART 4 - EXECUTION

4.1 GENERAL

A. The transfer switch shall be installed as shown on the plans, in accordance with the manufacture’s recommendations and all applicable codes.
4.2 FACTORY TESTS

A. The transfer switch manufacturer shall perform a complete functional test on the switch, controller and accessories prior to shipping from the factory. A certified test report shall be available upon request.

4.3 SERVICE

A. The manufacturer shall maintain a national service organization that is factory trained and certified for transfer switch equipment. In addition, the service organization shall be available 24 hours per day, 365 days per year.

4.4 WARRANTY

A. The automatic transfer switch shall be warranted against defective workmanship for a period of two years, including both parts and labor. An additional five-year warranty shall be provided for all parts. Extended warranties shall be available upon request or as specified herein.

END OF SECTION
SECTION 264300 - TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) / SURGE PROTECTIVE DEVICE (SPD)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes the materials and installation requirements for transient voltage surge suppressors (TVSS), alternatively called Surge Protective Devices (SPD). TVSS/SPD devices are used for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

B. This specification also describes the mechanical and the electrical requirements for the TVSS devices. The TVSS shall be suitable for application in both category A, B and C environments as described in ANSI/IEEE C62.41-2002.

C. The TVSS shall be of parallel design and provide individual protection components connected Line to Ground and Line to Line for Delta and High Resistance Grounded systems and Line to Ground, Line to Neutral and Neutral to Ground for Wye and Single-Phase distribution systems.

D. Systems not providing discreet protection components in the above configuration will be rejected. A schematic diagram showing the configuration and technology of all internal connected components must be provided with submittals.

E. The TVSS devices will be used both near electrical service entrance locations and at locations distant from service entrance locations (Panels, MCC’s, Equipment Disconnects, etc.). For the purposes of this specification it should not be assumed that on Wye systems a neutral to ground bond will not be located electrically close to the suppressor location, thus discreet Neutral to Ground Suppression and Filter components are required.

F. The Manufacturer/Vendor shall furnish all of the necessary TVSS/SPD products and related hardware (i.e. flush mounting kits, mounting brackets, etc.) as required for the installation of the Transient Voltage Surge Suppression (TVSS) / Surge Protective Devices (SPD) System suitable for the application.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 260000 – Electrical General Conditions

B. Section 260519 - Wire and Cable

C. Section 260526 - Grounding

D. Section 260532 – Outlet and Pull Boxes
E. Section 260533 – Raceways

F. Section 262413 - Switchboards

G. Section 262416 – Panelboards

1.3 INFORMATIONAL SUBMITTALS

A. Buy America: Certification that all steel, iron and manufactured components are provided in compliance with the Buy America requirements.

1.4 SUBMITTALS

A. The vendor/manufacturer shall submit 3 copies of all related TVSS Specifications, product data, electrical and mechanical shop drawings, installation requirements/instructions, maintenance manuals (if applicable) and performance/warranty information requested in this document for the actual proposed TVSS/SPD device(s) to Project Engineer. All information shall be submitted in a three-ring binder indexed by response and test. Project Engineer reserves the right to select or reject any vendor response or product.

B. In order for TVSS device to be considered for this project, all responses to information requested in this specification must be provided in writing and must reference each specification section and sub-section. Written submittal responses shall be signed by manufacturer’s VP of Engineering. Attach information as necessary to provide compliance with specification response requirements. If a manufacturer can not fully comply with a section of the specification, this must be stated in the response and the reason for non-compliance shall be provided.

1.5 QUALITY ASSURANCE AND PERFORMANCE

A. Each complete suppression unit shall be UL1449 3rd Edition Listed as a Transient Voltage Surge Suppressor. UL 1449 test data for TVSS devices proposed, including UL let through voltage classification shall be provided with submittal. Units shall bear suppressed voltage rating issued by UL.

B. Engineer reserves the right to have an employee or a representative designated by firm witness any testing required by this document. Vendor/manufacturer shall provide written notice of intent to test and shall coordinate testing with Engineer, should Engineer desire to witness tests.

C. Performance & Durability Testing. Units shall be tested by an independent test agency in accordance with test procedures outlined in ANSI/IEEE C62.45, NEMA LS1 & UL1449. The following test data shall be provided:
D. Provide Maximum Surge Current (Single Pulse Rated, 8/20μS, by mode, Amperes) as per NEMA LS1-1992 – 2.2.9 with submittals document. Maximum surge current rating shall not be less than 120kA (60kA per mode including N-G) for branch panel models in low exposure areas, high exposure areas and for IEEE C62.41.1-2002 - Category B Switchboard and Motor Control Center Locations. Maximum surge current rating (per phase in applicable modes other than Neutral to Ground) shall not be less than 240kA (120kA per mode including N-G) for IEEE C62.41.1-2002 - Category C Locations, including all Electrical Equipment located at Service Entrance location. Provide proof of completion of such tests and test data with submittal data. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G & N-G) with submittals.

E. Provide durability test data utilizing the ANSI/IEEE C62.41-1991, Category C3, 20kV/10kA, 1.2 x 50 S - 8x20S combination waveform. Provide test data with submittals. Let through voltages shall be provided for all applicable protection modes (L-N, L-G & N-G) from zero reference. All TVSS/SPD devices (including branch panel) shall withstand a minimum of 5,000 hits delivered at a rate of one pulse per minute. Unit shall not fail or suffer let through voltage degradation of more than 7%. Lead length for testing and let through measurements shall be 6”. Provide lead length used for testing with submittals.

F. Provide performance test data utilizing the ANSI/IEEE C62.41.2-2002, Exposure - High, 10kV/10kA, 1.2 x 50μS - 8x20μS combination waveform. Provide test data with submittals. Let through voltages shall be provided for all applicable protection modes (L-N, L-L & L-G) from zero reference. Lead length for testing and let through measurements shall be 6”. Provide lead length used for testing with submittals.

G. Provide let through voltage test data and test waveforms used for (N-G) with the submittals for units intended for grounded Wye systems.

H. Provide let through voltage test data for the ANSI/IEEE C62.41.2-2002, Category B, 0.5μS-100 kHz 6kV/.5kA ring wave (L-L, L-N & L-G) with the submittals. Let through voltages shall be provided for all applicable protection modes and shall be measured from the zero reference.

I. Provide let through voltage test data for the ANSI/IEEE C62.41.2-2002, Neutral grounded at service entrance – Far Category, 0.5μS-100 kHz 3kV ring wave (N-G) with the submittals for units intended for grounded systems.

J. If available, test data shall be provided for the ANSI/IEEE C62.41.2-2002 level three category of the 5/50 nS EFT Burst waveform as a part of this submittal package. Let through voltages shall be provided for all applicable protection modes (L-L, L-N, L-G & N-G).

K. All TVSS/SPD tests must provide let through voltages using a positive polarity pulse at the 90-degree phase angle location on the sine wave for Category B and C waveforms and 180-degree for Category A waveforms. Let through voltages must be measured from the zero voltage reference line for the tests.
L. All let through voltage test results must be provided with a minimum of six inches of lead length as measured from the point where the wire would normally exit the TVSS enclosure (standard installation) to the point of termination. Wire used for test must be of the type of building wiring material recognized by the latest adopted version of the NEC and must be readily available for wiring commercial buildings, unless permanently attached to and supplied with suppressor. Conductors sizing used for test shall be based on manufacturer's installation instructions for the proposed product.

M. The above test results, including oscillographs, test conditions, identity of the testing lab and the test technicians and engineers shall be provided as part of the submittal package. The manufacturer shall provide the contact phone number for a readily available factory engineer responsible for answering questions about this product and the tests performed. Information shall be provided in a format that is easily to analyze and review.

N. Maximum Let Through Voltages based on above requirements:

<table>
<thead>
<tr>
<th>Voltage &amp; Configuration</th>
<th>Test / Wave</th>
<th>L-L</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
<th>Phase Angle</th>
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<tr>
<td>480/277 Wye - Grounded</td>
<td>C3 – 20 kV/10ka</td>
<td>2500</td>
<td>1600</td>
<td>1900</td>
<td>1700</td>
<td>90</td>
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<tr>
<td>480/277 Wye - Grounded</td>
<td>B3 – 6 kV/3kA</td>
<td>1700</td>
<td>1000</td>
<td>1100</td>
<td>1000</td>
<td>90</td>
</tr>
<tr>
<td>480/277 Wye - Grounded</td>
<td>A1 – 2kV – 67A</td>
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<td>150</td>
<td>180</td>
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<tr>
<td>480/277 Wye - Grounded</td>
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<td>800</td>
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<td>1150</td>
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</table>

O. Manufacturers Qualifications: Only firms regularly engaged in the manufacture of TVSS products for category C locations (ANSI/IEEE C62.41.1-2002), and whose products have been providing satisfactory service for not less than five years, shall be considered. A customer reference list, with a minimum of five contact names and current phone numbers shall be provided with the submittals. All manufacturer qualifications shall be provided as part of the submittal.

P. The successful manufacturer/vendor shall assign a technical contact person for TVSS application, installation and warranty questions. This contact shall be available to provide a response to a technical question within a maximum of two business days.
Q. The Engineer reserves the right to accept or reject any or all submittals, to request additional information as deemed necessary or to request submittals for a different unit that may be deemed more appropriate for this installation.

R. Engineer reserves the right to have an employee or a representative designated by firm witness any testing required by this document. Vendor/manufacturer shall provide written notice of intent to test and shall coordinate testing with Engineer, should Engineer desire to witness tests.

1.6 CODES AND STANDARDS

A. UL compliance and labeling: Listed per UL 1449, Third Edition.

B. TVSS and Enclosures proposed and submitted shall be safety agency listed for all intended installations, meeting or exceeding all of the following: NEMA 1, 3R, 4, 12 & 13.

C. TVSS device shall be designed to allow installation in accordance with latest adopted version of the National Electrical Code (NEC), National Electrical Safety Codes (NESC) and applicable OSHA 1910 requirements.

D. NEMA LS1 (latest revision)


PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The TVSS shall be compatible with the electrical system voltage, current, system configuration and intended applications.

B. The TVSS maximum continuous operation voltage (MCOV) shall be capable of sustaining 115% of the nominal RMS voltage (with the associated peak voltage of 1.414*RMS) continuously without degradation and heating.

C. The TVSS shall only use clamping components connected in parallel with the supply to limit the surge voltages.

D. Arc Discharge components, such as Gas Tube Arresters shall not be used as the sole protection component in any protection mode. Gas Tube Arresters may be used in conjunction with other components, such as MOV's and SAD's to provide protection. Where Gas Tube Arresters are installed, the circuit shall be specifically designed to prevent power follow current.
E. Internal Fusing – If provided, shall be component level style:

1. Component Level Fusing:
   a. Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable.
   b. For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.
   c. Fusing shall be present in every mode, including Neutral-to-Ground.
   d. The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied, providing a listed 200kAIC Short Circuit Current Rating (SCCR) without additional over-current protection.

F. Status Indication & Monitoring: The suppressor shall include individual Phase Status LEDs, a red Service Required LED, an integrated Audible Alarm with silence button and Form C dry contacts (N.O. or N.C.) for remote monitoring capability. The form C contacts must be rated a minimum of 65VDC/150VAC with a load of 30WDC/60VA AC, and must be isolated and insulated from the ground plane and the power system to prevent Surges from reaching the monitoring system. The system shall provide insulation and isolation against any impressed voltages. Contacts shall be designed to change state upon device failure or loss of power.

G. The protection should be housed in the appropriate NEMA rated, heavy duty powder coated steel enclosure. This enclosure must provide complete protection against personnel hazards and damage to equipment should a failure of the TVSS protection device occur. This enclosure shall also be designed to allow connection of the TVSS device without sharp bends in the conductors and lead lengths of less than 18" from the TVSS Lugs (or enclosure opening for devices with leads attached) to the final point of attachment to the power system for the application (assuming connection point is 12" from the exterior of the enclosure).

H. Manufacturer shall provide a comprehensive warranty that provides for unlimited full replacement of a suppressor that is damaged or that fails to meet manufacturers published specifications and specifications provided within, without pro-rating value. Warranty shall provide coverage for a minimum period of 20 years for individual units (standard warranty) and Series SPDs shall be covered for 10 years. These Unlimited Replacement Warranties cannot exclude system overvoltages or direct lightning strike events. Warranty shall not require any factory or third-party testing. Warranty shall apply to installed unit(s) for the duration of the warranty period no matter who owns the facility or equipment. All warranty information and copies of warranty documents must be provided with this response.

1. All replacements shall be of same make, model and configuration as original unit unless otherwise requested or approved by customer.
2. The manufacturer/vendor shall provide a warranty replacement unit at the facility within 5 days of receipt of written notification that the TVSS unit has failed, at no cost to the customer.
3. If the manufacturer/vendor requires inspection of the installed unit to validate warranty claim, the manufacturer/vendor must visit the site where the failed TVSS device(s) are located within 3 days of notification. This visit will be performed at no cost to customer. This section does not modify the requirement for the TVSS replacement to be within 5 days of written notification as described in section G, above.

4. The replacement unit shall be sent to the facility without shipping, handling, examination or other fees.

I. Complete, comprehensive installation instructions shall be provided for the TVSS systems proposed. Installation instructions must provide for compliance with latest adopted NEC requirements and UL listing requirements, while not degrading performance of TVSS device as tested. Provide copies of installation instructions for the models proposed with the specification response. Successful vendors/manufacturer shall provide a complete, comprehensive installation checklist.

J. If manufacturer claims TVSS device to have filtering capabilities, provide complete information on filtering performance of TVSS device with specification response. This information must include attenuation across a stated frequency range. If the TVSS is a UL 1283 listed device, the manufacturer shall provide all performance specifications for filter attenuation.

K. Provide complete enclosure dimensions (H*W*D) and cutsheets indicating dimensions including locations of terminations and wire entry locations with specification response.

L. Provide UL Short Circuit Current Ratings (SCCR). Minimum ratings shall be 200kAIC without additional/external over-current protection.

M. Manufacturer shall make available metal flush plates for distribution and branch panel SPDs. The flush plate shall provide for a clean architectural finish and be utilized where the attached panel is mounted flush.

N. Manufacturer must have knowledgeable local representation and distribution within 100 miles of the project location and must be willing to provide technical support, warranty claim support, and installation support for the project.

O. Successful manufacturer/vendor must be capable of supplying TVSS for project within 20 days of receipt of order for orders of 25 units and less for models submitted in response to this specification.

2.2 SERVICE ENTRANCE

A. Transient Voltage Surge Suppressors shall be installed at all service entrances of each building and as shown on the riser / one-line diagram. Suppressors shall be listed in accordance with UL 1449 3rd Edition, Standard for Safety, Transient Voltage Surge Suppressors.

B. For 3-phase, 4-wire plus ground configurations, suppressors shall provide suppression and filter elements between each phase conductor and the system neutral, each phase conductor and the system ground and between the neutral conductor and ground.
C. Suppressors shall include a passive circuit that allows the suppressor to actively follow the voltage waveform and provide a clamping envelope that follows the sine wave to limit low level IEEE C62.41 A1 ring waves (of either polarity) at all locations on the sine wave. This circuit shall also perform in the Neutral to Ground Mode where a sine wave does not exist. Details of circuit used to provide this function and information detailing and quantifying the performance of this circuit (in all modes with Category A1 ring wave) shall be provided with specification response. All Let Through Voltage (LTV) values shall not exceed those stated in section 1.4.C.11.

D. Indication of proper suppressor connection and operation shall be provided, consisting of status LEDs for each phase, a Red Service Required LED and an internal Audible Alarm with silence/mute button. Dry contacts (NO/NC) are required for external monitoring.

E. SPD shall exhibit fully redundant protection for each phase.

F. The surge suppressor shall be of parallel design and shall be capable of being removed and replaced without disrupting electrical service to the facility.

G. Suppressors shall consist of solid-state components and shall operate bi-directionally.

H. All surge protective devices shall be of the same manufacturer.

I. The minimum single impulse current rating (as per NEMA LS-1) shall not be less than 240,000 amperes per phase (120KA per mode). Provide proof of compliance by supplying certified test results from independent test lab with submittals.

J. Maximum size of TVSS/SPD units for Primary, Service Entrance applications is 15.5”x12.3”x8.25”.

2.3 SECONDARY SUPPRESSORS FOR MCC, DISTRIBUTION & BRANCH PANELS

A. Transient Voltage Surge Suppressors shall be installed at all service entrances of each building and as shown on the riser / one-line diagram. Suppressors shall be listed in accordance with UL 1449 3rd Edition, Standard for Safety, Transient Voltage Surge Suppressors.

B. For 3-phase, 4-wire plus ground configurations, suppressors shall provide suppression and filter elements between each phase conductor and the system neutral, each phase conductor and the system ground and between the neutral conductor and ground.

C. Suppressors shall include a passive circuit that allows the suppressor to actively follow the voltage waveform and provide a clamping envelope that follows the sine wave to limit low level IEEE C62.41 A1 ring waves (of either polarity) at all locations on the sine wave. This circuit shall also perform in the Neutral to Ground Mode where a sine wave does not exist. Details of circuit used to provide this function and information detailing and quantifying the performance of this circuit (in all modes with Category A1 ring wave) shall be provided with specification response. All Let Through Voltage (LTV) values shall not exceed those stated in section 1.4.C.11.
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E. SPD shall exhibit fully redundant protection for each phase.

F. The surge suppressor shall be of parallel design and shall be capable of being removed and replaced without disrupting electrical service to the facility.

G. Suppressors shall consist of solid-state components and shall operate bi-directionally.

H. All surge protective devices shall be of the same manufacturer.

I. The minimum single impulse current rating (as per NEMA LS-1) shall not be less than 120,000 amperes per phase (60KA per mode). Provide proof of compliance by supplying certified test results from independent test lab with submittals.

J. Maximum size of TVSS/SPD units for Secondary Suppressors for MCC, Distribution & Branch Panel applications is 15.5”x12.3”x8.25”.

2.4 PRIOR APPROVALS

A. The following manufacturer(s) have submitted the required information and have been reviewed and approved for this project:

<table>
<thead>
<tr>
<th>Voltage Location</th>
<th>480Y277v 3 Phase Bonded Wye</th>
<th>480v 3 Phase Delta</th>
<th>208Y120v 3 Phase Bonded Wye</th>
<th>208v 3 Phase Delta</th>
<th>120/240v Single / Split Phase</th>
<th>120v Fire Alarm, Security, PLC, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Services</td>
<td>ST240-3Y480-FL</td>
<td>ST240-480NN-FL</td>
<td>ST240-3Y208-FL</td>
<td>ST240-208NN-FL</td>
<td>ST240-1S240-FL</td>
<td>N/A</td>
</tr>
<tr>
<td>Distribution</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>LTE120-30A</td>
</tr>
</tbody>
</table>

TVSS/SPD Applications Notes:

2. Use Delta units for unbonded/ungrounded and high resistance ground Wye applications.
PART 3 - EXECUTION

3.1 GENERAL

A. Suppressors shall be installed per the manufacturer's installation instructions and the requirements of: the NEC, the local authority having jurisdiction and the project engineer.

B. Size overcurrent protective device and conductors per manufacturer's recommendations and NEC requirements.

C. Project Engineer or their appointed representative may perform inspection of the installed suppressors and reserves the right to require corrections to the installation to comply with manufacturer’s installation requirements and project specifications.

D. The SPD/TVSS supplier must provide on-site installation training for the electrical contractor.

3.2 SERVICE ENTRANCE

A. Install one primary suppressor at each utility service entrance to the facility as indicated on the drawings.

B. Suppressor shall be installed on the load side of the service entrance disconnecting means in accordance with NEC requirements.

C. Provide a 60 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the switchboard as over-current protection for the wire and as a disconnecting means for the SPD (or as specified by the manufacture).

D. Use minimum #6 AWG wire for connecting the SPD.

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Innovative Technology Protector by Eaton/Cutler Hammer

<table>
<thead>
<tr>
<th>Location</th>
<th>Voltage</th>
<th>480Y277v 3 Phase Bonded Wye</th>
<th>480v 3 Phase Delta</th>
<th>208Y120v 3 Phase Bonded Wye</th>
<th>208v 3 Phase Delta</th>
<th>120/240v Single / Split Phase</th>
<th>120v Fire alarm Security, PLC, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Services</td>
<td>PTE240-3Y201-L-SD</td>
<td>PTE240-NN400-L-SD</td>
<td>PTE240-3Y101-L-SD</td>
<td>PTE240-NN201-L-SD</td>
<td>PTE240-1S101-L-SD</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Distribution MCC &amp; Branch Panels</td>
<td>PTE120-3Y201-L-SD</td>
<td>PTE120-NN400-L-SD</td>
<td>PTE120-3Y101-L-SD</td>
<td>PTE120-NN201-L-SD</td>
<td>PTE120-1S101-L-SD</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Dedicated Equipment</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>LTE120-30A</td>
<td></td>
</tr>
</tbody>
</table>
E. Conductors between suppressor and point of attachment shall be kept as short and straight as possible. Lead length of connecting conductor shall not exceed two (2) feet without written permission of the specifying Engineer.

F. Over-length SPD leads (greater than 24”) must be twisted together (1 twist/foot) and securely tie-wrapped once per foot to reduce impedance of the leads.

G. SPD leads may not be spliced.

H. Suppressor's ground shall be bonded to enclosure frame and the service entrance ground bus, and conduit between the TVSS/SPD and the switchboard must provide secure electrical/mechanical connections.

3.3 SECONDARY SUPPRESSORS FOR MCC, DISTRIBUTION & BRANCH PANELS

A. Install one secondary suppressor at each MCC, Distribution Panel, Branch Panel & Sub-Panel location as indicated on the drawings.

B. Provide a 30 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the panel being protected as over-current protection for the wire and as a disconnecting means for the SPD (or as specified by the manufacture).

C. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible. Mount the TVSS directly adjacent to the circuit breaker closest to the neutral bus, such that the maximum length of connecting wiring is kept as short as possible, not exceed 18 inches for all phase and neutral leads (24” for ground lead on IG panels).

D. Over-length SPD leads (greater than 18”) must be twisted together (2 twists/foot) and securely tie-wrapped once per foot to reduce impedance of the leads. Quality compression butt-splice connections are required when extending SPD leads (wire nuts are not acceptable).

E. Grounding for all non-IG installations: Suppressor's ground lead shall be bonded to the panel enclosure with a small ground lug as close as possible to the TVSS mounting point. Conduit between the TVSS/SPD and the switchboard must provide secure electrical/mechanical connections.

F. Multiple “Feed-Through” Panels with shared SPD/TVSS units must be immediately adjacent to each other (side by side) with short tie cables not to exceed 36”. Sub-panels must be feed from a primary panel with a “lug-out’, lug-in” tie connection, and the tie connection lugs must be at the same end of the primary and sub-fed panel. i.e. bottom to bottom or top to top to ensure short tie “sub-feed” cables.

1. Dual Panel Configurations: One SPD/TVSS per two panels
2. Three and Four Panel Configurations: One SPD/TVSS installed on both outside panels of the multi-panel configuration, i.e. Install SPD on first (primary) and another one on the third or fourth sub-fed panel for a total of two SPDs.

END OF SECTION
SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Section 260000 – Electrical General Conditions

1.2 WORK INCLUDED
   A. Provide the lighting system complete and operational.
   B. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling.

1.3 FIXTURE SCHEDULE MANUFACTURER'S SERIES NUMBERS
   A. Are a design series reference and do not necessarily represent the number, size, wattage or the type of lamp, ballast or special requirements as specified hereinafter.

1.4 SUBMITTALS
   A. Shall be neatly and clearly marked to indicate the fixtures, lamps and ballasts fully comply with contract documents. When substitute fixtures are submitted (if permitted) the data shall clearly cross reference (written or highlighted) that the substitute fixture complies with every detail of the specified fixture. Fixtures not fully complying with contract documents are not permitted.

PART 2 - PRODUCTS

2.1 METAL PARTS
   A. Interior Fixtures: Steel or aluminum with 300°F, baked enamel finish, brushed aluminum with baked acrylic clear lacquer finish, or stainless steel with a brushed finish, manufacturer's standard color unless specified otherwise.
   B. Exterior Fixtures: Corrosion resisting metal, a (non-ferrous, stainless steel or special finish) and in all cases suitable for outdoor service without tarnishing or other damage due to exposure; manufacturer's standard colors unless specified otherwise; cadmium plate all metal parts concealed by canopies, including screws, plates and brackets. All exposed fasteners shall be tamperproof.
   C. Recessed Type: Recessed fixtures shall be IC rated for direct contact with insulation.
2.2 LIGHT TRANSMITTING COMPONENTS

A. Virgin acrylic or polycarbonate plastic (0.125-inch thick overall minimum), UV stabilized or glass. Shall be contained in a captive metal frame that remains attached to the fixture when door is in open position.

2.3 SPECIAL PARTS

A. Adapters, Plates, Brackets and Anchors: Provide where required by construction features of the building to suitably mount lighting fixture. All such appurtenances and mounting methods shall be approved by the Architect/Engineer prior to fabrication and installation.

B. Low Voltage Transformers: Provide and install where required to power individual

2.4 SOLID-STATE LIGHTING (LED)

A. Fixtures shall have a lumen maintenance life expectancy (L70) of > 50,000 hours, a CRI of > 82, and a CCT of 3500K. Each solid-state fixture model shall be tested in accordance with IES LM-79.

2.5 LED DRIVERS/POWER SUPPLIES

A. The LED drivers/power supplies shall meet the following criteria:

1. Drive mode: Constant Current or Constant Voltage depending on the LED configuration for the light fixture.
2. Output currents: 250 mA – 1000 mA
3. Output voltages: 6VDC – 48VDC
4. Input voltages: 110 to 277 VAC; 50/60 Hz.
5. Power factor at >0.90 @ full load
6. Line regulation accuracy: +/- 2%
7. Load regulation accuracy: +/- 3%
8. Greater than 80% efficient
9. Output over-voltage, output over-current and output short circuit protection with auto recovery
10. Limited power source output to allow for class 2 wiring.
11. Flicker Free 0-10V Dimmable to 5% light output.
12. Minimum of 50,000 hour rated life.
13. IP66 rated
14. 5 Year Warranty.
2.6 EMERGENCY BATTERY BACK-UP

A. Provide as indicated. Each LED fixture unit shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, automatic code-compliance testing, and fully automatic solid-state charger in a self-contained power pack. Battery shall meet UL924 and provide 100% lumen output for a period of 90 minutes. Emergency unit shall operate unattended and require no maintenance for a period of 5 years.

B. Remote Mounted Battery Back-Up Units: Where allowed by the Architect and the Engineer, contractor shall provide and install required conduit and wiring per manufacturer’s recommendations. Exact location of remote battery and test-switch shall be readily accessible and shall be approved by the Engineer.

2.7 HANGING FOR PENDANT FIXTURES

A. Rigid type, with not less than 5 thread engagement at each end, consisting of iron pipe, with brass or aluminum tubing casing, or painted tubing not less than 0.040 inches thick.

B. Provide a canopy for each fixture hanger except where fixture conceals the outlet box directly without a canopy.

C. Provide a safety chain for all glass pendant fixtures and for all fixtures mounted in gymnasiums.

D. Aircraft cable, stainless steel, sized appropriately by manufacturer for weight and seismic zone.

2.8 OUTDOOR LIGHTING STANDARDS

A. Provide watertight insulating fuse in the base of lighting standards to individually protect each lighting fixture; buss Style "HEB" or approved, waterproof fuseholder with Buss fuse of appropriate capacity and voltage. Provide fuse for each hot circuit wire; do not fuse neutral.

B. Provide concrete preformed round poles with base plate for bolting to concrete foundation. Natural exposed aggregate finish. Height as noted on drawings.

C. Provide concrete foundations as shown on drawings. Field verify locations with Architect prior to installation of bases.

2.9 EXIT SIGNS

A. Fronts: Cutout stencils made of minimum #20-gauge sheet steel or sheet aluminum with red glass or plastic back of the cutout. Mount fronts either on concealed hinges or pull-out type with chain catch. Removable cutout arrows shall indicate direction of travel.
PART 3 - EXECUTION

3.1 LIGHTING FIXTURES - GENERAL

A. Size and mounting height from finished floor to bottom of fixture as indicated on the drawings. Verify mounting provisions prior to the ordering of fixtures. Fixtures shall be UL listed for the location, and application in which they are installed.

B. Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer’s recommendations.

C. Recessed fixtures installed in seismic areas shall be installed utilizing specially designed seismic clips.

D. Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

3.2 DIFFUSERS AND ENCLOSURES

A. Install lighting fixture diffusers only after construction work, painting and clean up are completed. Prior to final acceptance, remove all lamps, reflectors and diffusers, wash, rinse and reinstall.

3.3 ADJUSTMENT OF FIXTURES

A. Make all final spotlight and adjustable light settings under the direction of the Architect/Engineer during a scheduled period of time prior to the completion of the project. Include costs for all equipment and personnel expenses required for adjustment.

B. For fixtures with indirect lighting, notify Engineer prior to installation of any circumstance where the fixture lamp source will be within 12” of ceiling.

3.4 SUPPORT OF LIGHT FIXTURES

A. Surface and Pendant Mounted Type:

1. Where mounted on accessible ceilings, hang from structural members by means of hanger rods through ceiling or as approved.

2. Where ceiling is of insufficient strength to support weight of lighting fixture, provide additional framing to support as required. Fixtures shall be supported from structure with seismic bracing independent of ceiling.

3. For Pendant Mount Type: Provide a unistrut channel for mounting fixtures entire fixture length unless light fixture is designed specifically for supporting itself. Provide 3/8-inch thread rod secured to structural members for support of unistrut channel.
4. Continuous Runs of Fixtures: Straight when sighting from end to end, regardless of irregularities in the ceiling. Where fixtures are so installed, omit ornamental ends between sections.

3.5 LOCATION

A. Mount to the dimensions shown on the drawings. Mount at quarter points where no dimensions appear. Architect shall specify mounting locations where no dimensions appear and quarter point mounting is impractical or not indicated on the drawings.

B. Refer to details, mechanical drawings, and coordinate with mechanical Contractor for equipment and ductwork mounted in ceilings to prevent conflict with light fixtures prior to installation. If conflicts cannot be resolved with the Mechanical Contractor, notify Architect/Engineer.

3.6 SPARE PARTS

A. Spare Driver Fuses: Provide twenty (2) spare fuses of each size used, packaged and marked to identify fixture type where used.

B. Spare Drivers: Provide a minimum of two (2) LED drivers per fixture type or 5% of each fixture type, whichever is greater. Provide proper labels to identify all fixture type spare drivers. Spare drivers shall be programmed to exactly match the lumen output and color temperature of each specified fixtures.

3.7 CONCRETE FOUNDATIONS

A. Install at locations shown taking care to provide soil compaction same as required under paving to avoid settling and tilting of pole. Provide for all steel, concrete or aluminum poles shown. Concrete foundations shall have a minimum raceway sweeps of 90 degrees and anchor bolts shall be accurately set in foundations using a template supplied by the pole manufacturer. Concrete work and grouting, see Division 03 of the specifications. When concrete work has cured, base plates shall be leveled and grouted in place. Pole anchor bases shall then be set on base plates, leveled plumb on foundations, and secured with holding nuts.

3.8 FIXTURE TENTING

A. Contractor shall coordinate ceiling types with architectural drawings and specifications and provide equivalent fire rated enclosures above all light fixtures which penetrate rated ceilings. E.Z. barrier fire-rated recessed light enclosure.

END OF SECTION
SECTION 283100 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The Fire Alarm System for this project shall be a Silent Knight / Farenhyt Brand System.

1. Alternate Systems allowed:

2. Gamewell/FCI S3

B. Substitutions of the specified Fire Alarm will be not be allowed.

C. Includes, but not limited to, the following:

1. Provide all material, labor, equipment, design, and services necessary to perform the modification of a complete, fully operational, intelligent (analog) and addressable (digital), low voltage 24 Volts D.C., point identification, microprocessor-based Siemens EST-3 Fire Alarm System, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #72 accepted by the Authority having Jurisdiction and project specifications, except as modified herein.

D. Includes, but not limited to, the following:

1. Provide all material, labor, equipment, design, and services necessary to perform the installation of a complete, fully operational, intelligent (analog) and addressable (digital), low voltage 24 Volts D.C., point identification, microprocessor-based Fire Alarm System, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #72 accepted by the Authority having Jurisdiction (City of Pacific) and project specifications, except as modified herein.

2. The Contractor is to obtain a permit and final approval from (City of Pacific/Valley Regional Fire Authority) for the Fire Alarm System. All permits, fees for plan review, inspections, testing, etc. shall be included in the bid proposal.

3. The Fire Alarm System Contractor shall simultaneously submit "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Manufacturers Data Sheets, and a bond copy of each proposed Graphic Map to the local Authority Having Jurisdiction and Architect/Engineer for review that shall be approved by the Architect/Engineer prior to the purchase, fabrication, or installation of any system components as detailed in Paragraph 1.18 of Specification Section 28 31 00.

4. Products shall be domestically made and comply with the requirements of the “Buy American Act - Construction Materials Under Trade Agreements”.

E. By submitting a bid, the Fire Alarm System Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions, and has determined that these documents do sufficiently describe the scope of construction work required under this Contract.
1.2 RELATED DOCUMENTS

A. Drawings, General Conditions and Supplementary Conditions of the Contract, including Division 0 and Division 1 Specification Sections apply to work of this Division.

B. Environmental Protection Requirements: The work of this Section is part of the overall requirements to comply with the Environmental Protection, Hazardous Materials, and Green Procurement Requirements. Comply with Section 01 57 00 – Environmental Protection.

1.3 RELATED SECTIONS

A. The following sections apply to this section:

1. Section 28 31 33 "AIR SAMPLING SYSTEMS".

1.4 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over Fire Alarm System installations.

4. Authority Having Jurisdiction (Local Fire Marshal).
5. Occupational Safety and Health Administration (OSHA).
15. National Board of Fire Underwriters
17. National Electrical Manufacturers Association
18. Insulated Power Cable Engineers Associated
19. Certified Ballasts Manufacturers
20. Electrical Testing Laboratories
22. Underwriters Laboratories Incorporated (U.L.)
   a. UL #5 Standard for Surface Metal Raceways and Fittings
   b. UL #38 Standard for Manual Signaling Boxes for Fire Alarm Systems
   c. UL #50 Enclosures for Electrical Equipment, Non-Environmental Considerations
   d. UL #228 Standard for Door Closers-Holders, With or Without Integral Smoke Detectors
   e. UL #268 Smoke Detectors for Fire Alarm Systems
f. UL #268A Standard for Smoke Detectors for Duct Application

g. UL #464 Standard for Audible Signal Appliances

h. UL #497A Standard for Secondary Protectors for Communications Circuits

i. UL #521 Standard for Heat Detectors for Fire Protective Signaling Systems

j. UL #827 Standard for Central-Station Alarm Services

k. UL #864 Standard for Control Units and Accessories for Fire Alarm Systems

l. UL #1449 Standard for Surge Protective Devices

m. UL #1481 Standard for Power Supplies for Fire-Protective Signaling Systems

n. UL #1638 Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling

o. UL #1971 Standard for Signaling Devices for the Hearing Impaired

p. UL #2075 Standard for Gas and Vapor Detectors and Sensors

q. UL #2572 Standard for Mass Notification Systems

r. UL #60950 Information Technology Equipment – Safety

B. If any conflict occurs between Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes. Also, this shall not be construed as relieving the Fire Alarm System Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.5 DEFINITIONS

A. Thermal Envelope: The heat flow control layer (insulation for example) that separates the interior conditioned space from the exterior unconditioned space.

B. Cold Space: Spaces outside of the building’s thermal envelope in which ambient temperatures are expected to be below 40°F.

C. Warm Space: Spaces within the building’s thermal envelope in which ambient temperatures are not expected to be below 40°F.

D. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.

E. Unfinished Spaces: Spaces used for storage or work areas, such as sprinkler riser rooms, mechanical rooms, electrical rooms, etc., where appearance is not a factor.

F. Exposed: Open to view i.e. a room that is not covered by other construction.

G. Concealed Spaces: Spaces out of sight i.e. above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.

H. Trades: Design documents or work performed by architectural, civil, electrical, fire protection, landscape, mechanical, plumbing, electrical, and structural.

I. Soffit: A ceiling that is secondary to the primary ceiling elevation that is at a lower elevation and is finished with gypsum wall board or other construction materials.

J. Provide: It shall be interpreted as "furnishing and installing complete in operating condition".
K. Drawings: It shall be interpreted as "all Contract Drawings for all Disciplines".

1.6 GENERAL SYSTEM REQUIREMENTS

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical & fire alarm system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein.

B. Provide and install a new complete, fully operational, intelligent (analog) and addressable (digital), low voltage 24 Volts D.C., "Class B", point identification, microprocessor-based Fire Alarm System that will transmit a signal to the monitoring entity as described herein and as shown on the contract documents.

C. The Fire Alarm System shall include, but not be limited to a control panel, Remote Power Supplies, peripherals, initiating devices, notification appliances, cabling, conduit, junction boxes, fittings, raceways, termination at field devices and panels, etc. required for a complete operating system even though each item may not be specifically mentioned or described in this specification section or on the contract documents.

D. Devices and equipment for Fire Alarm System service shall be U.L. listed or Factory Mutual Global approved for use in Fire Alarm Systems and of the manufacturer's current model.

E. The Fire Alarm Control Panel shall be listed under U.L. Category UOJZ as a single control unit and shall be U.L. Listed for Power Limited Applications per Article 760 of N.F.P.A. #70 (National Electrical Code).

F. The Fire Alarm Control Panel shall electrically supervise and monitor the integrity of all conductors of all circuits.

G. The Fire Alarm System Control Panel and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

H. The Fire Alarm shall be of modular design to facilitate both expansion and service.

I. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the Fire Alarm control panel indicating that each device, and associated circuit cabling, is functional.

J. All power or system shutdowns shall be coordinated with the Owner or Owner’s representative with a minimum of (14) days advanced notice not exceeding (4) hours. Provide temporary provisions for periods greater than (4) hours with Lockout / Tagout procedures being used.

K. Equipment in compliance with U.L. standards but not bearing their label is not acceptable.
1.7 PROTECTION OF NEW FIRE ALARM EQUIPMENT
   A. The Fire Alarm System Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance.

1.8 HOUSEKEEPING
   A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.
   B. All marred surfaces shall be refinished and painted after installation.
   C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.9 COORDINATION
   A. The work covered by this Specification Section shall be coordinated with the related work as specified elsewhere on the contract documents or in the project specifications.
   B. The Fire Alarm System Contractor shall participate in the on-site coordination meetings to coordinate the Fire Alarm System installation with the Architectural features, H.V.A.C. grilles, electrical lights, fire protection sprinkler heads, and/or existing conditions.
   C. Coordination meetings shall consider elevations, required clearances, and routings of all trades to assure that all trades can be installed without conflict.
   D. The outcome of this coordination shall allow each system (Electrical, Mechanical, Fire Protection, etc.) to be installed without further conflicts for space or locations.
   E. Failure to coordinate with other trades and/or existing conditions that result in the removal and re-installation of systems shall not be charged as additional costs.

1.10 PENETRATIONS
   A. Fire Resistance Rated Penetrations:
      1. Where Fire Alarm System conduit penetrates a fire resistance rated wall or floor assembly, the Fire Alarm System Contractor shall provide a fire rated penetration that maintains the integrity and fire resistance rating of the assembly being penetrated.
      2. The fire resistance rated penetrations of walls or floor assemblies shall consist of one of the following:
         a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall be provided with sealant between the conduit and the wall or floor penetration
b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
with a section of conduit (sleeve) that extends past both faces of the penetration by
a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed or
Factory Mutual Global approved material and sealant that maintains the fire
resistance rating of the assembly being penetrated. Provide fire resistance rated
sealant to both sides of assembly penetration between the conduit (sleeve) and the
wall or floor assembly.

c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
with a fire resistance rated grommet that maintains the fire resistance rating of the
assembly being penetrated, such as those manufactured by Specified Technologies
Incorporated (STI). The grommet shall slipover the cabling and snap together to
form a round grommet that can slide into the penetration. A separate grommet shall
be required for each side of the assembly.

B. Non-Fire Resistance Rated Penetrations:

1. The Non-fire resistance rated penetrations of walls or floor assemblies shall consist of
one of the following:
   a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall not
      require additional sealant between the conduit and the wall or floor penetration
   b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
      with a section of conduit (sleeve) that extends past both faces of the penetration by
      a minimum distance of 6". Additional Sealant shall not be required.
   c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
      with a Non-fire resistance rated grommet, such as those manufactured by Specified
      Technologies Incorporated (STI). The grommet shall slipover the cabling and snap
      together to form a round grommet that can slide into the penetration. A separate
      grommet shall be required for each side of the assembly.

C. Smoke Barrier/Partition Penetrations:

1. Where Fire Alarm System conduit penetrates a smoke barrier/partition wall or floor
assembly, the Fire Alarm System Contractor shall provide a smoke barrier/partition
penetration that prevents the passage of smoke through the assembly being penetrated.
2. Smoke barrier/partition penetrations of walls or floor assemblies shall consist of one of
the following:
   a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall be
      provided with sealant between the conduit and the wall or floor penetration
   b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
      with a section of conduit (sleeve) that extends past both faces of the penetration by
      a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed or
      Factory Mutual Global approved material and sealant that prevents the passage of
      smoke. Provide sealant between the conduit (sleeve) and the wall or floor assembly
      on both sides of assembly penetration.
   c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide
      with a Non-fire resistance rated grommet, such as those manufactured by Specified
      Technologies Incorporated (STI). The grommet shall slipover the cabling and snap
together to form a round grommet that can slide into the penetration. A separate
      grommet shall be required for each side of the penetration.
D. All firestop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for inspection by the local authorities prior to cabling system acceptance.

E. Refer to Division 07 for requirements on sealing of penetrations.

F. The Fire Alarm System Contractor shall minimize the quantity of penetrations through the air barrier. All penetrations shall be filled with a spray type foam insulation or other approved means to maintain the integrity of the air barrier. The ends of seismic brace members that penetrate the air barrier shall also be filled with a spray type foam insulation of other approved means to maintain the integrity of the air barrier.

G. The Fire Alarm System and Electrical drawings do not specifically identify penetrations through walls, floors, platforms, and foundations.

H. The Fire Alarm System Contractor shall review all architectural and structural drawings to determine all penetration locations.

I. All penetration locations through walls, floors, platforms, and foundations shall be coordinated with the General Contractor and all other trades.

J. All penetrations through walls, floors, platforms, and foundations are the responsibility of the Fire Alarm System Contractor.

1.11 CUTTING AND PATCHING

A. Obtain permission from the General Contractor and Owner’s Representative prior to cutting. Locate cut locations so they will not weaken structural components the minimum amount necessary.

B. All construction materials damaged or cut into during the installation of the Fire Alarm System shall be repaired or replaced with materials of like kind and quality by skilled labor experienced in that particular building trade.

1.12 SYSTEM/DEVICE INTERFACE CONNECTIONS

A. The following system/device interfaces shall be connected to the Fire Alarm System for auxiliary functions initiated by the Fire Alarm System Control Panel and includes, but is not limited to:

1. Audio/Visual Sound Systems
2. Intercom Systems
3. Public Address Systems
4. Smoke and Fire/Smoke Dampers
5. Duct Smoke Detectors
6. H.V.A.C. Systems
7. Magnetic Door Holders
8. Magnetic Door Releases
9. Fire Rated Coiling Doors
1.13 SITE INSPECTIONS OF EXISTING BUILDINGS OR SITE CONDITIONS PRIOR TO BIDDING

A. The Fire Alarm System Contractor shall examine the structure, building, and existing conditions under which Divisions 28 work is to be installed for conditions detrimental to proper and timely completion of the work before submitting proposals and/or bids for this work.

B. Do not proceed with work until deficiencies encountered in existing installation have been corrected. Report any delay or difficulties encountered in installation of the existing Fire Alarm System which might be unsuitable to connect with work. Failure to report conditions shall constitute acceptance of other work as being fit and proper for the installation of the new Fire Alarm System.

C. Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits, wiring, and power restored back to original condition.

D. No subsequent allowance for time or costs will be considered for any consequence related to failure to examine site conditions.

E. Existing site conditions may not be fully depicted on the contract documents and is the bidding Fire Alarm System Contractor’s responsibility to fully understand the existing conditions of the project.

1.14 CONTRACT DOCUMENTS

A. The Fire Alarm System contract documents are intended to serve as working drawings for general layout and locations of components. The equipment layout is diagrammatic and unless specifically dimensioned or detailed, does not indicate all fittings, hardware or appurtenances required for a complete operating installation. It is the Fire Alarm System contractor’s responsibility to provide devices that may not be indicated or shown on the contract documents for a fully functional system.

B. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of device. Raceway and device locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

C. The Fire Alarm System contractor shall be responsible for reviewing all architectural, civil, electrical, mechanical, plumbing, structural, and fire protection drawings. These drawings may contain information related to the design and construction of this project and it is the Fire Alarm System contractor’s responsibility to review the contract documents of all trades and to coordinate the contract documents with the Fire Alarm System "Shop Drawings".

D. Architectural and Electrical drawings take precedence over Fire Alarm drawings.

E. The Fire Alarm System installation shall be developed in accordance with the contract documents, project specifications, and applicable standards. Should a conflict occur between the contract documents and project specifications, the project specifications shall prevail, refer to Division 1.
F. In the case that criteria contained on the contract documents is omitted from the project specifications or the project specifications have criteria that is omitted from the contract documents, the criteria given in one location shall apply as if shown in both the contract documents and in the project specifications (what's in one document applies to both documents). The contract documents and project specifications are complementary and what is called for in either is binding as if called for in both.

G. Fire Alarm System Work shall be as defined in the contract documents and in this specification Section. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

H. Fire Alarm System Drawings for the project have been developed by the Engineer using AutoCAD format. These drawing files will be made available to the Fire Alarm System Contractor for development of "Shop Drawings" and "As-Built" drawings, for a fee of $100.00 per sheet. Full payment to be made prior to release of drawing files.

1.15 SHOP DRAWINGS

A. Prepare detailed working drawings that are not larger than the contract documents for the system layout in accordance with N.F.P.A. #72.

B. All items contained in Section 7.4 "Shop Drawings" of the latest edition of N.F.P.A. #72 adopted by the Authority Having Jurisdiction shall be included on the Fire Alarm System Shop Drawings including, but not limited to the following:

1. Sheet Index.
3. Cabling Legend.
4. Alpha-numeric labeled cables based upon the "Cabling Legend" for each cable type and cable run.
5. Electrical Legend listing the electrical devices to be utilized as part of the Fire Alarm System installation.
6. Site Plan.
7. Floor Plans indicating all Fire Alarm System devices.
8. End-Of-Line Resistor(s) where applicable.
9. Device Address shown adjacent to each device.
10. One-Line Riser Diagram with all field devices and their respective room names, room numbers and device address.
11. "Sequence of Operations" matrix indicating all system Inputs and Outputs.
12. Mounting details and mounting heights

C. Provide "Shop Drawings" that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes, connection cabling for the entire Fire Alarm System layout, and riser diagrams.

D. Shop Drawings shall be clear and legible with a minimum text height of 1/8” for all text.

E. A graphical scale shall be provided for each floor plan or detail on the shop drawings in accordance with N.F.P.A. #72.
F. Projects that require more than one sheet to show the entire Fire Alarm System shall require a key plan.

G. The key plan shall identify the location of the Fire Alarm System that is contained on that sheet and shall contain a reference north arrow.

H. All sheets that contain a break in the building background shall contain a "Match Line" designation to indicate where the building and Fire Alarm System continues, even if on the same sheet.

1.16 PRE-CONSTRUCTION KICK–OFF MEETING

A. The Fire Alarm System Contractor may request a pre-construction kick-off meeting with the Architect, Fire Protection Engineer, General Contractor, Electrical Contractor, Building Owner Representative, and Owners IT Department (if applicable) to answer any specification and contract design related questions during the early design phase of the project.

B. The Fire Alarm System Contractor shall provide a written request for this meeting to the General Contractor that is addressed to the Architect.

C. The pre-construction kick-off meeting shall take place prior to submittal of equipment data sheets.

1.17 SEISMIC RESTRAINT AND BRACING

A. Provide seismic restraint and bracing for vertical and horizontal conduit loads and equipment mounted to walls in accordance with Section 1613.1 of the International Building Code (I.B.C.) and Chapter 13 of ASCE 7-10.

1.18 BUILDING EXPANSION, SEPARATION, OR SEISMIC JOINTS

A. The Fire Alarm System Contractor shall provide a junction box on each side of the Building Expansion, Separation, or Seismic joint.

B. The Fire Alarm System Contractor shall provide a section of flexible conduit between the junction boxes of sufficient length to accommodate for the calculated building movement.

C. The Fire Alarm System Contractor shall provide grounding bushings with #12 grounding cable to maintain continuity between junction boxes. Grounding cable shall be of sufficient length to accommodate for the calculated building movement.

D. The Fire Alarm System Contractor shall secure flexible conduit and grounding cable on each side of the Building Expansion, Separation, or Seismic joint.
1.19 SUBMITTALS

A. Product substitution during installation from the approved Equipment Submittals will not be allowed and shall result in the removal and re-installation of system components at no additional cost to the Owner.

B. All Substitution Requests shall be submitted on the forms provided in Division 0 or 1 of the General and Supplemental Conditions of the Project Manual.

C. Provide copies as specified by Division 1 and at a minimum provide six (3) sets of "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Graphic Map(s), and Manufacturer’s Data Sheets to the Architect/Engineer for approval prior to the purchase, fabrication, or installation of any system component. Failure to receive the Architect/Engineer approval that results in reordering of material, removal of installed system components, and the re-installation of the Fire Alarm System shall not be charged as additional cost to the Owner or General Contractor.

D. Equipment Submittals for the Fire Alarm System shall be submitted to the Architect / Engineer for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

E. All remote power supply locations deemed necessary by the Fire Alarm System Contractor shall be submitted for review and approval.

F. "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, and the Graphic Map(s) for the Fire Alarm System shall be submitted to the Architect / Engineer for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

G. Graphic Maps shall be submitted for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

H. Equipment submittals shall be broken up by "Tabbed Dividers" that shall include, at a minimum, the following:

1. Fire Alarm System Control Panel.
3. Power Supplies.
4. Initiating Devices.
5. Notification Appliances.
7. Modules.
8. Miscellaneous Equipment.

I. Equipment submittals shall include, at a minimum, the following:

1. Fire Alarm System Control Panel.
2. Fire Alarm System Control Panel Enclosures.
3. Fire Alarm System Terminal Cabinets
8. Internal Battery Chargers.
9. External Battery Chargers.
10. Initiation Devices:
    b. Manual Pull Station Stoppers (Shields).
    c. Heat Detectors.
    d. Linear Heat Detector Cables.
    e. Smoke Detectors.
    f. Duct Smoke Detectors.
    g. Duct Smoke Detector Remote Test Stations.
    h. Carbon Monoxide Only Detectors.
    i. Combination Smoke / Carbon Monoxide Detectors.
    j. Multi-Criteria Detectors.

11. Notification Appliances:
    a. Strobe only Appliances.
    b. Combination Horn / Strobe Appliances.

15. Relay Modules.
16. Multi-Voltage Relay Modules (Relay in Box).
17. Control Modules.
18. Zone Interface modules.
22. Magnetic Door Locks.
25. AES Wireless Transceiver.
26. Antenna.
27. Transient Voltage Surge Protection.
28. Wiremold Surface Raceway.
29. Wet Rated Cables.

J. Shop drawing submittals shall include the following information:

1. Floor plans identifying all Fire Alarm System components and devices.
2. Cabling / conduit routing and sizing.
3. Fire Alarm System zoning.
4. Point to point cabling diagrams.
5. One-line risers.
7. Voltage Drop Calculations.
8. Graphic Map Details / Artwork
K. Equipment Submittals, Back-Up Battery Calculations, Voltage Drop Calculations, and full-sized color bond Graphic Maps for the Fire Alarm System shall be contained within a single 3-ring hard cover binder having a typewritten index and divider sheets between categories with identifying tabs.

L. Equipment Submittals shall contain original brochures supplied by manufacturers (Photo copies of originals will only be accepted if they are clear and legible). Each type of device provided shall be identified in the Equipment Submittals using the same identification as shown on the drawings and specifications. The information included must be the exact equipment to be installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

M. If the submittals are being delivered electronically, the Fire Alarm System Contractor shall provide the following:

1. Submittal Drawings:
   a. The Submittal Drawings shall be a single PDF that is formatted to actual size (not 11x17) and collated in numerical order as designated in the title block of each drawing.

2. Equipment Submittals:
   a. The Equipment Submittal shall be a single PDF.
   b. The Equipment Submittal PDF shall contain all equipment, devices, and components that are collated for printing on 8½"x11" sized paper.
   c. The Equipment Submittal PDF shall be a searchable document.
   d. The Equipment Submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.
   e. The Equipment Submittal PDF shall contain a "Table of Contents" that indicates all pieces of equipment, devices, and components contained within each "Tabbed Divider" defined in Paragraph 1.13.G of this Specification Section.
   f. The Equipment Submittal PDF shall be bookmarked by "Tabbed Divider" and for each piece of equipment, device, and component.

3. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as part of the Equipment Submittal PDF shall be formatted to the following:
   a. Calculations shall be included at the end of the Equipment Submittal PDF under a separate "Tabbed Divider" for both Back-Up Battery Calculations and the Voltage Drop Calculations.
   b. The Equipment Submittal "Table of Contents" shall also indicate all calculations being provided for both the Back-Up Battery and the Voltage Drop Calculations

4. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as a separate PDF from the Equipment Submittal PDF:
   a. The single Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain all calculations that are collated for printing on 8½"x11" sized paper.
   b. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be a searchable document.
   c. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.
d. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Tabbed Divider" to separate the Back-Up Battery Calculations from the Voltage Drop Calculations.

e. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Table of Contents" that indicates all calculations contained within each "Tabbed Divider" defined in Paragraph 1.13.L.3.d of this Specification Section.

f. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be bookmarked by "Tabbed Divider" and for each Back-Up Battery Calculation or Voltage Drop Calculation.

5. Graphic Maps:
   a. Graphic Maps shall be submitted in a PDF that is full sized to allow printing of actual sized proposed Graphic Maps.

N. Review of Fire Alarm System submittal by the Engineer or Architect does not relieve the Contractor of responsibility for compliance with the intent of all contract documents and / or code.

O. Any material found to be installed without prior approval will be required to be removed and replaced with only specified approved material at Contractor's cost.

P. The contract documents shall not be used as the Fire Alarm System Contractor’s Shop Drawings.

Q. The Fire Alarm System Shop Drawings shall be system specific with only Fire Alarm System equipment and connections to other equipment that will be interfaced to the Fire Alarm System being shown.

R. All re-submittals shall have the areas of revision clearly marked with revision clouds.

S. The Fire Alarm System Contractor shall resubmit within 14 calendar days upon receiving a review letter rejecting any portion of the Fire Alarm System submittal.

1.20 CERTIFICATION AND LICENSING

A. The Fire Alarm System shall:

1. Be manufactured by an ISO 9001 certified company.

B. The Fire Alarm System Contractor shall:

1. Be currently listed and approved by Underwriters Laboratories Incorporated with a Certificate Service for Protective Signaling Services – Local, Auxiliary, Remote Station.
2. Be currently listed and approved by Underwriters Laboratories Incorporated for "Proprietary Protective Signal System Listing Program" with a UUJS certificate of compliance.

C. At the request of the Architect/Engineer, the Fire Alarm System Contractor shall provide:
   1. UL certificate specific to this installation.
   2. Proof of all Certificates and Listings

D. Fire Alarm System Shop Drawings shall be designed by one of the following (provide a copy of documentation):
   1. NICET Level III Certified Designer
   2. Registered Professional Fire Protection Engineer.

E. The Installing Fire Alarm System Contractor shall employ a minimum of NICET Level III technicians to:
   1. Provide and/or perform on site installation assistance throughout the duration of the project, up to and including acceptance of the Fire Alarm System by the Authority Having Jurisdiction.
   2. Oversee the final check-out and to ensure systems integrity.
   3. Trim and program the Fire Alarm System Control Panel.

F. Certificates issues by any company not directly associated with the installation of this project will be rejected.

G. The installing Contractor shall have a minimum of fifteen (15) years’ experience in the design, installation, servicing, and testing of the Fire Alarm System to be installed. A list of installations of a similar nature and scope shall be provided on request.

1.21 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The Fire Alarm System Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified.

1.22 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response to any Request for Information (RFI) regarding the Fire Alarm System work. To further expedite this process, if a suggestion can be determined or derived at by the initiator of the Request for Information (RFI), this suggestion shall be supplied with the submitted Request for Information (RFI). If no suggestion is given where one is possible, the RFI will be returned as incomplete.
B. All Fire Alarm System Request for Information (RFI) questions shall be written on the forms provided in Division 0 or 1 of the General and Supplemental Conditions of the Project Manual.

1.23 SCHEDULE OF VALUES

A. Provide schedule of values per Division 1 and related project requirements.

B. Provide a "Schedule of Values" that shall be broken down in accordance with the following subsection. Further breakdown into subcategories is at the option of the Contractor, except as noted below:

1. Engineering
2. Coordination Meetings
3. Materials and Labor
4. System Testing
   Closeout Materials

C. Engineering:

1. The dollar value for "Engineering" work associated with Fire Alarm System shall in no case be less than 17.00% of the total dollar value of the Fire Alarm System work or as indicated in Division 1, whichever is higher. "Engineering" work shall be a lump sum line item consisting of the following at a minimum:
   a. Shop Drawings
   b. Battery Back-Up Calculations
   c. Voltage Drop Calculations
   d. Equipment Submittals
   e. Permitting
   f. Architect and/or Engineer Approval

2. The Contractor is advised there will be no payments for "Engineering" until the submittal materials (Shop Drawings, Battery Back-up Calculations, Voltage Drop Calculations, and Equipment Submittals) have been reviewed and approved by the Architect and/or Engineer.

D. Coordination Meetings:

1. Provide a separate line item in the "Schedule of Values" for coordination meetings.
2. The dollar value for "Coordination Meetings" shall be not less than 3.00% of the total dollar value of the Fire Alarm System work.
3. The Contractor is advised there will be no payments for "Coordination Meetings" until documentation taken at the review meetings are received by the Architect and/or Engineer.

E. Materials and Labor:

1. Provide a separate line item in the "Schedule of Values" for "Materials and Labor" associated with the Fire Alarm System.
2. The Fire Alarm System shall be broken down into separate line items for installation work in the "Schedule of Values" consisting of the following at a minimum.
a. Each building shall have a line item.
b. Each wing of a building shall have a line item.
c. Each floor of a building shall have a line item.
d. Each "Phased Area" of the project, or area defined on the Architectural documents shall have a line item.

3. The dollar value for "Materials and Labor" shall be the remaining percentages of the total dollar value of all Fire Alarm System work.

F. System Testing:

1. Provide a separate line item in the "Schedule of Values" for "System Testing" associated with the Fire Alarm System.
2. The Fire Alarm System shall be broken down into separate line items for the following:
   a. Preliminary audibility testing (Decibel Readings).
   b. Preliminary system functionality testing.
   c. Final system functionality testing.
3. The dollar value for "System Testing" shall be not less than 20.00% of the total dollar value of the Fire Alarm System work.

G. Closeout Materials:

1. Provide a separate line item in the "Schedule of Values" for each "Closeout Material" consisting of the following at a minimum.
   a. Punch List
   b. Audibility Testing Results
   c. Warranty Letters
   d. Signed Test Certificates
   e. "As-Built" Drawings
   f. Operations and Maintenance Manuals
   g. Owner Training
   h. Testing Procedures and Frequency
   i. Electronic Copy of the Program Software
2. The dollar value for "Closeout Materials" shall be not less than 3.00% of the total dollar value of the Fire Alarm System work or as indicated in Division 1, whichever is higher.

H. The Contractor is advised that in addition to payments held out for retainage and project closeout materials, the Owner reserves the right to withhold 5% of the funds for any of the above categories until the systems have been proven to operate as specified and have been completely tested and approved.

1.24 QUALITY ASSURANCE

A. All devices, components, and equipment of the Fire Alarm system shall be listed as a product of a single Fire Alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), shall bear the UL label, and shall be listed under UL category UOJZ as a single control unit.
B. Partial or pending listings for a Fire Alarm system or components is not acceptable.

C. The Fire Alarm system installation shall comply with Article 760 of N.F.P.A. #70 with all circuits being marked in accordance with Article 760-30, 760-176, and 760-179.

D. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.
2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

1.25 OPERATIONS AND MAINTENANCE MANUAL

A. Bind Operation & Maintenance Manual for the Fire Alarm System in a single three-ring tabbed hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

OPERATION
AND
MAINTENANCE
MANUAL
FIRE ALARM SYSTEM

B. The Operations and Maintenance Manuals shall include a complete materials list of the Fire Alarm system including the addresses and phone numbers of local sources of replacement parts.

C. Operation and Maintenance manuals shall contain the following:

2. Cabling diagrams.
3. Operation and Maintenance instructions.
4. Replacement parts lists.
5. Manufacturer’s equipment submittal literature for all components.
6. Typewritten "Sequence of Operations".
7. Thorough testing procedures.
8. Recommended testing frequency for each item.

D. Operation and Maintenance Binders:

1. Binders shall be commercial quality, 8-1/2 x 11-inch (3) D-ring binders
2. Binders shall have durable plastic covers with clear pockets on the cover and spine to hold labels.
3. Binders shall have a 1" minimum and 3" maximum ring size.
4. Binders shall not be filled more than 2/3 of its capacity to accommodate future revisions.
5. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the project manual table of contents. Cross reference other binders where necessary to provide essential information for proper operations and maintenance of each piece of equipment.
E. Operation and Maintenance manuals shall contain the following:

1. Cover: Identify each binder with a typed or printed title.
2. Project Directory: Name, address, and phone number of Architect, General Contractor, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.
3. Table of Contents: List every item separated by a divider, using the same identification as on the divider tab.
4. Dividers: Provide heavy paper dividers with printed tabs for each section. Immediately following the divider tab include a description of product.
5. Typewritten Operation and Maintenance instructions.
6. Complete replacement parts list with part numbers.
7. Manufacturer’s equipment submittal literature for all components used in the system.
8. Typewritten "Sequence of Operations".
9. Thorough testing procedures.
10. Recommended testing frequency for each item.
11. Acceptance Test Certificates.
12. Copy of "As-Built" drawings.
   a. Where oversized drawings are necessary, fold drawings to the same size as text pages and use as foldout.
   b. If drawings are too large to be used practically as a foldout, place the drawing neatly folded in the front or rear pocket of the binder. Insert a typewritten page indicating drawing title, description of contents and drawing location in the appropriate location in the manual.
13. Warranties: Provide a copy of each warranty in the appropriate manual. Provide written data outlining the procedures to follow in the event of product failure.
14. Electronic copy of the final system program software. (USB Drive / CD)

F. Submit copies as specified by Division 1, and at a minimum, provide three (3) copies of Operation & Maintenance Manual to Architect and Engineer to review prior to scheduling the training session.

G. Operation and Maintenance manuals shall contain original color printed brochures supplied by manufacturers (Xerox black and white copies of originals will not be accepted).

H. The information included must be the exact equipment installed not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

I. Cabling Diagrams for each system shall be complete for the specific system installed under the Contract with typical "Cabling Diagrams" not being acceptable.

1.26 TRAINING MANUAL

A. The Training Manual shall contain a Syllabus titled "Section 28 31 00 Fire Alarm System – Training Syllabus".

B. Prior to starting the training session, provide a quantity of up to ten (10) Training Manuals to the Owners staff.
C. Each Training Manual shall be in its own 3-ring hard covered binder that shall be sized to allow for 20% additional documentation.

D. The spine and front cover of each Training Manual shall have a clear cover with a typed insert with the following information:
   1. Labeled "Section 28 31 00 Fire Alarm System – (City of Pacific Maintenance Shop) Training Manual".
   2. Site Name.
   3. Site Address.
   4. Project Name.
   5. Project address.
   6. Current Date.
   7. Installing Fire Alarm System Contractor.
   8. Installing Fire Alarm System Contractor’s Address.
   9. Installing Fire Alarm System Contractor’s Contact Name.
   10. Installing Fire Alarm System Contractor’s Phone Number.

E. Each Training Manual shall include the following:
   1. Use color coded numbered tabs to separate each item defined below and for each device that was installed.
   2. Provide a "Table of Contents" as the first page indicating each piece of equipment or device document.
   3. "Section 28 31 00 Fire Alarm System – (site name here) Training Syllabus".
   4. Provide color copies of a power point presentation consisting of two slides per page that demonstrates typical functions and operational instructions of the new Fire Alarm System that shall consist of, but not limited to the following:
   5. Step-by-step instructions of the most common features.
   6. How to acknowledge and silence an "Alarm" condition.
   7. How to acknowledge and silence a "Trouble" condition.
   8. How to acknowledge and silence a "Supervisory" condition.
   9. How to operate the "Drill" feature.
   10. What to do when there is a "Dirty Detector" alert.
   11. What to do when there is a loss of dialer communication alert.
   12. How and when the Owners Maintenance Staff should call for help.
   13. Include the Manufacturer’s Software User’s Manual.

1.27 WARRANTY LETTER

A. The Fire Alarm System contractor shall warranty the Fire Alarm System against defects in materials and workmanship for a period of 1 year from date of approved acceptance testing.

B. Provide a "Certificate of Warranty" letter at the completion of the project. The date of "Substantial Completion" shall be clearly shown on the letter indicating when the warranty period begins.

C. The "Certificate of Warranty" letter shall be signed by the Fire Alarm System contractor.
D. The "Certificate of Warranty" shall be included as part of the Operation and Maintenance Manual. The date of "Substantial Completion" shall be the date indicated on the approved test certificate that was signed by the Authority Having Jurisdiction for system acceptance.

E. The full cost of maintenance, labor, and materials required to correct any defect during this one-year period shall be included in the submittal bid.

1.28 TEST CERTIFICATES

A. Completely fill out the Fire Alarm System "Record of Completion" documents contained within the latest adopted Edition N.F.P.A. #72 and provided to the Owner at completion of this project.

B. Obtain the Authority Having Jurisdiction signature, printed name, date, and telephone number on the "Record of Completion" documents.

C. Upon completion of the Fire Alarm System installation, testing, and Instruction & Training, the Installing Vendor shall provide the following Signed Test Forms:

1. The signed original "Record of Completion".
2. The signed original Fire Alarm System Permit.

1.29 PREVENTATIVE MAINTENANCE AGREEMENT

A. Prior to completion of the Fire Alarm system installation, the Fire Alarm System Contractor shall provide a preventative maintenance agreement, which shall at the Owners option, become effective at the end of the 12-month warranty period.

1.30 OFF SITE MONITORING SERVICE AGREEMENT

A. Upon completion of the project, the Fire Alarm System Contractor shall provide to the Owner, an agreement for the purpose of providing off-site monitoring services.

1.31 AS-BUILT DRAWINGS

A. The Fire Alarm System Contractor shall maintain, in addition to any reference drawings, an "As-Built" set of drawings, which have been reproduced from the approved site set on which all deviations from the original design shall be drafted in a neat legible manner with red colored pencil.

B. "As-Built" drawings shall clearly indicate the following:

1. Actual routing of all raceways.
2. Actual cable type, numbers, and routing.
4. Connection diagrams.
5. Interface of all components in the system.
6. Equipment and device locations.
7. Final room names and numbers.
8. Programming addresses assigned for all components.

C. The room numbering system depicted in all graphics and referenced in data bases generated by the Fire Alarm System Contractor shall match that of the final signage and room identification system adopted by the Owner, unless specifically approved otherwise in writing by the Owner.

D. The "As-Built" drawings shall show actual installation from all addenda items, change orders, field authorizations, design changes, installation modifications, etc.

E. The Fire Alarm System Contractor shall update all references to specific products to indicate products actually installed on project.

F. Upon completion of work, the Fire Alarm System Contractor shall deliver the red lined drawings and one set of neatly drafted "As-Built" drawings on electronic media in AutoCAD format to the Architect for the Engineer to review and accept prior to being forwarded to the Owner for their records.

1.32 PROGRAM SOFTWARE

A. Following the completion of final system programming, the Fire Alarm System Contractor shall provide to the Owner an electronic copy of the final system program software and "Point Status Report".

B. A hard copy of the "System Report" which documents the status of all active devices in the system shall also be provided.

C. The software program shall be compatible with an IBM PC and provided with a verification software package.

D. A report shall be generated of the test results and two hard copies submitted to the Architect / Engineer for review.

E. Provide no less than (1) software upgrade and (1) firmware upgrade at the end of the 1-year warranty period.

1.33 SPARE PARTS

A. The Fire Alarm system contractor shall include in this "Scope of Work" the following list of material as "Spare Parts":

<table>
<thead>
<tr>
<th>QTY</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual Pull Stations</td>
</tr>
<tr>
<td>1</td>
<td>Manual Pull Station Stoppers</td>
</tr>
<tr>
<td>1</td>
<td>Photoelectric Smoke Detectors</td>
</tr>
<tr>
<td>1</td>
<td>Smoke Detector Bases</td>
</tr>
<tr>
<td>1</td>
<td>Combination Horn / Strobe Appliances</td>
</tr>
<tr>
<td>5</td>
<td>Device Boxes</td>
</tr>
<tr>
<td>5</td>
<td>4S J-boxes with blank covers</td>
</tr>
</tbody>
</table>
B. All Spare Parts shall be the same components as those components installed in the system.

C. Provide signed proof of delivery to the Owner with close out documentation.

1.34 CLOSEOUT MATERIAL

A. The Fire Alarm System close out material shall be submitted to the Architect / Engineer for review and approval prior to being provided to the Owner.

B. All close out materials shall be contained within a single 3-ring hard cover binder.

C. The close out materials shall include the following at a minimum:


2. Training Manuals: See Paragraph 1.30 of this Specification Section for "Training Manual" requirements.

3. Warranty Letters: See Paragraph 1.31 of this Specification Section for "Warranty Letter" requirements.

4. Test Certificates: See Paragraph 1.32 of this Specification Section for "Test Certificate" requirements.

5. Preventative Maintenance Agreement: See Paragraph 1.33 of this Specification Section for "Preventative Maintenance Agreement" requirements.

6. Off-Site Monitoring Services Agreement: See Paragraph 1.34 of this Specification Section for "Off-Site Monitoring Service Agreement" requirements.

7. "As-Built" Drawings: See Paragraph 1.35 of this Specification Section for "As-Built" Drawing requirements.

8. Program Software: See Paragraph 1.36 of this Specification Section for "Program Software" requirements.

9. Spare Parts: See Paragraph 1.37 of this Specification Section for "Spare Parts" requirements.

1.35 SERVICE

A. All Fire Alarm System equipment shall be of a single supplier and installed by an authorized factory distributor, having a local office located within 50 miles of the project site that is staffed with trained full-time employees who are capable of performing testing, inspections, repair, maintenance, and has the ability to provide prompt emergency services.

B. For non-emergency service, response time of the technician to the site shall not exceed 4 hours.

C. Service calls received before 1:00 P.M. shall be provided that day and service calls received after 1:00 P.M. shall be the following business day.

D. For emergency service, response time of the technician to the site shall not exceed 2 hours in accordance with NFPA 72 Section 26.3.8.
1.36 BATTERY BACK-UP CALCULATIONS

A. Battery Back-Up power shall be an integral part of the Fire Alarm System and shall automatically switch over upon the loss of AC power.

B. It shall be the Fire Alarm System Contractor’s responsibility to confirm that the proposed Fire Alarm system will meet or exceed the local Authority Having Jurisdiction (AHJ) requirements for Battery Back-Up power.

C. At a minimum, provide battery Back Up power for the entire Fire Alarm system to provide 24 hours of standby operation immediately followed by a minimum of 5 minutes of alarm operation.

D. Battery Back-up Calculations for each Control Panel and/or Power Supply shall indicate the following:

1. "Standby" or Non-Active Mode: "Amp Draw" for each device, quantity of each device, and total "Amp Draw" load for each circuit of the Fire Alarm System Control Panel and/or Power Supply.

2. "Alarm" or Active Mode: Individual "Amp Draw" of each device, quantity of each device, and total "Amp Draw" load in with all devices operating at the maximum load condition for each Control Panel and/or Power Supply.

3. Total "Amp Draw" load required by each Control Panel and/or Power Supply for verifying selection of back-up batteries.

E. For systems that include an Uninterruptible Power Supply (UPS), provide the maximum load allowed by the UPS manufacturer and list each item along with its maximum load that will be connected to the UPS.

1.37 VOLTAGE DROP CALCULATIONS

A. Provide the Voltage Drop Calculations for each Fire Alarm System Control Panel and/or Power Supply circuit.

B. Voltage Drop Calculations for each Fire Alarm System Control Panel and/or Power Supply circuit shall indicate the following:

1. All devices on each circuit.

2. Quantity of each device on each circuit.

3. Cable length of each circuit.

4. Gauge of cabling for each circuit.

5. Total line loss for each circuit.

6. Factor the line loss and "Amp Draw" to show the actual voltage available at the end of each circuit (after the last device).

1.38 SPARE CAPACITY

A. Spare capacity shall be incorporated into the Fire Alarm System design to support future expansion or renovations.
B. The minimum spare capacities shall be provided for the following circuits:

1. 25% for each Signaling Line Circuit (SLC).
2. 25% for each Initiating Device Circuit (IDC).
3. 25% for each Notification Appliance Circuit.

C. Batteries shall be provided with at least 25% spare capacity.

D. Conduit and wiremold fill shall not exceed 40% of the interior cross-sectional area.

PART 2 - PRODUCTS

2.1 DOMESTIC PRODUCTS

A. All Fire Alarm system components and devices shall be domestically made.

B. Products shall comply with the requirements of the "Buy American Act - Construction Materials under Trade Agreements", current adopted edition for components and devices on this project.

2.2 FIRE ALARM SYSTEM CONTROL PANEL

A. The Fire Alarm System Control Panel:

2. Each subassembly of the Fire Alarm System Control Panel shall include the appropriate UL modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts.
3. The Fire Alarm System Control Panel shall be capable of both "Class A" and Class "B" circuits.
4. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
5. The Fire Alarm System Control Panel shall be capable of supporting the following items at a minimum:
6. Provide new Circuit Labels and Directory cards for panels modified and / or added.
7. The Fire Alarm System Control Panel shall have a minimum 6-amp power supply and be capable of expansion to a maximum of 54 total amps via bus connected expander modules that supervise low battery, loss off AC, and loss of communication.
8. The Fire Alarm System Control Panel shall be capable of being programmed, configured, edited, and expanded onsite without requiring special equipment or the use of any external programming equipment.
9. The system programming shall be "Backed Up" via an upload/download program.
10. Audible and visual annunciation of any "Alarm", "Trouble", or "Supervisory" condition at the Fire Alarm System Control Panel, at the Fire Alarm System Remote Annunciator Panel(s), and at the operator's terminals,


12. The Fire Alarm System Control Panel shall provide the following features:
   a. Supervision of all initiating and notification circuits throughout the facility by way of connection to addressable control, monitor, and relay modules.
   b. Detect the activation of any initiating device and the location of the alarm condition.
   c. Operate all notification appliances and auxiliary devices as programmed.
   d. PAS pre-signal, meeting N.F.P.A. #72 requirements.
   e. Rapid manual station reporting (under 3 seconds).
   f. Coding panel node notification circuits in March Time (120 PPM), Temporal (N.F.P.A. #72), and California Code
   g. Periodic detector test (conducted automatically by the software).
   h. Shall support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes).
   1) Two stage operation shall allow 20 Pulses per Minute (PPM) on alarm and 120 Pulses per Minute (PPM) after 5 minutes or when a second device activates.
   2) Canadian Dual stage operation is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5-minute timer.
   i. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
   j. Cross zoning with the capability of counting two detectors in "Alarm", two software zones in "Alarm", or one smoke detector and one heat detector in "Alarm".
   k. Coding option that will synchronize specific strobe lights designed to accept a specific "Sync Pulse".
   l. Control-by-time for non-fire operations (with holiday schedules).
   m. Day/night automatic adjustment of detector sensitivity.
   n. Device "Blink Control" to turn off detector / module Light Emitting Diodes (LEDs) for special areas such as sleeping areas.

13. Install Synchronization modules and/or equipment to meet all code requirements that are powered from a Notification Appliance Circuit (NAC) for the following appliances:
   a. Visual Notification Appliances (strobes)
   b. Audible Notification Appliances (horns)

14. The Signaling Line Circuit (SLC) interface board shall be able to drive a "Class B" twisted unshielded circuit up to 12,500 feet in length.

B. The Central Processing Unit (CPU):

1. The Fire Alarm System Control Panel shall contain a microprocessor based Central Processing Unit (CPU) that shall communicate with, monitor, and control all external interfaces and annunciate A "Trouble" condition for a loss in communications for the following at a minimum:
   a. Intelligent Addressable Smoke Detectors.
   b. Intelligent Addressable Thermal (Heat) Detectors.
c. Addressable Modules.
d. Control Circuits.
e. Notification Appliance Circuits.
f. Local and Remote Operator Terminals.
g. Transponders.
h. Annunciators.
i. Other System Controlled Devices.
j. Peripheral Equipment.

2. It shall include an EPROM for system program storage, flash memory for building specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

3. Upon a loss of response from a device, the Central Processing Unit shall:
   a. Sound an audible trouble
   b. Illuminate a Light Emitting Diode (LED) indicating loss of communications.
   c. Indicate which device or devices are not responding
   d. Print the information in the history buffer.

4. The Central Processing Unit shall contain and execute all control-by-event programs for specific action to be taken if an "Alarm" condition is detected by the system that shall be held in non-volatile programmable memory and shall not be lost with system primary and secondary power failure.

5. A special program check function shall be provided to detect common operator errors.

6. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.

7. The Central Processing Unit shall provide a real-time clock for time annotation of system displays, events, and history files that shall not be lost if system primary and secondary power supplies fail.

8. The Central Processing Unit’s real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

9. The Central Processing Unit and associated equipment shall be protected from voltage surges or line transients.

10. Data transmissions between the Central Processing Unit and each peripheral device shall be continuously scanned for proper operation, reliable, and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.

11. The Central Processing Unit shall provide double pole relays for the following items:
   a. FIRE ALARM
   b. SYSTEM TROUBLE
   c. SUPERVISORY

12. The Central Processing Unit shall provide one high-speed serial connection for support of network communication modules.

13. In the event of Central Processing Unit failure, all Signaling Line Circuits (SLC's) loop modules shall fallback to degrade mode.
   a. Degrade mode shall treat the corresponding Signaling Line Circuits (SLC's) loop control modules and associated detection devices as conventional two-wire operation.
   b. Activation of any initiating device in this mode shall automatically activate associated Notification Appliance Circuits.
C. The Fire Alarm System Control Panel System Display Interface Assembly:

1. The Fire Alarm System Control Panel shall include a full featured System Display Interface Assembly that shall include the following:
   a. A backlit 80-character Liquid Crystal Display (LCD)
   b. Individual, color coded system status LEDs
   c. Display custom alphanumeric labels.
   d. Label information shall be stored in programmable nonvolatile memory (NVRAM).
   e. May be used to program all system operational parameters.
   f. Display battery charging current and voltage.

2. It shall also provide 10 Light Emitting Diodes (LEDs), which will indicate the status of the following system parameters:
   a. AC POWER: Green LED
   b. SYSTEM ALARM: Red LED
   c. SYSTEM TROUBLE: Yellow LED
   d. SIGNAL SILENCE: Yellow LED
   e. CPU FAILURE: Yellow LED
   f. SUPERVISORY: Yellow LED
   g. OTHER EVENT: Yellow Light Emitting Diode (LED)

3. Two different password levels will be accessible through the System Display Interface Assembly to prevent unauthorized system control or programming.
   a. Level 1 (User): Shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager).
   b. Level 2 (Master): Shall be used for actual change of the life safety program (installer) and allow access to password change screens.
   c. These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one-minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

4. The System Display shall include the following operator control switches:
   a. SIGNAL SILENCE
   b. LAMP TEST
   c. RESET
   d. ALARM ACTIVE (DRILL SWITCH)
   e. ACKNOWLEDGE

5. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type including:
   a. AC POWER
   b. FIRE ALARM
   c. PRE-ALARM WARNING
   d. SUPERVISORY SIGNAL
   e. TROUBLE
   f. DISABLED POINTS
   g. ALARM SILENCED
D. System Reports:

1. The Fire Alarm System shall provide means to obtain a variety of reports listing all:
   a. Events
   b. "Alarm" Conditions
   c. "Trouble" Conditions
   d. "Supervisory" Conditions
   e. Additional reports shall be available for the following:
   f. Last Walk Test performed
   g. Detector maintenance report containing the status of each installed addressable detector
   h. All Network Parameters
   i. All panel settings including broadcast time
   j. Event Ordering
   k. Block Acknowledge
   l. Panel timer values for Auto Silence
   m. Silence Inhibit
   n. AC Fail Delay time
   o. Supervision settings for power supply
   p. Supervision settings for printers
   q. All programmed logic equations
   r. All custom action messages
   s. All non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only
   t. Troubles Only
   u. Supervisory Alarms
   v. Pre-Alarms
   w. Disabled Points
   x. Activated Points
   y. All installed points filtered by Signaling Line Circuits (SLC) points
   z. Logic Zones
   aa. Annunciators
   bb. Releasing Zones
   cc. Special Zones
   dd. Trouble Zones

E. Enclosures:

1. The Fire Alarm System Control Panel Enclosure shall be listed to UL #50 "Enclosures for Electrical Equipment, Non-Environmental Considerations", N.F.P.A. #72, and shall be approved for fire protection service.
2. The control panel enclosure shall be suitable for surface or semi-flush mounting.
3. The control panel enclosure shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
4. The back box and door shall be constructed of 0.060" steel with provisions for electrical conduit connections into the sides and top.
5. The door shall be provided with a key cylinder lock and include a transparent opening for viewing all indicators.
6. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
7. The control panel enclosure shall be modular in structure for ease of installation, maintenance, and future expansion.

2.3 FIRE ALARM SYSTEM TERMINAL CABINETS

A. Fire Alarm System Terminal Cabinets shall be listed to UL #50 "Enclosures for Electrical Equipment, Non-Environmental Considerations", N.F.P.A. #72, and shall be approved for fire protection service.

B. The terminal cabinet shall be suitable for surface or semi-flush mounting.

C. The terminal cabinet shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

D. The back box and door shall be constructed of 0.060" steel with provisions for electrical conduit connections into the sides and top.

E. The door shall be provided with a keyed cylinder lock that is keyed similar to the main Fire Alarm Control Panel enclosure and include a transparent opening for viewing all indicators.

F. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.

G. The terminal cabinet shall be modular in structure for ease of installation, maintenance, and future expansion.

2.4 FIRE ALARM REMOTE ANNUNCIATOR PANELS (FARAP)

A. Provide a Fire Alarm Remote Annunciator Panel in the location(s) indicated on the contract documents.

B. The Fire Alarm Remote Annunciator Panel(s) shall be programmed to clearly indicate the exact same information that is displayed at the Fire Alarm Control Panel and shall be protected from unauthorized use by a keyed switch (similar to the main Fire Alarm Control Panel enclosure) or password.

C. The alphanumeric display annunciator shall be a supervised back-lit Liquid Crystal Display (LCD) containing a minimum of (80) eighty characters for visual annunciation of "Alarm", "Trouble", and "Supervisory" conditions.

D. The Fire Alarm Remote Annunciator Panel shall be provided with an integral piezo sounder for audible indication of an "Alarm" or "Trouble" conditions.

E. The Fire Alarm Remote Annunciator Panel shall be UL listed for Fire Alarm application with an On-line/Power Light Emitting Diode (LED).
F. The Fire Alarm Remote Annunciation Panel shall be capable of the following system functions:

1. Acknowledge.
2. Signal Silence.

2.5 MAIN FIRE ALARM SYSTEM POWER SUPPLIES (FAPS)


B. The Main Fire Alarm System Control Panel Power Supply shall be integral to the Fire Alarm System Control Panel itself or may be placed adjacent to the Fire Alarm System Control Panel within a separate key lockable metal enclosure that is approved by the manufacturer.

C. The Main Fire Alarm System Control Panel shall provide all power requirements for the Fire Alarm System Control Panel plus additional power for operation of external Notification Appliance Circuits (NACs), remote annunciators, remote paging units, etc.

D. The Main Fire Alarm System Control Panel Power Supply input power shall be 120 Volts A.C. at 50/60 Hertz.

E. The Main Fire Alarm System Control Panel shall continuously monitor all field cabling for Earth Ground conditions, and shall have the following "Trouble" Light Emitting Diode (LED) indicators:

1. AC Power Fail
2. Battery Fail
3. Negative Ground Fault
4. Positive Ground Fault

F. The Main Fire Alarm System Control Panel Power Supply shall be modular in design allowing additional Remote Power Supplies to be added.

2.6 REMOTE POWER SUPPLIES

A. Remote Power Supplies shall meet UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems", N.F.P.A. requirements for power-limited operation, and shall be approved for fire protection service.

B. Provide Remote Power Supplies as required for a fully functional system.

C. Remote Power Supplies shall be placed in a key lockable metal enclosure that is approved by the manufacturer in locations approved by the Electrical and Fire Protection Engineer for auxiliary power to supply Notification Appliance Circuits (NACs).

D. Remote Power Supply input power shall be 120 Volts A.C. at 50/60 Hertz.
E. Remote Power Supplies shall be modular in design allowing additional Remote Power Supplies to be added.

2.7 BACK-UP BATTERIES

A. Provide quantities of Back-Up Batteries that exceed the minimum Back-Up Battery calculation requirements specified in Paragraph 1.30 of Specification Section 28 31 00.

B. Back-Up batteries for the Fire Alarm Control Panel Power Supply and for each Remote Power Supply shall be a minimum of 12 Volts D.C.

C. Back-Up Batteries shall be Absorbed Glass Material (AGM) or Gel style sealed batteries.

D. Back-Up Batteries shall have the following features:
   2. Deep Cycle.
   3. Used in any Position.
   4. Low Self-Discharge Rates.
   5. Safe for use in Low Ventilated Areas.
   6. Can be transported by Ground or Air.

E. All batteries shall be placed inside a key lockable metal enclosure that is approved by the manufacturer.

F. Each battery shall have the date of installation written on the battery with a permanent marker and be visible when the enclosure door is open.

G. The back-up batteries shall be completely sealed, maintenance free, leak proof, and usable in any position.

2.8 INTERNAL BATTERY CHARGERS

A. The entire Fire Alarm System shall automatically charge Back-Up Batteries by an Internal Battery Charger that operates on a 120 Volts A.C. power source.

B. The Internal Battery Charger shall either be trickle or float charged and shall be capable of recharging batteries from a fully discharged condition to 100% within a 48-hour time period.

C. The Internal Battery Charger shall be an integral component of the Fire Alarm System Control Panel.

D. The charging rate of the Internal Battery Charger shall reduce upon attaining a fully charged condition to avoid damaging of the batteries.

E. The Internal Battery Charger shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.
F. The Internal Battery Charger shall be provided with a means for monitoring integrity to detect a battery charger failure and to provide a "Trouble" signal at the Fire Alarm System Control Panel.

G. This Internal Battery Charger will automatically inhibit the deep discharge of the system secondary batteries and shall be protected against the accidental reverse polarity connection of the secondary batteries.

2.9 EXTERNAL BATTERY CHARGERS

A. External Battery Charger shall automatically charge Back-Up Batteries and shall operate on a 120 Volts A.C. power source.

B. The External Battery Charger shall either be trickle or float charged and shall be capable of recharging batteries from a fully discharged condition to 100% within a 48-hour time period.

C. The External Battery Charger shall have the following forms of input:

1. A Notification Appliance Circuit (NAC) from the Fire Alarm System Control Panel.
2. A relay.

D. The charging rate of the External Battery Charger shall reduce upon attaining a fully charged condition to avoid damaging of the batteries.

E. The External Battery Charger shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.

F. The External Battery Charger shall be provided with a means for monitoring integrity to detect a battery charger failure and to provide a "Trouble" signal at the Fire Alarm System Control Panel.

G. This External Battery Charger will automatically inhibit the deep discharge of the system secondary batteries and shall be protected against the accidental reverse polarity connection of the secondary batteries.

2.10 MANUAL PULL STATIONS

A. Manual Pull Stations shall be listed to UL #38 "Standard for Manual Signaling Boxes for Fire Alarm Systems" and be compatible with the Fire Alarm System Control Panel.

B. Manual Pull Stations shall be double action type with a key operated test/reset lock (keyed similar to the Fire Alarm Control Panel), and designed so that after actuation, the Manual Pull Station cannot be restored to normal operating condition without the use of the key.

C. Manual pull stations shall be constructed of metal, Lexan, or polycarbonate with clearly visible operating instructions and the word "FIRE" in white lettering provided on the cover.

D. Each Manual Pull Stations shall be supervised by the Fire Alarm Control Panel.
E. Manual Pull Stations(s) shall not require more than 5 pounds of pull force to actuate.

F. Weatherproof Manual Pull Stations installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.
2. Shall have an operating temperature between -40°F and 151°F.

2.11 MANUAL PULL STATION STOPPERS (SHIELDS)

A. Manual Pull Station Stoppers (Shields) shall be U.L. Listed and approved for use with the Manual Pull Station being protected.

B. Manual Pull Stations located in Gymnasiums, Multi-Purpose Rooms, or other spaces in which impact to manual pull stations would be common and would cause a false alarm or damage shall be provided with a clear tamperproof polycarbonate or Lexan Stopper (Shield) and frame.

C. When required by the Authority Having Jurisdiction, the Manual Pull Station Stopper (Shield) shall be provided with an integral 9 Volts D.C. battery operated piezo warning horn that produces a warning sound of 95 dB at a distance of 1'-0".

D. The cover shall have the message "IN CASE OF FIRE – LIFT COVER" readily visible.

E. Weatherproof Manual Pull Station Covers installed outdoors or in places of high humidity shall be provided with a closed cell gasket or a rain tight seal.

2.12 HEAT DETECTORS


B. Heat Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. Heat Detectors shall be provided with (2) two Light Emitting Diodes (LEDs) to provide visible Heat Detector status that shall be controlled by the Fire Alarm System Control Panel.

1. The Fire Alarm System Control Panel shall provide coded signals to the Heat Detector that shall cause the Light Emitting Diodes (LEDs) to indicate the following status:

2. Normal Operating Condition
3. Alarm Condition
4. Latch On
5. Latch Off

D. An output connection shall also be provided in the base of the Heat Detector for connections to the following items:

1. External remote alarm Light Emitting Diode (LED).
2. Sounder base rated at a minimum of 85 dBA.
3. "Form C" Relay base.
4. Isolator base.

E. Heat Detectors shall have the following characteristics:
   1. Low profile ceiling-mount/wall-mount.
   2. Allow pre-cabling of the base.
   3. Plug-in style of head.
   4. Mounted into a twist-lock base.
   5. Constructed of off-white UV resistant polymer.
   6. Detachable from the mounting base.
   7. Cabling terminals accessible from the “room-side” after mounting.

F. Upon receiving an alarm signal at the Fire Alarm Control Panel from a Heat Detector, all notification appliances shall operate.

G. Heat Detectors shall have a maximum listed smooth ceiling "Area of Coverage" of 50'-0" x 50'-0" (2,500 square feet) and shall be installed in accordance with N.F.P.A. #72.

H. Heat Detector Types:
   1. "Fixed Temperature" Heat Detectors:
      a. "Fixed Temperature" Heat Detectors shall be rated at 135°F where ambient temperature does not exceed 100°F and rated for 194°F Fahrenheit in areas subject to high ambient temperatures in excess of 100°F.
      b. "Rate of Rise" Heat Detectors:
      c. "Rate of Rise" Heat Detectors shall have an element rated at 15°F per minute.
   2. Combination "Fixed Temperature" and "Rate of Rise" Heat Detectors:
      a. The "Fixed Temperature" portion of the Heat Detectors shall be rated at 135°F where ambient temperature does not exceed 100°F and rated for 194°F Fahrenheit in areas subject to high ambient temperatures in excess of 100°F.
      b. The "Rate of Rise" portion of the Heat Detector shall have an element rated at 15°F per minute.

I. Provide remote indicating lamps for Heat Detectors that when installed, the Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, in an attic, etc.

J. Provide anti-ligature guards for Heat Detectors installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.13 LINEAR HEAT DETECTION CABLES

B. Linear Heat Detector Cables shall be comprised of (2) low resistance, tri-metallic steel conductors individually encased in a heat sensitive polymer. The encased conductors are twisted together to impose a spring pressure between them, then spirally wrapped with a protective tape and finished with an outer jacket that is flame retardant, chemical resistant, low moisture absorption, and UV protected to suit the installation environment.

C. The inner conductors of the Linear Heat Detector Cables are coated with a vinyl of polymer-based jacket that are chemically engineered to break down at specific fixed temperatures allowing the conductors to make contact with one another and thereby signal an "Alarm" condition.

D. Linear Heat Detector Cables shall consist of sensing elements which respond to a specific temperature at any point along their length and shall not require that any special length be heated in order to initiate an "Alarm" condition.

E. Linear Heat Detector Cables shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

F. Linear Heat Detector Cables shall be installed in continuous runs without taps or branches in accordance with applicable sections of N.F.P.A. #70, N.F.P.A. #72, or as determined by the local Authority Having Jurisdiction.

G. Linear Heat Detector Cables shall be simple to install and in-line spliced with Splicing Sleeves or Splicing Connections using common tools. Junctions shall be made without affecting the integrity of the system.

H. Linear Heat Detector Cables installed in areas of high humidity or dampness shall require the use of SFTS Sealant Tape for all in-line splices where Splicing Sleeves or Splicing Connections are used.

I. The Linear Heat Detector Cable portion of every initiating circuit shall terminate at each end in the following locations with terminals, the use of wire nuts or other similar wiring devices is not allowed.
   1. An Approved Zone Box.
   2. End-of-Line Zone Box.
   3. Or other approved junction box provided as part of the system.

J. Strain relief connectors shall be installed in all junction boxes where Linear Heat Detector Cables enter or exit the enclosure to hold the cable securely and the conduit shall be completely closed off with duct seal so that no gases, condensation, or dust will be able to reach the inside of the enclosure.

K. All zone box enclosures shall be rated and approved for use in the environment where they will be installed.

L. Whenever the Linear Heat Detector Cable comes within 6'-0" of the floor, it should be enclosed in conduit. This applies particularly to entry into:
   2. Control Units.
3. Zone or end-of-line junction boxes.
4. To all runs through floors.

M. Linear Heat Detector Cable sensitivity shall not be affected by changes in ambient temperature or length of cable used on the detection circuit.

N. The maximum length of each Linear Heat Detector Cable shall be limited by the capacity of the Fire Alarm System Control Panel but shall not exceed 5,000 lineal feet.

O. Where mounting of Linear Heat Detector Cables is difficult due to lack of appropriate support structures or mounting surfaces, the Linear Heat Detector Cables shall be provided with Messenger wires.

1. Messenger wires shall consist of high tensile strength stainless steel wire.
2. Messenger wires shall be wound around the Linear Heat Detector Cable at the rate of approximately one turn per foot.
3. When using Messenger wires, turnbuckles and eyebolts must be employed at each end of a run to place tension on the support wire.
4. The maximum Linear Heat Detector Cable run length between turnbuckles shall not exceed 250'-0".
5. The Messenger wire must also be supported with approved intermediate fasteners at intervals ranging from 15'-0" to 50'-0" depending upon the application.

2.14 SMOKE DETECTORS

A. Smoke Detectors shall be listed to UL #217 "Standard for Single and Multiple Station Smoke Alarms", UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors", UL #268 "Smoke Detectors for Fire Alarm Systems", and UL #1730 "Standard for Smoke Detector Monitors and Accessories for Individual living Units of multifamily Residences and Hotel/Motel Rooms".

B. Smoke Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. Smoke detector sensitivity shall be set through the Fire Alarm System Control Panel and shall be adjustable in the field through the field programming of the system to meet the requirements of N.F.P.A. #72.

D. Smoke Detectors shall be provided with (2) two Light Emitting Diodes (LEDs) to provide visible Smoke Detector status that shall be controlled by the Fire Alarm System Control Panel.

E. The Fire Alarm System Control Panel shall provide coded signals to the Smoke Detector that shall cause the Light Emitting Diodes (LEDs) to indicate the following status:

1. Normal Operating Condition
2. Alarm Condition
3. Out of Sensitivity
4. Latch On
5. Latch Off
F. An output connection shall also be provided in the base of the Smoke Detector for connections to the following items:

1. External remote alarm Light Emitting Diode (LED).
2. Sounder base rated at a minimum of 85 dBA.
3. "Form C" Relay base.
4. Isolator base.

G. Smoke Detectors shall have the following characteristics:

1. Low profile ceiling-mount/wall-mount.
2. Allow pre-cabling of the base.
3. Plug-in style of head.
4. Mounted into a twist-lock base.
5. Constructed of off-white UV resistant polymer.
6. Detachable from the mounting base.
7. Operating range between 32°F and 100°F.
8. Cabling terminals accessible from the “room-side” after mounting.

H. Smoke Detectors shall have a maximum listed smooth ceiling "Area of Coverage" of 30'-0" x 30'-0" (900 square feet) and shall be installed in accordance with N.F.P.A. #72.

I. Photoelectric Smoke Detectors:

1. Detectors shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel indicate the analog level of smoke density.
2. The photoelectric smoke detector shall have a sensitivity range between 0.67% and 3.77% obscuration per foot as measured in the UL smoke box with the following divisions:
   a. Most Sensitive: 1.0% obscuration per foot
   b. More Sensitive: 2.0% obscuration per foot
   c. Normal Sensitive: 2.5% obscuration per foot
   d. Less Sensitive: 3.0% obscuration per foot
   e. Least Sensitive: 4.0% obscuration per foot

J. Ionization Smoke Detectors:

1. Detectors shall use a dual chamber design to automatically compensate for the following environmental conditions:
   a. Atmospheric Pressure
   b. Humidity
   c. Ambient Temperature

K. Provide remote indicating lamps for Smoke Detectors that when installed. The Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, etc.
2.15 DUCT SMOKE DETECTORS

A. Duct Smoke Detectors shall be listed to UL #268A "Standard for Smoke Detectors for Duct Application" and installed in accordance with manufacturer's recommendations.

B. Duct Smoke Detectors shall be Intelligent, Analog, Addressable, 24 Volts D.C. type with visual alarm and power indicators, and a reset switch that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC) loops for monitoring and control.

C. Duct Smoke Detectors shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel representing the analog level of smoke density.

D. Duct Smoke Detectors shall have an operating air velocity range of 100 feet per minute to 4,000 feet per minute.

E. Duct Smoke Detectors shall be capable of providing a trouble signal in the event that the front cover is removed.

F. Duct Smoke Detector shall be provided with properly sized air sampling tubes.

G. Each Duct Smoke Detector shall be provided with a "Form C" Relay rated at 30 Volts D.C. and at 2.0 Amps for controlling ancillary equipment.

H. Duct Smoke Detectors shall have a sensitivity range between 0.79% and 2.46% obscuration per foot.

I. The Duct Smoke Detector "Response Time" shall not exceed 15 seconds.

J. Duct Smoke Detectors shall initiate a "Supervisory" signal to the Fire Alarm Control Panel and initiate shutdown of the H.V.A.C. unit in which the Supervisory signal occurred.

K. Provide remote indicating lamps for Dust Smoke Detectors that when installed, the Light Emitting Diodes (LEDs) are not visible from the walking surface / floor or when installed at an elevation higher than 15'-0" above finished floor.

2.16 DUCT SMOKE DETECTOR REMOTE TEST STATIONS

A. Provide (1) one Duct Smoke Detector Remote Test Station for each duct smoke detector installed that is not visible or readily accessible from the floor.

B. The use of a single Duct Smoke Detector Remote Test Station to serve multiple duct smoke detectors will not be allowed.

C. The Duct Smoke Detector Remote Test Station shall be a polarized device that is designed for both conventional and intelligent applications and shall operate on a 32 Volts D.C. power source.
D. A key switch on the Duct Smoke Detector Remote Test Station shall be used to select the connected duct smoke detector for testing or resetting.

E. Duct Smoke Detector Remote Test Stations Light Emitting Diodes (LEDs) shall indicate the status of the following conditions:
   1. Standby: Blinking Green LED.
   2. Trouble: Solid Amber LED.
   3. Maintenance: Blinking Amber LED.
   4. Alarm: Solid Red LED.

2.17 CARBON MONOXIDE ONLY DETECTORS

A. Carbon Monoxide Only Detectors shall be listed to UL #2075 "Gas and Vapor Detectors and Sensors" and be compatible with the Fire Alarm System Control Panel.

B. Carbon Monoxide Only Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. Carbon Monoxide Only Detector shall be provided with (2) two Light Emitting Diodes (LEDs) to provide visible Carbon Monoxide Only Detector status.

D. The Fire Alarm System Control Panel shall provide coded signals to the Carbon Monoxide Only Detector that shall cause the Light Emitting Diodes (LEDs) to indicate the following status:
   1. Normal Operating Condition
   2. Alarm Condition
   3. End of life

E. Carbon Monoxide Only Detectors shall be equipped with the following items:
   1. Trouble Relay.
   2. A 6 year "End-of-Life" timer that initiate a "Trouble" signal to the Fire Alarm System Control Panel to indicate Carbon Monoxide Detector replacement.
   3. A means to test CO gas entry into the Carbon Monoxide Detector’s sensing cell.

F. An output connection shall also be provided in the base of the Carbon Monoxide Only Detector for connections to the following items:
   1. External remote alarm Light Emitting Diode (LED).
   2. Sounder base rated at a minimum of 85 dBA.
   3. "Form C" Relay base.
   4. Isolator base.

G. Carbon Monoxide Only Detectors shall have the following characteristics:
   1. Low profile ceiling-mount/wall-mount.
   2. Allow pre-cabling of the base.
   3. Plug-in style of head.
4. Mounted into a twist-lock base.
5. White finish.
6. Detachable from the mounting base.
7. Operating range between 32°F and 100°F.
8. Cabling terminals accessible from the “room-side” after mounting.

H. Carbon Monoxide Only Detectors shall have a maximum listed "Area of Coverage" of 2,000 square feet and shall be installed in accordance with N.F.P.A. #72.

2.18 COMBINATION SMOKE / CARBON MONOXIDE DETECTORS

A. Combination Smoke / Carbon Monoxide Detectors shall be listed to UL #268 "Smoke Detectors for Fire Alarm Systems", UL #1730 "Standard for Smoke Detector Monitors and Accessories for Individual living Units of Multifamily Residences and Hotel/Motel Rooms", UL #2075 "Gas and Vapor Detectors and Sensors" and be compatible with the Fire Alarm System Control Panel.

B. Combination Smoke / Carbon Monoxide Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. Combination Smoke / Carbon Monoxide Detectors shall be photoelectric smoke sensing and electrochemical CO sensing.

D. Combination Smoke / Carbon Monoxide Detectors shall be provided with (2) two Light Emitting Diodes (LEDs) to provide visible Combination Smoke / Carbon Monoxide Detectors status.

E. The Fire Alarm System Control Panel shall provide coded signals to the Combination Smoke / Carbon Monoxide Detectors that shall cause the Light Emitting Diodes (LEDs) to indicate the following status:
   1. Normal Operating Condition
   2. Smoke Alarm Condition
   3. Smoke Maintenance
   4. CO Alarm Condition
   5. CO Trouble / End of life

F. Combination Smoke / Carbon Monoxide Detectors shall be equipped with the following items:
   1. Trouble Relay.
   2. "Hush" button that when activated will silence the Carbon Monoxide Detector sounder for 5 minutes.
   3. A 6 year "End-of-Life" timer that initiate a "Trouble" signal to the Fire Alarm System Control Panel to indicate Carbon Monoxide Detector replacement.
   4. Send distinct smoke and CO signals to the Fire Alarm System Control Panel.
   5. A means to test CO gas entry into the Carbon Monoxide Detector’s sensing cell.
   6. A replaceable CO cell that can be replaced at end of cell life.
G. An output connection shall also be provided in the base of the Carbon Monoxide Only Detector for connections to the following items:

1. External remote alarm Light Emitting Diode (LED).
2. Sounder base rated at a minimum of 85 dBA.
3. "Form C" Relay base.
4. Isolator base.

H. Combination Smoke / Carbon Monoxide Detectors shall have the following characteristics:

1. Low profile ceiling-mount/wall-mount.
2. Allow pre-cabling of the base.
3. Plug-in style of head.
4. Mounted into a twist-lock base.
5. White finish.
6. Detachable from the mounting base.
7. Operating range between 32°F and 122°F.
8. Cabling terminals accessible from the “room-side” after mounting.

I. Photoelectric Smoke Detectors:

1. Detectors shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel representing the analog level of smoke density.
2. The photoelectric smoke detector shall have a sensitivity range between 0.67% and 3.77% obscuration per foot as measured in the UL smoke box with the following divisions:
   a. Most Sensitive: 1.0% obscuration per foot
   b. More Sensitive: 2.0% obscuration per foot
   c. Normal Sensitive: 2.5% obscuration per foot
   d. Less Sensitive: 3.0% obscuration per foot
   e. Least Sensitive: 4.0% obscuration per foot

J. Provide remote indicating lamps for Smoke Detectors that when installed. The Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, etc.

K. Combination Smoke / Carbon Monoxide Detectors shall have a maximum listed "Area of Coverage" of 30'-0" x 30'-0" (900 square feet) and shall be installed in accordance with N.F.P.A. #72.

2.19 MULTI-CRITERIA DETECTORS

B. Multi-Criteria Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. The Multi-Criteria Detector shall have the ability to detect all four major elements of a fire.
   1. Photoelectric chamber senses airborne particulate for smoke detection.
   2. Electrochemical cell technology monitors carbon monoxide (CO) produced by smoldering fires.
   3. Infrared (IR) sensing measures ambient light levels and flame signatures.
   4. Thermal detection monitors temperature.

D. An output connection shall also be provided in the base of the Multi-Criteria Detector for connections to the following items:
   1. External remote alarm Light Emitting Diode (LED).
   2. Sounder base rated at a minimum of 85 dBA.
   3. "Form C" Relay base.
   4. Isolator base.

E. Multi-Criteria Detectors shall have the following characteristics:
   1. Low profile ceiling-mount/wall-mount.
   2. Allow pre-cabling of the base.
   3. Plug-in style of head.
   4. Mounted into a twist-lock base.
   5. Constructed of off-white UV resistant polymer.
   6. Detachable from the mounting base.
   7. Operating range between 32°F and 100°F.
   8. Cabling terminals accessible from the “room-side” after mounting.
   9. Unique ability to detect all four major elements of a fire
  10. Highest nuisance alarm immunity
  11. Advanced algorithms interpret and respond to the multiple inputs
  12. Six levels of sensitivity
  13. CO sensing for fastest response to slow-developing, smoldering fires
  14. Fully integrated infrared sensing to support the fire alarm decision
  15. Automatic drift compensation of smoke sensor and CO cell
  16. Superior EMI protection
  17. Twin LED indicators providing 360° visibility
  18. LEDs can be panel controlled to blink, latch on, latch off

F. Provide remote indicating lamps for Multi-Criteria Detectors that when installed. The Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, etc.

G. Provide anti-ligature guards for Multi-Criteria Detectors installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.
H. Smoke Detectors shall have the following features:
   1. A maximum listed smooth ceiling "Area of Coverage" of 30'-0" x 30'-0" (900 square feet) and shall be installed in accordance with N.F.P.A. #72.
   2. Shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel indicate the analog level of smoke density.

I. Heat Detectors shall have the following features:
   1. A maximum listed smooth ceiling "Area of Coverage" of 50'-0" x 50'-0" (2,500 square feet) and shall be installed in accordance with N.F.P.A. #72.
   2. Shall be "Fixed Temperature" style.
   3. Shall be rated at 135°F.

J. Carbon Monoxide Detectors shall have the following features:
   1. A maximum listed "Area of Coverage" of 2,000 square feet and shall be installed in accordance with N.F.P.A. #72.
   2. A minimum "End-of-Life" timer of 6 years.
   3. The Carbon Monoxide Detector shall not be replaceable.

2.20 STROBE ONLY APPLIANCES

A. Strobe Only Appliances shall be listed to UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling", shall be approved for fire protective service, and be compatible with the Fire Alarm System Control Panel.

B. Strobe Only Appliances shall be Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. Strobe Only Appliances shall have the following characteristics:
   1. Shall be 24 Volts D.C.
   2. Be installed on the ceiling or on the wall.
   3. Shall be red or white finished.
   4. Tamper resistant construction.
   5. Shall flash at a rate of one flash per second at 1Hz over the strobes entire operating voltage.
   7. Associated lens/reflector system shall be rated at a minimum of 15 candela and meet or exceed the requirements of the Americans with Disabilities Act (ADA).
   8. Shall have field selectable candela settings.
   9. Shall be plug-in type.
   10. Shall terminate at a universal mounting plate.
   11. Shall be backward compatible.

D. Strobe Only Appliances installed in interior climate-controlled spaces shall have an operating temperature between 32°F and 120°F.
E. Weatherproof Strobe Only Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.
2. Shall have an operating temperature between -40°F and 151°F.
3. Shall be provided with an outdoor/weatherproof back box with:
   a. Conduit entries of ½" and ¾".
   b. Weatherproof sealant per the manufacturer’s recommendations to prevent moisture from entering the structure.

F. If the Strobe Only Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

G. Provide anti-ligature guards for Strobe Only Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.21 COMBINATION HORN / STROBE APPLIANCES

A. Combination Horn / Strobe Appliances shall be listed to UL #464 "Standard for Audible Signal Appliances", UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling", UL #1971 “Standard for Signaling Devices for the Hearing Impaired", shall be approved for fire protective service, and be compatible with the Fire Alarm System Control Panel.

B. Combination Horn / Strobe Appliances shall be Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. The Horn Appliance shall be powered independently of the Strobe Appliance on a coded or non-coded power supply.

D. Combination Horn / Strobe Appliances shall have the following characteristics:

1. Shall be 24 Volts D.C.
2. Be installed on the ceiling or on the wall.
3. Shall be red or white finished.
4. Tamper resistant construction.
5. Shall have three (3) audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern.
6. Shall produce a nominal sound output of 82 dBA at 10'-0".
7. Shall produce a maximum sound output of 90 dBA at 10'-0".
8. Shall flash at a rate of one flash per second at 1Hz over the strobes entire operating voltage.
9. Shall be xenon / Xenon flash tube type.
10. Associated lens/reflector system shall be rated at a minimum of 15 candela and meet or exceed the requirements of the Americans with Disabilities Act (ADA).
11. Shall have field selectable candela settings.
12. Shall be plug-in type.
13. Shall terminate at a universal mounting plate.
14. Shall be backward compatible.

E. The Combination Horn / Strobe Appliance rated decibel output shall be de-rated by 6 decibels each time the distance is doubled as follows:

1. At a distance of 10'-0" from sounder: Rated dB Output.
2. At a distance of 20'-0" from sounder: Rated dB Output less 6 dB.
3. At a distance of 40'-0" from sounder: Rated dB Output less 12 dB.

F. Combination Horn / Strobe Appliances installed in interior climate-controlled spaces shall have an operating temperature between 32°F and 120°F.

G. Weatherproof Combination Horn / Strobe Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.
2. Shall have an operating temperature between -40°F and 151°F.
3. Shall be provided with an outdoor/weatherproof back box with:
   a. Conduit entries of ½" and ¾".
   b. Weatherproof sealant per the manufacturer’s recommendations to prevent moisture from entering the structure.

H. If the Combination Horn / Strobe Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

I. Provide anti-ligature guards for Combination Horn / Strobe Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, or in areas subject to mechanical damage.

2.22 DAMAGE STOPPERS (WIRE GUARDS)

A. The Damage Stopper (Wire Guard) shall be UL Listed to U.S. safety standards for use with specific Fire Alarm System devices.

B. Damage Stoppers (Wire Guards) shall be provided where Fire Alarm System devices (i.e. Strobes, Horns, Smoke Detectors, Heat Detectors, Beam Detectors, Manual Pull Stations, etc.) are subject to vandalism or damage due to flying objects (i.e. Gymnasiums, Multi-Purpose Rooms, Play Areas, etc.)

C. Provide Cold-Rolled Steel Damage Stoppers (Wire Guards) with a white finished coating to protect Fire Alarm System devices from vandalism or accidental damage in spaces indicated on the contract documents.

D. The Damage Stopper (Wire Guard) shall be fabricated from 9 gauge cold rolled steel with a white corrosion-resistant polyester coating.

E. The Detector Damage Stopper (Wire Guard) shall be available for flush mount or with a spacer for surface mounted applications.
F. Detector Damage Stopper (Wire Guard) shall include (4) stainless steel tamper resistant #8 X 2" snake eye fasteners for added protection against vandalism or accidental damage.

G. Detector Damage Stopper (Wire Guard) shall be provided with an easy means of installation and removal of the Damage Stopper (Wire Guard) to facilitate servicing of smoke detector.

H. Provide Damage Stopper (Wire Guard) with conduit spacers for mounting over surface mounted Fire Alarm System devices, with or without conduit.

2.23 GRAPHIC MAPS

A. Provide a full color graphical representation of the floor plan(s) that shall be installed directly adjacent to each Fire Alarm Remote Annunciator Panel and by the Fire Alarm System Control Panel.

B. Graphic maps shall be produced and manufactured by a professional graphic map company. Suggested retailer is H.R. Kirkland or equivalent.

C. Graphic Maps shall be a minimum of 11"x17" in size but shall be based upon the actual building footprint and all text being at a 1/8" scale.

D. Graphic Maps shall include the following information at a minimum:

1. Building Name(s) (and numbers where applicable).
2. Room Names and Numbers.
3. Doors.
4. Location of the Fire Alarm Remote Annunciator Panel
5. Location of the Fire Alarm System Control Panel.
6. End-of-Line resistor locations (Class "B" circuits only).
7. A “You Are Here” with an arrow pointing at the wall or area location of where Graphic Map is to be installed.
8. Show the connections and system(s) being monitored by the Fire Alarm System.
9. Provide a System Legend at the top of each Graphic Map indicating the following applicable systems:
   a. Fire Protection Sprinkler System Post Indicator Valve(s)
   b. Fire Protection Sprinkler System Water Flow Switch(s)
   c. Fire Protection Sprinkler System Tamper Switch(s)
   d. Fire Protection Sprinkler System Pressure Switch(s)
   e. Suppression System Release Panel(s)
   f. Fire extinguisher cabinets
   g. Other systems that would typically interface to the Fire Alarm System.
10. "North" arrow
11. Provide the image/logo and name of the Owner at the top of each Graphic Map.

E. Each Graphic Map shall identify the following areas (solid fill, not just an outline) by a separate pastel Color:

1. Administrative Areas
2. Class Rooms
3. Hallways and Commons
4. Gymnasium(s) and Multi-Purpose Room(s)
5. Kitchens
6. Cafeteria
7. Restrooms
8. Portables

F. The room numbering system depicted on each Graphic Map shall match that of the final signage and room identification system adopted by the Owner.

G. For Multi-Story Buildings:
   1. The bottom of each Graphic Map shall be the lowest level of the building.
   2. The top of each Graphic Map shall be the highest level of the building.

H. Graphic Maps shall be secured in a black anodized aluminum frame, have Tempered Glass to protect the graphic image, and be mounted with a concealed security hanging system.

I. Graphic Maps installed on the interior of the building shall consist of the following:
   1. Printed on the reverse side of 10 mil polycarbonate Lexan.
   2. Standard background shall be white.
   3. The Lexan image shall mount to a rigid 1/8" substrate with removable adhesive mounts.
   4. The Graphic Map shall be secured to a black anodized aluminum frame.
   5. Provide Graphic Map with a concealed security hanging system to prevent unauthorized removal.

J. Graphic Maps installed on the exterior of the building shall consist of the following:
   1. Printed on 1/8" silver brushed aluminum, white aluminum, or stainless steel.
   2. The Graphic Map shall be designed to attach to an exterior wall by a screw located in each of the four corners.

2.24 MONITOR MODULES

A. Monitor Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Provide an addressable Monitor Module to supervise a circuit of dry contact input devices.

C. Monitor Modules shall have built-in type identification that automatically identifies the devices as a Monitor Module to the Fire Alarm System Control Panel.

D. Monitor Modules shall be powered by the Fire Alarm System Signaling Line Circuit (SLC).

E. Monitor Modules shall be capable of providing a minimum of 5 input circuits.

F. Monitor Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.
Monitor Modules shall monitor Alarm, Trouble, and Supervisory outputs for the following Specialty Systems:

1. Pre-Action System
2. Deluge System
3. Clean Agent Suppression System
4. Hood Suppression System
5. Other systems that would typically interface to the Fire Alarm System.

2.25 RELAY MODULES

A. Relay Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Relay Modules shall allow a compatible Fire Alarm System Control Panel to switch discrete contacts by coded command.

C. The Relay Module shall provide (2) two isolated sets of "Form C" contacts, which operate as a Double Pole Double Throw (DPDT) switch rated at up to:

1. 1 Amp at 30 Volts D.C. of inductive load.
2. 2 Amps at 30 Volts D.C. (coded) of resistive load.
3. 3 Amps at 30 Volts D.C. for non-coded applications.

D. The Relay Module shall allow the Fire Alarm System Control Panel to switch the "Form C" contacts upon command.

E. The Relay Module shall not provide supervision of the Notification Appliance Circuit (NAC).

F. Relay Modules shall have both normally open and normally closed connections available for field cabling.

G. Addressable Relay Modules shall be provided for the following:

1. Audio/Visual Sound Systems
2. Duct Smoke Detectors
3. H.V.A.C. Systems
4. Magnetic Door Holders
5. Magnetic Door Releases
6. Fire Rated Coiling Doors
7. Fire Rated Shutters
8. Won Doors
9. Smoke Vents
10. Other building functions.

H. The relay coil shall be magnetically latched to reduce cabling connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of cables.

I. Relay Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.
J. Coded signals, transmitted from the Fire Alarm System Control Panel, can cause the Light Emitting Diode (LED) to blink, latch on, or latch off.

2.26 MULTI-VOLTAGE RELAY MODULES (RELAY IN BOX)

A. Multi-Voltage Relay Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Multi-Voltage Relay Modules shall allow a compatible Fire Alarm System Control Panel to switch discrete contacts by coded command.

C. Multi-Voltage Relay Modules shall be used for high-current switching applications such as fan and damper assembly control, door control, air handling unit controls, and other types of system interfacing.

D. Multi-Voltage Relay Modules shall have (1) one "Form C" contact which operate as a Single Pole Double Throw (SPDT) relay with a red activation Light Emitting Diode (LED).

E. Multi-Voltage Relay Modules shall be mounted into a steel enclosure that has a removable front cover to provide easy access with a Light Emitting Diode (LED) viewing hole.

F. The Multi-Voltage Relay Module shall allow the Fire Alarm System Control Panel to switch the "Form C" contact upon command.

G. The Multi-Voltage Relay Module shall not provide supervision of the Notification Appliance Circuit (NAC).

H. Multi-Voltage Relay Modules shall have both normally open and normally closed connections available for field cabling.

I. Multi-Voltage Relay Modules shall be capable of operating on a 24 Volts D.C., 120 Volts A.C., or 240 Volts A.C. power source.

J. Multi-Voltage Relay Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

K. Coded signals, transmitted from the Fire Alarm System Control Panel, can cause the Light Emitting Diode (LED) to blink, latch on, or latch off.

2.27 CONTROL MODULES

A. Control Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Power for the Control Module shall be provided by the 24 Volts D.C. Signaling Line Circuit (SLC) loop to reduce cabling connection requirements.

C. Control Modules shall be capable of Class "A or B" operation.
D. Addressable Control Modules shall be activated through Fire Alarm System Control Panel programming on a select basis (zone or area of coverage).

E. Upon programming command from the Fire Alarm System Control Panel, the Control Module shall disconnect the supervision and connect the external power supply in the proper polarity across the load device.

F. The disconnection of the supervision shall provide a positive indication to the Fire Alarm System Control Panel that the Control Module has turned "On".

G. The external power supply shall always be Control Module isolated from the communication loop so that a trouble condition on the external power supply will never interfere with the rest of the system.

H. Control Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

2.28 ZONE INTERFACE MODULES

A. Zone Interface Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Zone Interface Modules shall be capable of Class "A or B" operation.

C. Zone Interface Modules shall provide an interface between the intelligent alarm system and a two-wire conventional detection zone.

D. A common Signaling Line Circuit (SLC) input is used for all Zone Interface Modules, and the initiating device circuits share a common external supervisory supply and ground. Otherwise, each Zone Interface Module operates independently from the others.

E. All two-wire detectors being monitored must be two-wire compatibility listed with the Zone Interface Modules.

F. The Zone Interface Module transmits the status of a zone of two-wire detectors to the Fire Alarm System Control Panel. Status conditions are reported as Normal, Open, or Alarm.

G. The Zone Interface Module supervises the zone of detectors and the connection of the external power supply.

H. Zone Interface Modules shall have Light Emitting Diodes (LEDs) that are controlled by the Fire Alarm System Control Panel to indicate module status.

I. Coded signals, transmitted from the Fire Alarm System Control Panel, can cause the Light Emitting Diodes (LEDs) to blink, latch on, or latch off.
2.29 ISOLATION MODULES

A. Isolation Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Isolation Modules shall be provided to automatically isolate wire-to-wire short circuits on Signaling Line Circuit (SLC) loops.

C. A maximum of 20 devices shall be provided between Isolation Modules on the Signaling Line Circuit (SLC) loop and limits the number of modules or detectors that may be rendered inoperative by a short circuit fault on the Signaling Line Circuit (SLC) Loop.

D. If a wire-to-wire short occurs, the Isolation Module shall automatically open-circuit (disconnect) the Signaling Line Circuit (SLC) loop and prevent the short from causing failure of the entire Signaling Line Circuit (SLC) loop.

E. When the short circuit condition is corrected, the Isolation Module shall automatically reconnect the isolated section of the Signaling Line Circuit (SLC) loop.

F. The Isolation Module shall not require any address-setting, and its operations shall be totally automatic.

G. It shall not be necessary to replace or reset an Isolation Module after its normal operation.

H. The Isolation Module shall mount in a standard 4" deep electrical box, in a surface-mounted back box, or in the Fire Alarm System Control Panel.

I. The Isolation Module shall have a single Light Emitting Diode (LED) which shall flash to indicate that the Isolator Module is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.30 REMOTE INDICATING LAMPS

A. The Remote Indicating Lamp shall provide status indication by a single RED Light Emitting Diode (LED),

B. The RED Light Emitting Diode (LED) shall be mounted on a single gang plate.

C. Provide label on plate indicting device designation in concealed space above.

2.31 MAGNETIC DOOR HOLDERS

A. Magnetic Door Holders shall be listed to UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors" and shall be approved for fire protection service.

B. Magnetic Door Holders shall consist of both an electromagnet and an armature assembly.

1. Magnetic Door Holders shall be rated for continuous duty and operate using a 24 Volts D.C. 120 Volts A.C. power source.
C. Activation of the Fire Alarm System shall automatically release the Magnetic Door Holders allowing the fire rated doors to close and shall remain in the release mode until the Fire Alarm System Control Panel is reset.

2.32 MAGNETIC DOOR LOCKS

A. Magnetic Door Locks shall be listed to UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors" and shall be approved for fire protection service.

B. Magnetic Door Locks shall consist of both an electromagnet and an armature assembly.

C. Magnetic Door Locks shall be rated for continuous duty and operate using a 24 Volts D.C. 120 Volts A.C. power source.

D. Activation of the Fire Alarm System shall automatically release the Magnetic Door Locks unlocking the doors and shall remain in the release mode until the Fire Alarm System Control Panel is reset.

2.33 SYSTEMS PLYWOOD BACKBOARD(S)

A. Plywood Backboard shall be used to mount all Fire Alarm System enclosures to any wall or surface, even if wall is concrete or CMU.

B. Mounting of equipment shall be logically placed, and shall be located to accommodate future growth of the Fire Alarm System.

C. The Systems Plywood Backboard shall be securely fastened to the wall to accommodate no less than ten times the total weight of the equipment to be mounted or 150 pounds, whichever is greater.

D. The Systems Plywood Backboard shall be a minimum of 3/4", APA exterior grade Douglas Fir A-C that is fire retardant having a flame spread rating not more than 25 when tested in accordance with ASTM E-84.

E. Provide Systems Plywood Backboard from 1'-0" above finished floor up to the ceiling height or 10'-0", whichever is lower.

F. The entire backboard shall be painted with three (3) coats of fire-retardant paint (the color shall match the adjacent surface).

2.34 UNIVERSAL DIGITAL ALARM COMMUNICATOR TRANSMITTER (UDACT)

A. The Universal Digital Alarm Communicating Transmitter (UDACT) shall be listed to UL #827 "Standard for Central Station Alarm Services", UL #1981 "Standard for Central Station Automatic Systems” and shall be approved for fire protection service.
B. The Universal Digital Alarm Communicating Transmitter (UDACT) is an interface for communicating digital information between a Fire Alarm System Control Panel and central station monitoring company.

C. Cabling connections between the Universal Digital Communicator Transmitter (UDACT) and the Fire Alarm System Control Panel shall be supervised with one pair of cabling for power and one pair of cabling for multiplexed communication of overall system status.

D. The Universal Digital Communicator Transmitter (UDACT) shall include the following:

2. Connections for dual telephone lines with voltage detect.
3. The ability for split reporting events up to three different telephone numbers.
4. Capable of transmitting events in at least 15 different formats to ensure compatibility with existing and future transmission formats.
5. Completely field programmable from a built-in keypad with a 4-character, seven segment displays.
6. Support independent zone/point reporting when used in contact ID format.
7. Support transmission of up to 2,040 points to the central station monitoring company.
8. Have the ability for mounting at distances of up to 6,000 feet from the Fire Alarm System Control Panel.

E. The Universal Digital Communicator Transmitter (UDACT) shall communicate the following vital system information:

1. Independent zone (alarm, trouble and supervisory).
2. Independent addressable device status.
3. AC power loss.
4. Low battery (DC power).
5. Earth fault.
7. 12 and 24-hour test signal.
8. Abnormal test signal (per UL requirements).
9. EIA-485 communication failure.
10. Phone line failure.

F. An IP Communicator option shall be available to interface to the Universal Digital Communicator Transmitter (UDACT) and be capable of transmitting signals over the internet/intranet to a compatible receiver.

2.35 AES WIRELESS TRANSCEIVER

A. AES Wireless Transceiver shall be listed to UL #365 "Standard for Police Station Connected Burglar Alarm Units and Systems", UL #864 "Commercial Fire Alarm Requirements for Primary Standalone Communication", UL #1681 "Standard for Wiring Device Configurations" and meet N.F.P.A. #72 requirements.
B. The AES Wireless Transceiver (AES 7788F-ULP) shall provide a wireless communication link between the Fire Alarm System Control Panel and the central station monitoring company receiver via telephone lines connected to the Universal Digital Communicator Transmitter (UDACT).

C. The AES Wireless Transceiver shall be capable of supporting Alarm, Supervisory, and Trouble signals from the Fire Alarm System Control Panel and shall be able to monitor telephone lines, antenna cuts, battery status, and AC power status.

D. The standard frequency range of the AES Wireless Transceiver shall be 450-470 MHz and shall be narrow band compliant.

E. The AES Wireless Transceiver shall be provided within a full-sized rugged metal enclosure.

F. The Fire Alarm System Contractor shall confirm radio signal strength and provide appropriate antenna.

G. Exterior antenna installations shall require all exterior building penetrations to be sealed.

2.36 ANTENNAS

A. Antennas shall be omnidirectional coaxial halfwave dipole type for radio transmitters with a driving point impedance to match transmitter output.

B. VHF Antennas provide transmission and reception of the VHF RF signals between the radio Transmitter and the Radio Frequency Modem that is connected to the Radio Central Receiving System.

C. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities up to 100 m.p.h.

D. Do not mount antennas to any portion of the building roofing system.

E. Protect the antenna from physical damage.

F. The Antenna shall be provided with a Lightning Arrestor to drain static charges from the antenna system.

G. The Lightning Arrestor shall allow direct earth ground connection in accordance with N.F.P.A. #70 Section 810-21 while preventing are energy from being coupled to the equipment through the coaxial shields.

H. The use of enlarged coaxial cabling shall require Voltage Drop Calculations.

2.37 TRANSIENT VOLTAGE SURGE PROTECTION

A. If not provided as an integral part of the Fire Alarm System power supply, an external means of Transient Voltage Surge Protection shall be provided for all components of the system.

C. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

D. Transient Voltage Surge Protection shall have a minimum energy handling of 70 Joules on line to line, line to neutral, and line to ground spikes.

E. The response time for Transient Voltage Surge Protection shall be 5 nanoseconds or less and shall begin at 140 Volts A.C.

F. Provide (1) dedicated Transient Voltage Surge Suppressor (TVSS) for each 120 Volts A.C. hard wired connection point.

2.38 FIRE PROTECTION SYSTEM CONNECTIONS

A. Fire Sprinkler System Connections shall be listed to UL #346 "Standard for Waterflow Indicators for Fire Protective Signaling Systems", UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Fire Protection Sprinkler System devices shall be connected to the Fire Alarm System Control Panel so that the movement of a valve and/or switch shall notify the Fire Alarm System.

C. The Fire Protection Sprinkler Contractor shall provide and install all fire protection sprinkler system switches and/or equipment that include, but are not limited to following:

1. Post Indicator Valve (PIV) Tamper Switch(s)
2. Tamper Switch(s)
3. Water Flow Switch(s)
4. Pressure Switch(s)
5. Fire Pump Controller(s)
6. Clean Agent Suppression System Control Panel(s)
7. Cooking Hood Fire Suppression System Control panel(s)
8. Other systems that would typically interface to the Fire Alarm System.

D. The Fire Alarm System Contractor / Electrical Contractor shall provide and install the conduit, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power the fire sprinkler system switches and equipment.

E. Each fire protection sprinkler system tamper switch shall be provided with a Monitor Module by the Fire Alarm System Contractor.

F. Fire protection sprinkler system tamper switches on the valve controlling the backflow preventer full forward flow test piping shall be connected to the Fire Alarm System Control Panel such that the movement of a valve from the normally closed position shall initiate a supervisory signal.
G. Fire protection sprinkler system tamper switches on all other valves except for the valve controlling the backflow preventer full forward flow test piping shall be connected to the Fire Alarm System Control Panel such that the movement of a valve from the normally open position shall initiate a supervisory signal.

H. The Fire Alarm System Contractor shall coordinate locations and quantities of Fire Protection Sprinkler System devices with the Fire Protection Sprinkler System Contractor.

I. Fire Protection Sprinkler System Electric Alarm Bell:
   1. The Fire Protection Sprinkler System Contractor shall provide an electric alarm bell.
   2. The Fire Protection system electric alarm bell shall operate on a 120 Volts A.C. power supply.
   3. The Fire Protection system electric alarm bell shall operate on a 24 Volts D.C. power supply that shall be powered by the Fire Alarm System Control Panel allowing the electric bell to be on a back-up power supply.
   4. The Fire Alarm System Contractor / Electrical Contractor shall connect the sprinkler system electric alarm bell to the Fire Alarm system Control Panel.
   5. Coordinate installation location of the electric alarm bell with the Fire Protection Sprinkler System Contractor.
   6. The sprinkler system electric alarm bell shall activate upon the flow of water past the water flow switch or pressure switch only.
   7. The sprinkler system electric alarm bell shall be silenced upon the flow of water past the water flow switch or pressure switch terminating and water flow switch or pressure switch returning to a "Normal" condition.

2.39 FAN / DAMPER CONTROL CIRCUITS

A. Fan shutdown control circuits and smoke removal circuits shall be electrically supervised per N.F.P.A. #72 requirements.

B. Provide a single "Form C" isolated contact output and cabling from the Fire Alarm System to the Energy Management Control System (EMCS).

C. Provide a second isolated contact for automatic closure of smoke dampers and combination smoke / fire dampers.

D. Upon activation of a general "Alarm" condition in the area in which the smoke damper or combination fire / smoke damper is located, the smoke damper or combination fire / smoke damper shall automatically close and the mechanical equipment shall be disabled.

E. Provide all necessary connections, programming and testing for the shutdown of affected mechanical equipment.

F. Power supply for damper actuators shall be provided by the Electrical Contractor.

G. Fusible link style dampers shall not be connected to the Fire Alarm System.
2.40 WIREMOLD SURFACE RACEWAY

A. Wiremold Surface Raceway shall be meet the requirements of Underwriters Laboratories Inc. and conform to U.S. Federal Specification W-C-582.

B. Wiremold Surface Raceway shall be in accordance with N.F.P.A. #70, local requirements, and state requirements.

C. Wiremold Surface Raceway shall be constructed of steel with a minimum thickness of 0.040”.

D. Wiremold Surface Raceway shall have the following features:

1. Rugged steel raceway.
2. Low-profile and unobtrusive appearance.
3. Base and cover are preassembled as a one-piece unit.
4. Surface mounting.
5. Full line of fittings.
6. Fittings have removable covers.
7. UL #5 "Standard for Surface Metal Raceways and Fittings" and ADA compliant.

2.41 WET RATED CABLES

A. Wet Rated Cables shall have a flame rating that meet UL #1685 "Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables" requirements.

B. Wet Rated Cables shall be Type FPL, PLTC, or CL3 cables that meet the 300 Volt requirements as specified in N.F.P.A. #70.

C. Wet Rated Cables shall be rated for "Direct Burial" or "Underground in Conduit" installations.

1. "Direct Burial" rated cables shall consist of the following:
   a. ASTM Bare Copper.
   b. PVC Insulation with Nylon.
   c. Twisted Pair or Cabled Construction.
   d. Overall Shield 100% Coverage of Aluminum Polyester Foil with Drain Wire.
   e. Water Blocked Construction.
   f. Overall Sunlight / Moisture Resistant PVC Jacket.

2. "Underground in Conduit" rated cables shall consist of the following:
   a. ASTM Bare Copper.
   b. PVC Insulation.
   c. Short Twisted Construction.
   d. Unshielded.
   e. Water Blocked Construction.
   f. Overall Sunlight / Moisture Resistant PVC Jacket.
PART 3 - SYSTEM OPERATION

3.1 FIRE ALARM SYSTEM CIRCUITS

A. Circuits not capable of transmitting an "Alarm" signal beyond the location of the open or ground fault as specified above, are designated Class B. Class B circuits generally do not return to the control panel but are terminated by an end-of-line device remote from the control panel.

B. Class A Circuits shall not cause system malfunction, loss of operating power, or the ability to report an alarm upon a single ground fault or open circuit on the system Signaling Line Circuit (SLC).

C. Alarm signals arriving at the Fire Alarm System Control Panel shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

D. Notification Appliance Circuit (NAC) circuits shall be arranged such that there is a minimum of one horn circuit per floor of the building or smoke zone whichever is greater, but not more than 25 devices per circuit.

E. Notification Appliance Circuit (NAC) circuits and control equipment shall be arranged such that loss of any one (1) Horn circuit will not cause the loss of any other horn circuit in the system.

3.2 FIRE ALARM SYSTEM OPERATION

A. When a Fire Alarm System "Alarm" condition is detected and reported by one of the systems initiating devices, the following functions shall immediately occur:

1. The system alarm LED shall flash.
2. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
3. The backlit LCD display shall indicate all information associated with the "Alarm" condition, including:
   a. Type of "Alarm" point.
   b. Location of "Alarm" point within the protected premises.
   c. Time of the "Alarm" condition.
   d. Date of the "Alarm" condition.
4. The audio portion of the system shall sound the proper audio signal (consisting of tone, voice, or tone and voice) to the appropriate zones.
5. Display the device location unique nomenclature (for each addressable and non-addressable point in the system) on the Fire Alarm System Control Panel Display and at each Fire Alarm System Remote Annunciator Panel Display.
   a. All points of identification shall clearly indicate the following:
      1) Device Type
      2) Room Name
      3) Room Number
      4) Location of device in the room.
6. The system "Alarm" Light Emitting Diode (LED) on the system display shall flash.
7. A local piezo electric signal in the control panel shall sound.
8. Activate all notification appliances.
9. Upon the flow of water through the fire protection sprinkler system only, activate the 24 Volts D.C. Fire Protection Sprinkler System electric bell.
10. All horns and strobes shall be synchronized throughout the facility, and meet or exceed all ADA requirements.
11. All Notification devices shall operate continuously until the Fire Alarm System Control Panel has been "Silenced".
12. Initiate signal to the remote central station monitoring station.
13. Magnetic door holders shall release self-closing fire and smoke doors (where applicable).
14. "Alarm" signals shall be annunciacted by point and zone at the control panel.
15. All H.V.A.C. air handling unit of 2,000 CFM or larger shall be shutdown.
16. Visual notification appliances shall be controlled independently from audible notification appliances.
17. Upon system silence, visual notification appliances shall continue to operate until system reset is provided.
18. Alarm circuits shall remain energized and the zone annunciation LED will continue to flash until the acknowledge switch is operated at which time the audible notification appliances will be de-energized.
19. Should an "Alarm" condition be initiated in a subsequent zone after an "Alarm" condition has been acknowledged, the "Alarm" condition shall be re-energized.
20. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
21. All system outputs assigned via control-by-event equations for a particular point in "Alarm" shall be executed, and the associated system outputs ("Alarm" notification appliances and/or relays) shall be activated.
22. Unacknowledged "Alarm" conditions shall have priority over "Trouble" conditions and if an "Alarm" condition occurs during a "Trouble" condition, the "Alarm" condition will have display priority.

B. When a Fire Alarm System "Trouble" condition is detected and reported by one of the systems initiating devices or appliances, the following functions shall immediately occur:

1. The system trouble LED shall flash.
2. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
3. The backlit LCD display shall indicate all information associated with the "Trouble" condition, including:
   a. Type of "Trouble" point.
   b. Location of "Trouble" point within the protected premises.
   c. Time of the "Trouble" condition.
   d. Date of the "Trouble" condition.
4. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
5. All system outputs assigned via control-by-event equations for a particular point in "Trouble" shall be executed, and the associated system outputs ("Trouble" notification appliances and/or relays) shall be activated.
6. Unacknowledged "Alarm" conditions shall have priority over "Trouble" conditions and if an "Alarm" condition occurs during a "Trouble" condition, the "Alarm" condition will have display priority.
C. When a Fire Alarm System "Supervisory" condition is detected and reported by one of the systems initiating devices or appliances, the following functions shall immediately occur:

1. The system trouble LED shall flash.
2. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
3. The backlit LCD display shall indicate all information associated with the "Supervisory" condition, including:
   a. Type of "Supervisory" point.
   b. Location of "Supervisory" point within the protected premises.
   c. Time of the "Supervisory" condition.
   d. Date of the "Supervisory" condition.
4. Printing and history storage equipment shall log and print the event information along with a time and date stamp.

D. When a "Pre-Alarm" condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system "Pre-Alarm" LED shall flash.
2. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
3. The backlit LCD display shall indicate all information associated with the "Pre-Alarm" condition, including:
   a. Type of "Pre-Alarm" point.
   b. Location of "Pre-Alarm" point within the protected premises.
   c. Time of the "Pre-Alarm" condition.
   d. Date of the "Pre-Alarm" condition.
4. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
5. All system outputs assigned via control-by-event equations for a particular point in "Pre-Alarm" shall be executed, and the associated system outputs ("Pre-Alarm" notification appliances and/or relays) shall be activated.

E. System Point Operations:

1. Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
2. System output points shall be capable of being turned on or off through the system keypad.

F. Point Read:

1. The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
   a. Device Status.
   b. Device Type.
   c. Custom Device Label.
   d. Software Zone Label.
   e. Device Zone Assignments.
   f. Analog Detector Sensitivity.
g. All Program Parameters.

G. System History Recording and Reporting:

1. The Fire Alarm Control Panel shall contain a history buffer that will be capable of storing up to 4,000 system events.
2. Up to 1,000 events shall be dedicated to alarm and the remaining events are general purpose.
3. Systems that do not have dedicated "Alarm" storage and allow "Alarm" events are overridden by non-alarm type events, are not allowed.
4. Each of these activations will be stored along with a time and date stamp with the actual time of the activation.
5. The contents of the history buffer may be manually reviewed (one event at a time) or printed in its entirety.
6. History events shall include all "Alarm" conditions, "Trouble" conditions, Operator Actions, and programming entries.
7. The history buffer shall use non-volatile memory.
8. Systems that use volatile memory for history storage are not acceptable.

H. Programmable Trouble Reminder:

1. The system shall provide means to automatically initiate a reminder that troubles exist in the system.
2. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

I. Environmental Drift Compensation:

1. The system shall provide means for setting Environmental Drift Compensation by device.
2. Drift compensation shall also include a smoothing algorithm feature, allowing transient noise signals to be filtered out.
3. Provide two levels of alert to warn of excessive smoke detector dirt or dust accumulation.
   a. Maintenance Alert: When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit.
   b. Maintenance Urgent: When the detector accumulates dust in the chamber above the allowed limit.

J. Automatic Detector Maintenance Alert:

1. The Fire Alarm System Control Panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time.
2. If any intelligent detector in the system responds with a reading which is below 20% of normal limits (for 5 out of 6 polls), or above 80% of normal limits for a period of 26 hours, then, then the system will enter the "Trouble" mode and the particular Intelligent Detector will be annunciated on the System Display and printed on the optional System Printer.
3. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools, or computer expertise to perform.
K. Smoke Detector Pre-Alarm Indication at Control Panel:

1. To obtain early warning of incipient or potential fire conditions, the Fire Alarm System shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting.
2. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
   a. Alert Level:
      1) It shall be possible to set individual smoke detectors for pre-programmed "Pre-Alarm" thresholds.
      2) If the individual threshold is reached, the "Pre-Alarm" condition shall be activated.
      3) This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.
   b. Action Level:
      1) If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the Fire Alarm System Control Panel shall indicate an action condition.
      2) Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

3. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.

L. Pre-Alarm Function:

1. The system shall provide two levels of "Pre-Alarm" warning to give advance notice of a possible fire situation.
2. Both "Pre-Alarm" levels shall be fully field adjustable.
3. The first level shall give an audible indication at the control panel.
4. The second level shall give an audible indication and may also activate control relays.
5. The system shall also have the ability to activate local detector sounder bases at the "Pre-Alarm" level, to assist in avoiding nuisance alarms.

M. Pre-signal and Positive Alarm Sequence:

1. The Fire Alarm System shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing.
2. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device.
3. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

N. Elevator interface to the Fire Alarm System:

1. Activation of a smoke detector located in any Elevator Lobby, Top of Hoistway, or Elevator Machine Room shall initiate the "Elevator Recall" feature.
a. All elevator cabs shall return to the "Primary" floor of egress when the smoke detector activated is not located on the "Primary" floor of egress.
b. All elevator cabs shall return to the "Alternate" floor of egress when the active smoke detector is located on the "Primary" floor of egress.
c. Installation of the smoke detector serving any Elevator Lobby, Top of Hoistway, or Elevator Machine Room shall be coordinated with the Electrical Contractor and Elevator Contractor.
d. The heat detector installed at the Top of Hoistway or in the Elevator Machine Room shall be a mechanical style, 135°F fixed temperature activation having dual contacts that are in the normally open position for the following features:
   e. One set of contacts shall be used to monitor integrity of the circuit by the Fire Alarm System Control Panel.
   f. One set of contacts shall be used to initiate the "Shunt Trip Breaker" feature in which power to the elevator is terminated and the Elevator instantaneously shut down in accordance with ANSI A17.1 requirement.

2. Installation of the heat detector serving the Top of Hoistway or Elevator Machine Room shall be coordinated with the Electrical Contractor, Elevator Contractor, and Fire Protection Sprinkler System Contractor.

3.3 SYSTEM COMMON CONTROL SWITCH OPERATION

A. Acknowledge (ACK/STEP) Switch:
   1. Activation of the Fire Alarm System Control Panel Acknowledge Switch in response to a single new "Alarm" and/or "Trouble" condition shall silence the local panel piezo electric signal and change the System "Alarm" or "Trouble" Light Emitting Diode (LED) from flashing mode to steady-ON mode.
   2. Depression of the Acknowledge Switch shall silence all Fire Alarm System Remote Annunciator piezo sounders.
   3. Depression of the Acknowledge Switch shall cause a corresponding (time-stamped) message to be displayed on all system peripheral equipment (if used).
   4. The Fire Alarm System Control Panel shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
   5. If additional new "Alarm" or "Trouble" conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next "Alarm" or "Trouble" condition.
   6. In this case, the local piezo sounder shall not silence, and the "Alarm" or "Trouble" Light Emitting Diodes (LEDs) shall not transfer to their steady-on mode, thus signaling to the operator that more "Alarm" or "Trouble" conditions are present in the system.
   7. "Alarm" conditions shall always have display priority before "Trouble" conditions.
   8. Occurrence of any new "Alarm" or "Trouble" condition in the system shall cause the Fire Alarm System Control Panel to resound the Local Piezo sounder and repeat the "Alarm" or "Trouble" sequences.

B. Signal Silence Switch:
   1. Activation of the Signal Silence Switch shall cause all programmed "Alarm" Indicating Appliances and relays to return to the normal condition after an alarm condition.
2. The selection of indicating circuits and relays which are silenceable by this switch shall be fully programmable within the confines of all applicable standards.

3. The Fire Alarm System Control Panel software shall include silence inhibit and auto-silence timers.

C. Alarm Activate (Drill) Switch:

1. The system shall support means to activate all silenceable fire output circuits in the event of a practice evacuation or "drill".

2. If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function.

3. The Alarm Activation (Drill) Switch shall activate all:
   a. Local system Light Emitting Diodes (LEDs).
   b. Illuminate each segment of the Liquid Crystal Display (LCD).
   c. Display the panel software revision for service personnel.
   d. Programmed Notification Appliance Circuits (NACs).

4. The Alarm Activation (Drill) Switch shall latch until the Fire Alarm System Control Panel is "Silenced" or "Reset".

D. Walk Test:

1. The system shall provide both a basic and advanced walk test for testing the entire Fire Alarm System.

2. Basic walk Test:
   a. Shall allow a single operator to run audible tests on the panel.
   b. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state.

3. Advanced Walk Test:
   a. Field-supplied output point programming will react to input stimuli such as CBE and logic equations.
   b. When points are activated, each initiating event shall latch the input.
   c. The Advanced Walk Test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and cabling operation/verification.

4. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system.

5. Operation shall be as follows:
   a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
   b. Introducing a "Trouble" into the initiating device shall activate the programmed outputs for 8 seconds.
   c. All devices tested in walk test shall be recorded in the history buffer.

E. System Reset Switch:

1. Activation of the System Reset Switch shall cause all electronically latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
2. Initiating devices shall re-report if active.
3. Active Notification Appliance Circuits (NACs) shall not silence upon Reset.
4. Systems that de-activate and subsequently re-activate Notification Appliance Circuits (NACs) shall not be considered equal.
5. All programmed Control-By-Event equations shall be re-evaluated after the System Reset Switch sequence is complete if the initiating condition has cleared.
6. Non-latching "Trouble" conditions shall not clear and re-report upon reset.
7. If the "Alarm" condition(s) still exist, or if they re-occur in the system after System Reset Switch activation, the system shall then resound the alarm conditions.

F. Lamp Test Switch:
   1. Activation of the Lamp Test Switch shall sequentially:
      a. Turn on all local system Light Emitting Diodes (LEDs).
      b. Illuminate each segment of the Liquid Crystal Display (LCD).
      c. Display the panel software revision for service personnel.
      d. Turn on the local Piezo-Electric signal.
      e. Automatically return the Fire Alarm System Control Panel to the previous condition.

G. Smoke Detector Sensitivity Adjust:
   1. Means shall be provided for adjusting the sensitivity of any or all analog intelligent detectors in the system from the system keypad or from the keyboard of the video terminal.
   2. The Fire Alarm System Control Panel shall provide automatic Smoke Detector Sensitivity Adjust based on occupancy schedules including a Holiday list of up to 15 days.
   3. Sensitivity range shall be within the allowed UL window and shall be a HIGH/MEDIUM/LOW selection.
   4. Smoke Detectors shall have a minimum of 9 selectable sensitivity settings.
   5. Sensitivity levels for an "Alarm" condition that are selected by detector of the following:
      a. Photoelectric Smoke Detectors: The "Alarm" level range shall be 0.5 to 2.35 percent per foot.
      b. Ionization Smoke Detectors: The "Alarm" level range shall be 0.5 to 2.5 percent per foot.
      c. Advanced Laser Detectors: The "Alarm" level range shall be 0.02 to 2.0 percent per foot.
   6. The system shall also include sensitivity levels of "Pre-Alarm" that are selected by detector to indicate impending "Alarm" conditions to maintenance personnel.

H. Alarm Verification:
   1. Each of the Intelligent/Addressable Detectors in the system may be independently selected and enabled to be an alarm verified detector.
   2. The alarm verification function shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification during the field programming of the system or any time after system turn-on.
   3. The Alarm Verification shall not require any additional hardware to be added to the Fire Alarm System Control Panel.
4. The Fire Alarm System Control Panel shall keep a count of the number of times that each
detector has entered the verification cycle.
5. These counters may be displayed and reset by the proper operator commands.
6. A "Trouble" condition shall be initiated to alert maintenance personnel when a detector
enters verification 20 times.

I. System Status Reports:

1. The system shall be capable of generating and printing a summary of all of the Detectors,
Modules, Pull Stations, Zones, etc. that are currently active in the System.
2. This printout will require password protection to prevent unauthorized user access and
will automatically print the system report using "soft" (single push) keys.
3. No computer expertise will be required to initiate the System Report sequence.
4. Upon command from a password-authorized operator of the system, a Point Status
Report: shall be generated which details each and every installed detector, module, zone,
and annunciator, as well as any and all field programmed parameters which have been
assigned to these points, and (optionally) printed.

3.4 FIRE ALARM SYSTEM AUXILIARY SYSTEM CONNECTIONS

A. Integration with Sound System(s):

1. Provide the necessary cabling and one (1) Fire Alarm system addressable relay module at
each Sound System rack location shown on the drawings.
2. Connect and program as required.
3. When the Fire Alarm System is in General Alarm, each of the Sound System(s) shall be
muted.
4. When the Fire Alarm System Control Panel is reset, the Sound System(s) may return to
their previous operational status.

B. Fire Control:

1. The system shall provide a Type ID called "Fire Control" for purposes of air-handling
shutdown, which shall be intended to override normal operating automatic functions.
2. Activation of a “Fire Control” point shall cause the control panel to:
   a. Initiate the monitor module Control-by-Event
   b. Send a message to the panel display, history buffer, installed printer and
      annunciators
   c. Shall not light an indicator at the control panel
   d. Shall display ACTIVE on the LCD as well a display a "Fire Control" Type Code
      and other information specific to the device.

C. Smoke Control Modes:

1. The Fire Alarm System shall provide means to perform Firefighters Smoke Control
Station (FSCS) mode Smoke Control to meet N.F.P.A. #90A, N.F.P.A. #90B, and
N.F.P.A. #92A.
PART 4 - EXECUTION

4.1 INSTALLATION

A. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with N.F.P.A. #72, except as modified herein.

B. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "Good Quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

C. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings).

E. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all cabling diagrams, schematics, physical equipment sizes, etc. before beginning system installation and refer to the riser / connection diagram for all specific system installation / termination / cabling data.

F. Fasteners and supports shall be adequate to support the required load.

4.2 FLEXIBILITY IN SYSTEM DESIGN

A. The Fire Alarm System contractor shall provide flexibility in their design to accommodate future expansion or tenant improvements.

B. Provide all quantities of equipment as specified, while maintaining the “Spare Capacity” requirements listed in this Specification.

4.3 FIRE ALARM SYSTEM MOUNTING HEIGHTS AND LOCATIONS

A. Fire Alarm System Control Panel (FACP)

1. The Fire Alarm System Control Panel shall be installed in the location indicated on the contract documents.

2. The Fire Alarm System Control Panel shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3. The top of the Fire Alarm System Control Panel shall be located 60" above the finished floor, unless noted otherwise and shall be installed level.
B. Fire Alarm System Terminal Cabinets:
   1. Where Fire Alarm System Terminal Cabinets are required, they shall be installed within spaces designated for electrical equipment (Electrical Rooms, MDF Rooms, IDF Rooms, etc.).
   2. Fire Alarm System Terminal Cabinets shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
   3. The top of the Fire Alarm System Terminal Cabinet shall be located 60" above the finished floor, unless noted otherwise and shall be installed level.

C. Fire Alarm Remote Annunciator Panel(s) (FARAP):
   1. The Fire Alarm Remote Annunciator Panel(s) shall be installed in the location indicated on the contract documents.
   2. The Fire Alarm Remote Annunciator Panel(s) shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
   3. The top of the Fire Alarm Remote Annunciator Panel(s) (FARAP) shall be located 48" above the finished floor, unless noted otherwise and shall be installed level.
   4. The maximum length of cabling between the Fire Alarm System Control Panel and the Fire Alarm Remote Annunciator Panel(s) shall be limited to 6,000 feet.

D. Manual Pull Stations:
   1. Provide semi-flush mounted Manual Pull Station(s) on standard single gang electrical back box when located in finished areas or where indicated on the contract documents.
   2. Provide surface mounted Manual Pull Station(s) on matching back box when located in unfinished areas or where indicated on the contract documents.
   3. The operable part of each manual pull station shall be mounted no lower than 42" or more than 48" above the finished floor.
   4. Each manual pull station shall be located within 5'-0" of the latch side of an exterior opening man door.
   5. In some cases, a single manual pull station may be located in a constantly attended area, such as a receptionist area.

E. Heat Detectors:
   1. The distance between Heat Detectors shall not exceed their listed spacing and shall be installed in accordance with manufacturer’s recommendations.
   2. Heat Detectors shall be within a distance of one-half their listed spacing measured at right angles from:
      Walls
      a. Partitions extending upward to within the top 15% of the ceiling height.
      b. Exposed solid joists extending more than 4" down from the ceiling.
   3. All points on the ceiling shall have a Heat Detector within a distance equal to or less than 0.7 times the listed spacing.
   4. Ceiling mounted Heat Detectors shall not be installed closer than 4" of a wall.
   5. Wall mounted Heat Detectors shall not be installed closer than 4" or more than 12" down from the ceiling to the top of the Detector.
6. Heat Detector locations under sloped ceilings / roofs:
   a. Placed at or within 3'-0" (measured horizontally) of the high side of sloped ceilings/roofs.
   b. For Sloped ceilings / roofs less than 30°: All Heat Detectors shall be spaced based upon the overall height of the peak.
   c. For Sloped ceilings / roofs of 30° or greater: All Heat Detectors (other than those located in the peak) shall be spaced based upon the average slope height of the peak.
   d. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

7. Listed Heat Detector spacing shall be de-rated in accordance with Table 17.6.3.5.1 of N.F.P.A. #72 for spaces having a ceiling height of 10'-0" up to 30'-0" in height.

8. Heat Detectors shall be located 3'-0" or more away from a supply or exhaust H.V.A.C. grille.

F. Linear Heat Detection Cable:

1. The distance between Linear Heat Detector Cables shall not exceed their listed spacing and shall be installed in accordance with manufacturer’s recommendations.

2. Linear Heat Detector Cables installed in the following construction types shall be installed in the following locations:
   a. Smooth Ceilings: There shall be a detector run within a distance of one-half the listed spacing measured at a right angle from:
   b. Walls.
   c. Partitions that extend to within the top 15% of the ceiling height.
   d. Solid Joist Construction: The Linear Heat Detector Cables shall be mounted on the bottom of solid joist
      1) Linear Heat Detector Cable spacing on all runs measured at right angles parallel to the joists shall not exceed 50% of the smooth ceiling spacing.
      2) Linear Heat Detector Cable spacing on all runs that parallel both joists and walls, the spacing shall not exceed 25% of the smooth ceiling spacing.
   e. Beam Construction:
      1) Where beams are 4" or less in depth, the ceiling shall be treated the same as a smooth ceiling.
      2) Where beams project more than 4" below the ceiling, the spacing at right angles to the direction of beam travel shall not exceed two-thirds of the smooth ceiling spacing.
      3) Where the beams project more than 18" below the ceiling and are spaced more than 8'-0" on center, each bay formed by the beams shall be treated as a separate area requiring coverage.

3. Ceiling mounted Linear Heat Detector Cables shall not be installed closer than 4" of a wall.

4. Wall mounted Linear Heat Detector Cables shall not be installed closer than 4" or more than 20" down from the ceiling.

5. At least one Linear Heat Detector Cable shall be placed at or within 3'-0" (measured horizontally) of the high side of sloped ceilings / roofs, but no closer than 4" vertically from the high side of sloped ceiling / roofs.

6. Linear Heat Detector Cable spacing shall be de-rated in accordance with Table 17.6.3.5.1 of N.F.P.A. #72 for spaces having a ceiling height of 10'-0" up to 30'-0" in height.
7. Linear Heat Detector Cable shall be located 3'-0" or more away from a supply or exhaust H.V.A.C. grille.
8. For special application protection, the Linear Heat Detector Cable shall be installed immediately above the particular hazard in such a way that it will be exposed to the hot gases emanating from any fire or mounted beneath a horizontal surface that will cause the same radial spread of heat as the ceiling of a room does in area protection applications.
9. Corners should be rounded by pulling the Linear Heat Detector Cable into a natural curve rather than bending it to create a spring tension at the corners that helps hold the Linear Heat Detector Cable in place.
10. All bending and fitting of Linear Heat Detector should be done with the fingers, the use of pliers or other hard tools shall not be used.
11. Bend of 90° or larger shall not be allowed.

G. Smoke Detectors:

1. The distance between Smoke Detectors shall not exceed their listed spacing and shall be installed in accordance with manufacturer's recommendations.
2. Smoke Detectors shall be within a distance of one-half their listed spacing measured at right angles from:
   a. Walls
   b. Partitions extending upward to within the top 15% of the ceiling height.
3. All points on the ceiling shall have a Smoke Detector within a distance equal to or less than 0.7 times the listed spacing.
4. Ceiling mounted Smoke Detectors shall not be installed closer than 4" of a wall.
5. Wall mounted Smoke Detectors shall not be installed closer than 4" or more than 12" down from the ceiling to the top of the Detector.
6. Smoke Detectors shall be located no closer than 3'-0" from a supply or exhaust H.V.A.C. grille.
7. Smoke Detectors shall be located no further than 5'-0" from the Fire Alarm System Control Panel, Remote Audible / Visual Power Supplies, and Transmitting Equipment.
8. For ceiling containing beams, Smoke Detectors shall be installed in accordance with Section 17.7.3.2.4.2.
9. For sloped ceilings with beams, Smoke Detectors shall be installed in accordance with Section 17.7.3.2.4.3.
10. For "Peaked" or "Shed" roofs, Smoke Detectors shall first be spaced and located within 3'-0" of the "Peak" or high side of the "Shed" ceiling, measured horizontally. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.
11. Smoke Detectors shall not be installed prior to the system programming and test period to avoid getting the Smoke Detector dirty from construction. If after the installation of the Smoke Detector construction is still ongoing, the Fire Alarm System Contractor shall protect Smoke Detectors from contamination and physical damage.
12. Smoke Detector listed spacing shall be de-rated in accordance with Table 17.7.6.3.3.2 of N.F.P.A. #72 in "High Air Movement Areas".

H. Smoke Detectors for Magnetic Door Holders:

1. Ceiling mounted smoke detectors shall be located in the following locations:
   a. Placed along the centerline of the door opening in a perpendicular direction.
b. Placed no further than 5'-0" measured along the ceiling from the door in which it serves

2. Wall mounted smoke detectors shall be located in the following locations:
   a. Placed above the door opening centerline.

3. When the distance from the ceiling to the top of the door opening is 2'-0" or less on both sides of the door opening:
   a. Provide a single Ceiling Mounted or Wall Mounted Smoke Detector located on one side of the door opening.
   b. When the distance from the ceiling to the top of the door opening is 2'-0" or less on one side of the door opening and greater than 2'-0" on the other side of the door opening:
      c. Provide a single Ceiling Mounted or Wall Mounted Smoke Detector located on the higher ceiling side of the door opening.

4. When the distance from the ceiling to the top of the door opening is greater than 2'-0" on both sides:
   a. Provide a Ceiling Mounted or Wall Mounted Smoke Detector located on each side of the door opening.

I. Smoke Detectors for Elevator Recall:

1. Smoke Detectors for Elevator Recall shall be installed in the following manor:
   a. On the ceiling.
   b. Placed along the centerline of each elevator door within the elevator bank under control of the Smoke Detector.
   c. Within 21'-0" of each elevator door. In the elevator bank.

J. Duct Smoke Detectors:

1. Install in accordance with manufacturer's recommendations.
2. Duct Smoke Detectors shall be mounted on return H.V.A.C. air ducts that contain an airflow greater than 2,000 c.f.m.
3. Duct smoke detectors shall be installed in the return H.V.A.C. air duct (not supply) at a point downstream of the last tap location where 100% full air flow is present with properly sized air sampling tubes.
4. Duct smoke detectors shall be installed at each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air return systems having a capacity greater than 15,000 c.f.m. and serving more than one story.
5. Duct Smoke Detectors shall be mounted on supply H.V.A.C. air ducts that contain an airflow greater than 2,000 c.f.m.
6. Duct Smoke Detectors shall be installed in the supply H.V.A.C. air duct (not return) at a point upstream of the first tap location where 100% full air flow is present with properly sized air sampling tubes.

K. Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED):

1. Ceiling Mounted Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) shall not be installed.
2. Mount Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) on the wall such that the key is located at an elevation of approximately 5'-0" above finished floor and located within a 5'-0" radius of the duct smoke detector in Floor Plan view.
3. The location of the Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) shall be visible from the floor and readily accessible.
4. Install Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) whenever a duct smoke detectors Light Emitting Diode (LED) is not visible to responding personnel from the walking surface / floor, such as:
   a. When installed above a ceiling.
   b. At an elevation higher than 8'-0" above finished floor.
   c. In an attic.

L. Carbon Monoxide Detectors:

   1. Carbon Monoxide Detectors can be mounted on the wall or ceiling.
   2. Carbon Monoxide Detectors shall be flush mounted when located in finished areas.
   3. Wall mounted Carbon Monoxide Detectors installed in indoor locations shall be at 80" above the finished floor or 6" below the ceiling, whichever is lower.
   4. Carbon Monoxide Detectors shall be placed in the following locations:
      a. In any room that contains a fuel-burning appliance.

M. Combination Smoke / Carbon Monoxide Detectors:

   1. Combination Smoke / Carbon Monoxide Detectors can be mounted on the wall or ceiling.
   2. Carbon Monoxide Detectors shall be flush mounted when located in finished areas.
   3. Wall mounted Carbon Monoxide Detectors installed in indoor locations shall be at 80" above the finished floor or 6" below the ceiling, whichever is lower.
   4. Carbon Monoxide Detectors shall be placed in the following locations:
      a. In any room that contains a fuel-burning appliance.

N. Multi-Criteria Detectors:

   1. Multi-Criteria Detectors shall not exceed their listed spacing and shall be installed in accordance with manufacturer’s recommendations.
   2. Multi-Criteria Detectors shall be within a distance of one-half their listed spacing measured at right angles from:
      a. Partitions extending upward to within the top 15% of the ceiling height.
   4. All points on the ceiling shall have a Multi-Criteria Detector within a distance equal to or less than 0.7 times the listed spacing.
   5. Ceiling mounted Multi-Criteria Detectors shall not be installed closer than 4" of a wall.
   6. Wall mounted Multi-Criteria Detectors shall not be installed closer than 4" or more than 12" down from the ceiling to the top of the Detector.
   7. Multi-Criteria Detectors shall be located no closer than 3'-0" from a supply or exhaust H.V.A.C. grille.
   8. For ceiling containing beams, Multi-Criteria Detectors shall be installed in accordance with Section 17.7.3.2.4.2.
   9. For sloped ceilings with beams, Multi-Criteria Detectors shall be installed in accordance with Section 17.7.3.2.4.3.
10. Multi-Criteria Detector locations under sloped ceilings / roofs:
   a. Placed at or within 3'-0" (measured horizontally) of the high side of sloped ceilings/roofs.
   b. For Sloped ceilings / roofs less than 30°: All Multi-Criteria Detectors shall be spaced based upon the overall height of the peak.
   c. For Sloped ceilings / roofs of 30° or greater: All Multi-Criteria Detectors (other than those located in the peak) shall be spaced based upon the average slope height of the peak.
   d. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

11. Multi-Criteria Detectors shall not be installed prior to the system programming and test period to avoid getting the Smoke Detector dirty from construction. If after the installation of the Smoke Detector construction is still ongoing, the Fire Alarm System Contractor shall protect Smoke Detectors from contamination and physical damage.

12. Multi-Criteria Detector listed spacing shall be de-rated in accordance with Table 17.7.6.3.3.2 of N.F.P.A. #72 in "High Air Movement Areas".

O. Strobe Only Appliances:

1. Strobe Only Appliances shall be flush mounted when located in finished areas.
2. Strobe Only Appliances may be surface mounted when located in unfinished areas.
3. If there is an interruption of the concentrated viewing path, such as a fire door, an elevation change, or any other obstruction, the area shall be treated as a separate corridor.
4. Strobe Only Appliances indicated on the contract documents are based upon the utilization of (75) Candela (Cd) strobes at a 44'-0" x 44'-0" spacing for ceiling mounted visual appliances and 45'-0" x 45'-0" spacing for wall mounted visual appliances. If the Fire Alarm System Contractor decides to install lower output Strobe Only Appliances, it becomes the responsibility of the Fire Alarm System Contractor to meet the minimum Candela (Cd) rating at the listed maximum room size indicated in Table 18.5.5.4.1(a) for wall mounted Strobe Only Appliances or Table 18.5.5.4.1(b) for ceiling mounted Strobe Only Appliances of N.F.P.A. #72.
5. Ceiling Mounted Strobe Only Appliances shall be installed as recommended by the manufacturer.
6. Wall mounted Strobe Only Appliances installed in indoor locations shall be installed with the entire lens not less than 80" above the finished floor and not greater than 96" above the finished floor.
7. Where low ceiling heights do not allow wall mounted Strobe Only Appliances to be installed with the entire lens not less than 80" above the finished floor, the following shall apply:
   a. Wall mounted Strobe Only Appliance shall be mounted within 6' of the ceiling.
   b. The "Area of Coverage" of Strobe Only Appliances shall be reduced by twice the difference between the minimum mounting height of 80" and the actual, lower mounting height.
8. Strobe Only Appliances installed in corridors greater than 20'-0" wide shall comply with the spacing requirements of Section 18.5.5.4 of N.F.P.A. #72.
9. Strobe Only Appliances installed in corridors less than 20'-0" wide shall not be located more than 15'-0" from the end of the corridor or more than 100'-0" apart.
10. A "Performance Based Alternative" shall be allowed for designs that provide a minimum illumination of 0.0375 lumens per square feet (foot-candles) to all occupiable spaces where visible notification is required.
   a. The illumination from a visible notification appliance (E) at a particular distance is equal to the effective intensity (cd) of the appliance divided by the distance (D) squared (E = cd/D²) for projections to the opposite wall.
   b. The illumination from a visible notification appliance (E) at a particular distance at 90° off-axis is 25% of rated intensity (cd) of the appliance divided by the distance (D) squared (E = 25% cd/D²) for projections to the adjacent wall.

P. Horn Only Appliances:
   1. Horn Only Appliances shall be flush mounted when located in finished areas.
   2. Horn Only Appliances may be surface mounted when located in unfinished areas.
   3. Ceiling Mounted Horn Only Appliances shall be installed as recommended by the manufacturer.
   4. Wall mounted Horn Only Appliances installed in indoor locations with the top of the appliance not less than 90" above the finished floor or less than 6" below the ceiling, whichever is lower.

Q. Mini-Horn Appliances:
   1. Mini-Horn Only Appliances shall be flush mounted when located in finished areas.
   2. Mini-Horn Only Appliances may be surface mounted when located in unfinished areas.
   3. Ceiling Mounted Mini-Horn Only Appliances shall be installed as recommended by the manufacturer.
   4. Wall mounted Mini-Horn Only Appliances installed in indoor locations with the top of the appliance not less than 90" above the finished floor or less than 6" below the ceiling, whichever is lower.

R. Combination Horn / Strobe Appliances:
   1. Combination Horn / Strobe Appliances shall be flush mounted when located in finished areas.
   2. Combination Horn / Strobe Appliances may be surface mounted when located in unfinished areas.
   3. Strobe Only Appliances indicated on the contract documents are based upon the utilization of (75) Candela (Cd) strobes at a 44'-0" x 44'-0" spacing for ceiling mounted visual appliances and 45'-0" x 45'-0" spacing for wall mounted visual appliances. If the Fire Alarm System Contractor decides to install lower output Combination Horn / Strobe Appliances, it becomes the responsibility of the Fire Alarm System Contractor to meet the minimum Candela (Cd) rating at the listed maximum room size indicated in Table 18.5.5.4.1(a) for wall mounted Combination Horn / Strobe Appliances or Table 18.5.5.4.1(b) for ceiling mounted Combination Horn / Strobe Appliances of N.F.P.A. #72.
   4. Ceiling Mounted Combination Horn / Strobe Appliances shall be installed as recommended by the manufacturer.
   5. Wall mounted Combination Horn / Strobe Appliances installed in indoor locations shall be at 80" above the finished floor or 6" below the ceiling, whichever is lower.
   6. If there is an interruption of the concentrated viewing path, such as a fire door, an elevation change, or any other obstruction, the area shall be treated as a separate corridor.
7. Wall mounted Combination Horn / Strobe Appliances installed in indoor locations shall be installed with the entire lens not less than 80" above the finished floor and not greater than 96" above the finished floor.

8. Where low ceiling heights do not allow wall mounted Combination Horn / Strobe Appliances to be installed with the entire lens not less than 80" above the finished floor, the following shall apply:
   a. Wall mounted Combination Horn / Strobe Appliances shall be mounted within 6" of the ceiling.
   b. The "Area of Coverage" of Combination Horn / Strobe Appliances shall be reduced by twice the difference between the minimum mounting height of 80" and the actual, lower mounting height.

9. Combination Horn / Strobe Appliances installed in corridors greater than 20'-0" wide shall comply with the spacing requirements of Section 18.5.5.4 of N.F.P.A. #72.

10. Combination Horn / Strobe Appliances installed in corridors less than 20'-0" wide shall not be located more than 15'-0" from the end of the corridor or more than 100'-0" apart.

11. A "Performance Based Alternative" shall be allowed for designs that provide a minimum illumination of 0.0375 lumens per square feet (foot-candles) to all occupiable spaces where visible notification is required.
   a. The illumination from a visible notification appliance (E) at a particular distance is equal to the effective intensity (cd) of the appliance divided by the distance (D) squared (E = cd/D²) for projections to the opposite wall.
   b. The illumination from a visible notification appliance (E) at a particular distance at 90° off-axis is 25% of rated intensity (cd) of the appliance divided by the distance (D) squared (E = 25%cd/D²) for projections to the adjacent wall.

S. Graphic Maps:
   1. Provide a minimum of 6" of wall space between the Graphic Map and each Fire Alarm Remote Annunciator Panel and the Fire Alarm System Control Panel.
   2. Tops of the Graphic Maps shall be located 60" above the finished floor, unless noted otherwise.
   3. The top of the Graphic Map shall be level.
   4. Use the Manufacturer provided mounting hardware and install per Manufacturer’s recommendations.

T. AES Wireless Transceiver:
   1. The AES Wireless Transceiver shall be installed in the location indicated on the contract documents.
   2. The AES Wireless Transceiver shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
   3. The top of The AES Wireless Transceiver shall be located 60" above the finished floor, unless noted otherwise and shall be installed level.
   4. The maximum distance between the AES Wireless Transceiver and the Fire Alarm System Control Panel shall be 25'-0"

U. Antennas:
   1. Antenna shall be installed above the roof line of the building in a location having an unobstructed path to the supervising station receiving equipment.
2. Standard coaxial cabling length shall not exceed 100'-0" and shall be cut to length with a maximum service loop of 1'-0" provided at the radio transmitter enclosure.
3. Enlarged coaxial cabling length shall not exceed 500'-0" and shall be cut to length with a maximum service loop of 1'-0" provided at the radio transmitter enclosure.
4. The coaxial cable shall be entirely installed in metallic conduit.
5. The coaxial cable shall be routed from the antenna to the lightning arrester (static discharge unit) and from the lightning arrester to the radio transmitter.
6. The connections at the antenna and lightning arrester shall be provided with a sealant for weatherproofing.
7. Where the conduit penetrates the building, the conduit should be, at a minimum, 3/4-inch rigid conduit.
8. Penetrating conduit should directly enter the lightning arrester enclosure on the inside of the building.
9. A drip loop shall be provided where the cable enters conduit to prevent rain or moisture from entering.

4.4 MISCELLANEOUS CONNECTION POINTS

A. Magnetic Door Holders:

1. Magnetic Door Holders (indicated on the contract documents) shall be controlled by use of a relay module.
2. Magnetic Door Holder relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Magnetic Door Holder relay modules to be on a battery back-up power supply.
3. Upon activation of the Fire Alarm System, Magnetic Door Holder relay modules shall release allowing the Doors to close.

B. Magnetic Door Locks:

1. Magnetic Door Locks (indicated on the contract documents) shall be controlled by use of a relay module.
2. Magnetic Door Lock relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Magnetic Door Lock relay modules to be on a battery back-up power supply.
3. Upon activation of the Fire Alarm System, Magnetic Door Lock relay modules shall release allowing the Door Locks to open.

C. Coiling Fire Doors:

1. Coiling Fire Doors (indicated on the contract documents) shall be controlled by use of a relay module.
2. Coiling Fire Door relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Coiling Fire Door relay modules to be on a battery back-up power supply.
3. Upon activation of the Fire Alarm System, Coiling Fire Door relay modules shall release allowing the Coiling Fire Doors to close.
D. Fire Rated Shutters:
   1. Fire Rate Shutters (indicated on the contract documents) shall be controlled by use of a relay module.
   2. Fire Rate Shutter relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Fire Rate Shutter control modules to be on a battery back-up power supply.
   3. Upon activation of the Fire Alarm System, Fire Rated Shutter relay modules shall release allowing the Fire Rated Shutters to close.

E. Intercom Systems:
   1. Intercom Systems (indicated on the contract documents) shall be controlled by use of a relay module.
   2. Intercom System relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Intercom System relay modules to be on a battery back-up power supply.
   3. Upon activation of the Fire Alarm System, the Intercom System relay modules shall terminate the Intercom systems allowing the Fire Alarm System to be the only operational sound producing system.

F. Public Address (PA) Systems:
   1. Public Address (PA) Systems (indicated on the contract documents) shall be controlled by use of a relay module.
   2. Public Address (PA) System relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Public Address (PA) System relay modules to be on a battery back-up power supply.
   3. Upon activation of the Fire Alarm System, the Public Address (PA) System relay modules shall terminate the Public Address (PA) Systems, allowing the Fire Alarm system to be the only operational sound producing system.

4.5 DEVICE RELOCATIONS

A. Prior to installation and without extra charge, the Architect and/or Engineer may:
   1. Relocate devices up to 15'-0" from location indicated.
   2. Change from a ceiling mounted to a wall mounted installation.
   3. Change from a wall mounted to a ceiling mounted installation.

4.6 CONDUIT

A. Provide and install conduit, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power any specialty system control panel(s) and equipment.

B. The Contractor is responsible for assuring that the conduit size is suitable for the equipment supplied.
C. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

D. Cabling installed in walls, below 8'-0" in elevation, above inaccessible ceilings or installed exposed to view shall be installed in conduit.

E. Conduit shall be in accordance with N.F.P.A. #70, local requirements, and state requirements.

F. The minimum radius bend of conduit shall be:

1. Ten (10) times the cable outside diameter with no tensile load applied during installation.
2. Twenty (20) times the cable outside diameter with a maximum tensile load of 25 feet/lbs. applied during installation.

G. Conduit shall not enter the Fire Alarm System Control Panel or any other remotely mounted panel, equipment, or back box, except where conduit entry is specified by the manufacturer.

4.7 WIREMOLD SURFACE RACEWAY

A. Provide and install the Wiremold Surface Raceway, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power any specialty system control panel(s) and equipment.

B. The Contractor is responsible for assuring that the Wiremold Surface Raceway size is suitable for the equipment supplied.

C. All Wiremold Surface Raceway, junction boxes, conduit supports, and hangers shall be exposed.

D. Wiremold Surface Raceway shall not enter the Fire Alarm System Control Panel or any other remotely mounted panel, equipment, or back box, except where Wiremold entry is specified by the manufacturer.

4.8 CABLING

A. Cabling for 24 Volts D.C. control, alarm notification, and similar power-limited auxiliary functions may be run in the same conduit as Initiating Device Circuits (IDC) and Signaling Line Circuits (SLC).

B. The Contractor is responsible for assuring that the cable quantity, size, and type is suitable for the equipment supplied.

C. Cable must be separated from any open conductors of Power or Class 1 circuits and shall not be placed in any conduit, junction box, or raceway containing these conductors per Article 760 of N.F.P.A. #70.

D. Do not exceed the cabling distance limitation of the equipment, device(s), cable(s), and/or conductor(s) as recommended by the manufacturer of either equipment and/or cables for each installation application.
E. All Fire Alarm System cabling must be new and free from insulation scrapes or peeling.

F. Cabling insulation shall be one of the types required by Article 725-16 of N.F.P.A. #70 and shall be consistently color coded throughout the system.

G. The Fire Alarm System Control Panel shall be connected to a separate dedicated branch circuit rated for a maximum of 20 amperes at 120 Volts A.C. This circuit shall be labeled at the main power distribution panel as "FIRE ALARM".

H. Permanent cable markers shall be affixed to all conductors at terminations and splices.

I. T-Tapping of Class "A" circuits (i.e. Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Signaling Line Circuits (SLC) etc.) is not allowed.

J. T-Tapping of Class "B" circuits (i.e. Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Signaling Line Circuits (SLC) etc.) is allowed.

K. All cabling terminal blocks shall be the plug-in / removable type and shall be capable of terminating up to 12 AWG cable.

L. Exposed cabling will be allowed above accessible ceilings only.

   1. Class "A" exposed cabling installed vertically in concealed locations shall be provided with a minimum separation distance of 1'-0".
   2. Class "A" exposed cabling installed horizontally in concealed locations shall be provided with a minimum separation distance of 4'-0".

M. Cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in N.F.P.A. #70 (e.g., FPLR).

N. The Fire Alarm System Contractor shall ensure that cables are installed with care, using techniques which prevent kinking, sharp bends, scraping, cutting, deforming the jacket, or other damage. During inspection, evidence of such damage will result in the material being declared unacceptable. The Fire Alarm System Contractor shall replace all unacceptable cabling at no additional expense to the Owner.

O. For consistency of cabling throughout the entire system equipment, if specific conductor colors are not called out in each system specification, then the following colors shall apply:

   1. Red is (+) Positive voltage.
   2. Black is (-) Negative voltage.
   3. White is common.
   4. Green is normally open or normally closed.

P. All cabling penetrations into a box, fitting, enclosure, panel, etc. shall be provided with a bushing to protect the cabling from abrasion in accordance with Paragraph 342.46 of N.F.P.A. #70. Hard rubber or compression bushings will not be approved and shall not be used.
Q. In the event of a primary power failure, disconnected back-up battery, an open circuit in the field cabling, or removal of any internal modules a trouble signal shall be activated and remain active until the system is restored to normal condition.

1. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow).

R. No cable other than the detector circuit shall be permitted in conduit feeding detectors unless approved.

S. Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

T. Minimum cable sizes shall be as follows:

1. 120 Volts A.C. cabling shall be a minimum of #12 American Wire Gauge (AWG).
2. Initiating Device Circuits (IDC) (Manual Pull Stations, Heat Detectors, Smoke Detectors, Carbon Monoxide Detectors, Duct Smoke Detectors, etc.) shall be a minimum of #16 American Wire Gauge (AWG) twisted shielded pair FPL rated.
3. Notification Appliance Circuits (NAC) (Horns, and Strobes) shall be a minimum of #16 American Wire Gauge (AWG) shielded, twisted FPL rated cable.
5. Heat detectors shall be a minimum of #16 American Wire Gauge (AWG).
6. Linear Heat Detector Cables shall be served by a minimum of #18 American Wire Gauge (AWG) from the Fire Alarm System Control Panel out to the hazard area where it is then connected to the beginning of the Linear Heat Detector Cable portion of the circuit.
7. Monitor modules shall be a minimum of #18 American Wire Gauge (AWG).
8. "Direct Burial" cables shall be a minimum of #16 American Wire Gauge (AWG).
9. "Underground in Conduit" cables shall be a minimum of #16 American Wire Gauge (AWG).

U. Provide a Fire Alarm System Device Naming Matrix that identifies the nomenclature used on the shop drawing consisting of the following:

1. Circuit Type
2. Circuit Number
3. Device type
4. Device number

V. All circuits shall be identified with labels to include cable type, quantity, and circuit number in accordance with the following example:

1. Example circuit identification: C2HX3
   C = Signal Circuit Cabling
   2 = Signal Circuit Number
   H = Annunciator Cabling
   X = Addressable Initiating Device Circuit Cabling
   3 = Addressable Initiating Device Circuit Number
W. Circuit labels shall be provided using an electronic labeler for the following circuit locations:

1. At the Fire Alarm System Control Panel.
2. At all junction boxes.

4.9 CABLE SUPPORTS

A. All horizontal cables shall be independently supported from other trade work at a maximum of 4’-0” intervals. At no point shall cables rest on, be tied to, or otherwise secured to electrical conduit, plumbing piping, H.V.A.C. ductwork, Fire Protection Piping, accessible ceiling and/or light fixture hangers, or any other equipment.

B. Cable shall be secured to building structure by means of approved low voltage cabling supports.

C. Cabling in any Panel shall be neatly arranged and bundled with cabling ties or approved equivalent, zip ties shall not be utilized.

D. All open cabling and/or conduit shall be installed parallel or perpendicular to the structure.

E. Open cable installations shall use insulated mounting supports, "D rings", or "J-Hooks" above accessible ceilings where approved for such use.

F. Cabling shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

G. Installing open cabling and/or conduit on an exposed area of wall that could have been installed in a less conspicuous manner is not acceptable. Any installation that does not meet this requirement will be required to be removed and the ceiling/wall patched and painted to match adjacent surfaces to the satisfaction of the Architect at no additional cost to the Owner.

H. Hangers provided under other Divisions shall not be used for support of Fire Alarm System equipment unless permitted by Engineer.

4.10 JUNCTION BOXES

A. Provide access panels as needed for junction boxes located above inaccessible ceilings or behind walls.

B. All junction boxes for the Fire Alarm System shall be painted red.

C. All Fire Alarm System junction boxes shall be annotated "FA" on the cover in black bold print having minimum character font size of 2” tall by 1” wide.

D. All Fire Alarm System junction boxes shall be annotated "Fire Alarm Power Limited" on the cover in black bold print having a minimum character font size of ¼” tall by ¼” wide.

4.11 GROUNDING

A. A grounding system shall be maintained as required by code.
4.12 ADDITIONAL FIELD DEVICES AND INSTALLATION LABOR

A. In order to minimize the impacts to project schedule and costs of implementing changes during the course of construction, the Fire Alarm System Contractor shall include in his bid the following list of material, associated installation labor based on existing jobsite conditions, established construction standards, and all fees associated with documenting and executing changes.

<table>
<thead>
<tr>
<th>QTY</th>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual Pull Stations</td>
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<tr>
<td>1</td>
<td>Heat Detectors</td>
</tr>
<tr>
<td>1</td>
<td>Photoelectric Smoke Detectors</td>
</tr>
<tr>
<td>2</td>
<td>Smoke Detector Bases</td>
</tr>
<tr>
<td>5</td>
<td>Device Boxes</td>
</tr>
<tr>
<td>5</td>
<td>4S J-boxes with blank covers</td>
</tr>
<tr>
<td>50</td>
<td>LF ¾&quot; EMT with (4) #14 THHN cabling (include couplers, straps, connectors, etc.)</td>
</tr>
<tr>
<td>10</td>
<td>Hrs. Labor for Journeyman Electrician</td>
</tr>
</tbody>
</table>

B. The installation locations of additional field devices shall be as directed by the Architect and/or Engineer with all remaining "Spare Parts" being provided to the Owner upon completion of the final testing and system certifications.

C. All material shall match those components utilized in the system.

D. Provide signed proof of delivery to the Owner with close out documentation.

4.13 FORMAL TESTS AND INSPECTIONS

A. Upon completion of the Division 28 work, the Fire Alarm System Contractor shall deliver to the Fire Protection Engineer a completion letter stating that he has fulfilled all the requirements of his Contract work, as set forth in the contract documents and project specifications and that all items in pre-final inspection lists submitted by the Engineer have been satisfactorily completed.

B. The Fire Alarm System Contractor shall arrange for and obtain all required inspections and certificates pertaining to the Fire Alarm System work and deliver the certificates to the Fire Protection Engineer.

C. Submit copies of preliminary test results to the Architect/Engineer for review and approval prior to submitting a request for final acceptance testing with the Authority Having Jurisdiction.

D. Submit a written request to local fire protection authority for formal inspection at least 14 days before the inspection date.

E. An experienced technician regularly employed by the system installer shall be present during the inspection.

F. At this inspection, repeat any or all of the required tests as directed.
G. Correct defects in work provided by the Contractor and perform additional system tests until the system complies with current code and the contract requirements.

H. Furnish appliances, equipment, electricity, instruments, connecting devices and personnel for the tests.

I. Furnish Architect with three (3) copies of test certificates required by testing agencies.

4.14 FIRE ALARM SYSTEM TESTING

A. Upon completion on the system installation, the Fire Alarm System Contractor shall conduct a system test for the Owner, Architect, Engineer, and Authority Having Jurisdiction (for those who wish to attend) to verify operation of the system.

B. This system test shall be conducted by a factory trained technician.

C. The Fire Alarm System Contractor shall provide a minimum of (2), two-way communication devices for the system test.

D. The Fire Alarm System Contractor shall completely fill out all applicable documents contained Section 7.8 "Forms" of N.F.P.A. #72.

E. If the Fire Alarm System Contractor fails the Authority Having Jurisdiction system test and inspection, the following shall occur:
   1. The Fire Alarm System Contractor shall make all of the necessary corrections as required, to pass the Authority Having Jurisdiction testing and inspection.
   2. Notify the Authority Having Jurisdiction and schedule another test.
   3. Pay all associated fees for additional site visits made by the Authority Having Jurisdiction.
   4. Continue making corrections until the Fire Alarm System has been accepted by the Authority Having Jurisdiction.

F. After acceptance of the system testing, the Fire Alarm System Contractor shall submit a copy of approved test certificates with Authority Having Jurisdiction signature

4.15 TESTING REQUIREMENTS

A. Fire Alarm Control Panel testing shall include, but is not limited to the following:
   1. Verify Control Panel LED’s.
   2. Verify Control Panel Display.
   3. Verify Control Panel Piezo-electric audible device operates.
   5. Verify "Trouble" Condition at the Control Panel.
   6. Verify "Supervisory" Condition at the Control Panel.
   8. Verify "Queue Switch" at the Control Panel.
   9. Verify "Reset Switch" at the Control Panel.
11. Verify Battery Trouble at the Control Panel.
12. Verify Battery Charger Output at the Control Panel.
15. Verify Open Circuit condition at the Control Panel.
16. Verify Short Circuit condition at the Control Panel.
17. Verify Addresses match the address and location of all field devices at the Control Panel.

B. Fire Alarm System Remote Annunciator Panel testing shall include, but is not limited to the following:

1. Verify Remote Annunciator Panel LED’s.
2. Verify Remote Annunciator Panel Display.
8. Verify "Queue Switch" at the Remote Annunciator Panel.
9. Verify Remote Annunciator Panel display matches the display at the Fire Alarm System Control Panel.

C. Fire Alarm System Power Supply testing shall include, but is not limited to the following:

2. Verify Battery Trouble at the Power Supply.
3. Verify Battery Charger Output at the Power Supply.
5. Verify Ground Fault at the Power Supply.
7. Verify Short Circuit at the Power Supply.

D. Fire Alarm System Initiating Device testing shall include, but is not limited to the following:

2. Verify activation of all System Smoke Detectors initiate an "Alarm" condition at the Fire Alarm System Control Panel.
4. Verify activation of Duct Smoke Detector initiates a "Supervisory" condition at the Fire Alarm System Control Panel and that the H.V.A.C. unit being served by the Duct Smoke Detector shuts down.
5. Verify activation of all System Carbon Monoxide Detectors initiates an "Alarm" condition at the Fire Alarm System Control Panel.

E. Fire Alarm System Notification Appliance testing shall include, but is not limited to the following:

1. Verify that all Strobes are operational and synchronized.
2. Verify that all Horns are operational and synchronized.

F. Magnetic Door Holder testing shall include, but is not limited to the following:
   1. Verify activation of smoke detector placed within 5'-0" of a Magnetic Door Holder releases the Magnetic Door Holders.

G. Magnetic Door Lock testing shall include, but is not limited to the following:

H. Audio/Visual Sound System testing shall include, but is not limited to the following:
   1. Verify that each active Audio/Visual Sound System terminates operation upon an "Alarm" condition at the Fire Alarm System Control Panel.

I. Intercom System testing shall include, but is not limited to the following:
   1. Verify that each Intercom System terminates operation upon an "Alarm" condition at the Fire Alarm System Control Panel.

J. Public Address System testing shall include, but is not limited to the following:
   1. Verify that each Public Address (PA) System terminates operation upon an "Alarm" condition at the Fire Alarm System Control Panel.

K. Smoke Damper and Combination Fire / Smoke Damper testing shall include, but is not limited to the following:
   1. Verify an "Alarm" condition at the Fire Alarm System Control Panel from a smoke detector located in the area in which the Smoke Damper or Combination Fire / Smoke Damper is located automatically closes the Smoke Damper or Combination Fire / Smoke Damper and the H.V.A.C. mechanical unit is shut down.

L. Initiating Device Circuits (IDC), Signaling Line Circuit (SLC), and Notification Appliance Circuit (NAC) cable testing shall include, but is not limited to the following:
   1. Loop Resistance test.
   2. Verify Open Circuit condition on Negative Leg of all circuits.
   3. Verify Open Circuit condition on Positive Leg of all circuits.
   4. Verify Open Circuit Ground condition on Negative Leg of all circuits.
   5. Verify Open Circuit Ground condition on Positive Leg of all circuits.
   6. Verify Open Circuit Cable-to-Cable Short condition in all circuits.
   7. Verify Closed Circuit Ground Fault condition in all circuits.
   8. Verify Closed Circuit Cable-to-Cable Short condition in all circuits.
   9. Verify Closed Circuit Cable-to-Cable Short and Ground condition on Negative Leg of all circuits.
  10. Verify Closed Circuit Cable-to-Cable Short and Ground condition on Positive Leg of all circuits.
  11. Verify Circuit Voltage of each circuit at maximum system operation.
12. Verify Current Draw of each circuit at maximum system operation.
13. Verify Class "B" wiring in all circuits.

4.16 AUDIBILITY REQUIREMENTS

A. The Fire Alarm System Contractor shall perform audibility testing in each space of the building prior to acceptance testing.

B. Decibel readings shall be taken at a point 10'-0" from the appliance at an elevation of 5'-0" above finished floor.

C. The sound level shall meet both of the following requirements:
   1. A minimum of 15 decibels (dBs) above the average ambient sound level.
   2. A minimum of 5 decibels (dBs) above the maximum sound level having a minimum duration of 60 seconds.

D. Decibel measurements shall be taken using the "A-weighted" measurements which are relatively flat from 600 Hz to 7,000 Hz, "B-weighted" (relatively flat from 300 Hz to 4,000 Hz) and "C-weighted" (relatively flat from 700 Hz to 4,000 Hz, measurements will not be acceptable.

4.17 INSTRUCTION AND TRAINING PERIOD

A. Upon completion of the work and after all tests and inspections by the authority(s) having jurisdiction, the Fire Alarm System Contractor shall "Hands On" demonstrate and train the Owner's designated operation and maintenance personnel in the operation and maintenance of the Fire Alarm System.

B. The Fire Alarm System Contractor's representative shall be a superintendent, foreman, or technician who is knowledgeable in the system installed.

C. The Fire Alarm System Contractor shall arrange scheduled instruction periods with the Owner's designated operation and maintenance personnel.

D. The Fire Alarm System Contractor shall provide in their bid the following:
   1. (1) editing session of the control panel programming to address any changes required by the Owner.
   2. Training periods shall be based upon complexity of the system installed, but in no case be less than 4 hours in duration.

E. Upon request of the Owner, a "DVD" of the training period shall be made available by the Fire Alarm System Contractor at no additional cost to the Owner.

END OF SECTION
Appendix A:
Prevailing Wages
<table>
<thead>
<tr>
<th>County</th>
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### Prevailing Wage Rates for King County

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<th>Holiday</th>
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<tr>
<td>King</td>
<td>Power Equipment Op Conveyors: 200 tons- 299 tons, or 250â€™ of</td>
<td>$70.57</td>
<td>7A</td>
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<td>Power Equipment Op Conveyors: 300 tons and over or 300â€™ of</td>
<td>$71.26</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Conveyors: 45 Tons Through 99 Tons, Under</td>
<td>$69.16</td>
<td>7A</td>
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<td>Power Equipment Op Conveyors: A-frame - 10 Tons And Under</td>
<td>$65.05</td>
<td>7A</td>
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<td>Power Equipment Op Conveyors: Friction cranes through 199 tons</td>
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<td>7A</td>
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<td>Power Equipment Op Conveyors: through 19 tons with attachment</td>
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<td>7A</td>
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<td>Power Equipment Op Crusher</td>
<td>$68.55</td>
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<td>Power Equipment Op Deck Engineer/Deck Winches (power)</td>
<td>$68.55</td>
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<td>Power Equipment Op Derrick, On Building Work</td>
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<td>7A</td>
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<td>Power Equipment Op Dozers D-9 &amp; Under</td>
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<td>King</td>
<td>Power Equipment Op Drill Oilers: Auger Type, Truck Or Crane</td>
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<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Drilling Machine</td>
<td>$69.85</td>
<td>7A</td>
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<td>Power Equipment Op Elevator And Man-lift: Permanent And Sh</td>
<td>$65.05</td>
<td>7A</td>
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<td>Power Equipment Op Finishing Machine, Bidwell And Gamaco</td>
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<td>Power Equipment Op Forklift: 3000 Lbs And Over With Attach</td>
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<td>Power Equipment Op Forklifts: Under 3000 Lbs. With Attachme</td>
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<td>Power Equipment Op Guardrail Punch</td>
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<td>King</td>
<td>Power Equipment Op Hard Tail End Dump Articulating Off- Road</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<td>Power Equipment Op Hard Tail End Dump Articulating Off-road</td>
<td>$68.55</td>
<td>7A</td>
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<td>Power Equipment Op Horizontal/Directional Drill Locator</td>
<td>$68.02</td>
<td>7A</td>
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<td>Power Equipment Op Horizontal/Directional Drill Operator</td>
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<td>Power Equipment Op Hydralifts/Boom Trucks Over 10 Tons</td>
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<td>Power Equipment Op Loader, Overhead 8 Yards. &amp; Over</td>
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<td>7A</td>
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<td>Power Equipment Op Loader, Overhead, 6 Yards. But Not Inclu</td>
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<td>7A</td>
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<td>Power Equipment Op Loaders, Overhead Under 6 Yards</td>
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<td>7A</td>
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<td>Power Equipment Op Loaders, Plant Feed</td>
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<td>Power Equipment Op Loaders: Elevating Type Belt</td>
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<td>7A</td>
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<td>Power Equipment Op Locomotives, All</td>
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<td>King</td>
<td>Power Equipment Op Material Transfer Device</td>
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<td>Power Equipment Op Mechanics, All (leadmen - $0.50 Per Hour)</td>
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<td>King</td>
<td>Power Equipment Op Motor Patrol Graders</td>
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<td>Power Equipment Op Oil Distributors, Blower Distribution &amp; M</td>
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<td>7A</td>
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<td>Power Equipment Op Outside Hoists (Elevators And Manlifts), A</td>
<td>$68.02</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Overhead, Bridge Type Crane: 20 Tons Th</td>
<td>$68.55</td>
<td>7A</td>
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<td>Power Equipment Op Overhead, Bridge Type: 100 Tons And Ov</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<td>Power Equipment Op Overhead, Bridge Type: 45 Tons Through</td>
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<td>7A</td>
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<td>Power Equipment Op Pavement Breaker</td>
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<td>7A</td>
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<td>Power Equipment Op Pile Driver (other Than Crane Mount)</td>
<td>$68.55</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Plant Oiler - Asphalt, Crusher</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Posthole Digger, Mechanical</td>
<td>$65.05</td>
<td>7A</td>
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<td>Power Equipment Op Power Plant</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Pumps - Water</td>
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<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Quad 9, Hd 41, D10 And Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Quick Tower - No Cab, Under 100 Feet In</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Remote Control Operator On Rubber Tire</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Rigger and Bellman</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>Power Equipment Op Rigger/Signal Person, Bellman (Certified)</td>
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<td>King</td>
<td>Power Equipment Op Rollagon</td>
<td>$69.16</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Roller, Other Than Plant Mix</td>
<td>$65.05</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Roller, Plant Mix Or Multi-lift Materials</td>
<td>$68.02</td>
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<td>Power Equipment Op Roto-mill, Roto-grinder</td>
<td>$68.55</td>
<td>7A</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Saws - Concrete</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Scaper, Self Propelled Under 45 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Scrapers - Concrete &amp; Carry All</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<td>Power Equipment Op Scrapers, Self-propelled: 45 Yards And Ov</td>
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<td>7A</td>
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<td>Power Equipment Op Service Engineers - Equipment</td>
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<td>Power Equipment Op Shotcrete/Gunite Equipment</td>
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<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Shovel , Excavator, Backhoe, Tractors Unc</td>
<td>$68.02</td>
<td>7A</td>
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<td>Power Equipment Op Shovel, Excavator, Backhoe: Over 30 Met</td>
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<td>7A</td>
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<td>Power Equipment Op Shovel, Excavator, Backhoes, Tractors: 15</td>
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<td>Power Equipment Op Shovel, Excavator, Backhoes: Over 50 Me</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<td>King</td>
<td>Power Equipment Op Shovel, Excavator, Backhoes: Over 90 Me</td>
<td>$70.57</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Slipform Pavers</td>
<td>$69.16</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Spreader, Topsider &amp; Screedman</td>
<td>$69.16</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Subgrader Trimmer</td>
<td>$68.55</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Tower Bucket Elevators</td>
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<td>7A</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Tower Crane Up To 175’ In Height Base Tr</td>
<td>$69.85</td>
<td>7A</td>
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<td>Power Equipment Op Tower Crane: over 175â€”through 250â€”</td>
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<td>Power Equipment Op Tower Cranes: over 250â€”in height from 300â€”</td>
<td>$71.26</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Transporters, All Track Or Truck Type</td>
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<td>King</td>
<td>Power Equipment Op Trenching Machines</td>
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<td>King</td>
<td>Power Equipment Op Truck Crane Oiler/driver - 100 Tons And C</td>
<td>$68.55</td>
<td>7A</td>
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<tr>
<td>King</td>
<td>Power Equipment Op Truck Crane Oiler/Driver Under 100 Tons</td>
<td>$68.02</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Truck Mount Portable Conveyor</td>
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<td>Power Equipment Op Welder</td>
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<td>Power Equipment Op Wheel Tractors, Farmall Type</td>
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<td>Power Equipment Op Yo Yo Pay Dozer</td>
<td>$68.55</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Asphalt Plant Operators</td>
<td>$69.16</td>
<td>7A</td>
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<td>Power Equipment Op Assistant Engineer</td>
<td>$65.05</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Barrier Machine (zipper)</td>
<td>$68.55</td>
<td>7A</td>
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<td>King</td>
<td>Power Equipment Op Batch Plant Operator, Concrete</td>
<td>$68.55</td>
<td>7A</td>
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<td>Power Equipment Op Bobcat</td>
<td>$65.05</td>
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<td>Power Equipment Op Brokk - Remote Demolition Equipment</td>
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<td>Power Equipment Op Brooms</td>
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<td>Power Equipment Op Bump Cutter</td>
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<td>Power Equipment Op Cableways</td>
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<td>King</td>
<td>Power Equipment Op Chipper</td>
<td>$68.55</td>
<td>7A</td>
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<td>Shovel, Excavator, Backhoe, Tractors Un</td>
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## Prevailing Wage Rates for King County

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Appendix B:

Site Geo-Tech Information
TO: Jeff Morgan, Parametrix
FROM: Ed Heavey
DATE: April 28, 2004

RE: SUMMARY OF GEOTECHNICAL INVESTIGATION
PROPOSED REGIONAL STORMWATER FACILITY
AND WATER STORAGE RESERVOIR
PACIFIC, WASHINGTON

This technical memorandum summarizes the results of our geotechnical field investigation and provides a preliminary discussion on geotechnical issues for the proposed regional stormwater facility and water storage reservoir planned for a site located east of SR 167 and north of County Line Road in Pacific, Washington. The project location is shown on the Vicinity Map, Figure 1. The Site and Exploration Plan, Figure 2, shows the location of explorations completed for the project.

FIELD EXPLORATIONS

Subsurface conditions at the site were explored by drilling one boring on March 17, 2004 to a depth of about 69 ft below existing site grades and excavating 10 test pits to depths of between about 7 and 11½ ft below existing site grades on March 16, 2004. The boring was completed under subcontract to Landau Associates by Holocene Drilling with a truck-mounted drilling and the mud-rotary drilling method. The test pits were excavated using a rubber-tired excavator supplied and operated by The City of Pacific. The approximate locations of the boring and test pits are shown on the Site and Exploration Plan, Figure 2.

All soil encountered in the explorations was described using the Soil Classification System presented on Figure 3, and in general accordance with ASTM D2488 Standard Recommended Practice for Description of Soil (Visual-Manual Procedures). The subsurface conditions are described in summary logs on Figures 4 through 9. Information presented on the summary logs depicts subsurface conditions only at the specified location and at the date designated on the log. Soil and groundwater conditions at other locations may differ and changes may also result with the passage of time. Exploration locations were determined in the field by pacing and taping from existing site features.

Geotechnical laboratory testing consisted of natural moisture content determinations and grain-size analyses on selected samples from the boring and test pits. Results of the natural moisture content determinations are shown on the summary logs. Results of the grain size analyses are presented on Figures 10 and 11.
**Subsurface Conditions**

Subsurface conditions encountered in the explorations consisted generally of recent alluvium. Soil interpreted as mudflow deposits was encountered in boring B-1 beneath the alluvium at a depth of about 63 ft, and extends to the depth explored, about 69 ft.

Test pits excavated in the lower, western third of the site (TP-4, TP-5, TP-6, and TP-10), encountered a surficial layer of soft, wet, silt. This layer was observed to extend to depths of between 1½ to 3½ ft below existing grades. The silt is underlain by soft, wet, peat that extends to depths of about 7 to 8½ ft below existing grades. The peat is underlain by medium dense, wet, sand with silt in test pits TP-4 and TP-5, medium stiff, sandy silt in test pit TP-6, and by medium dense, wet, silty sand and sand with silt in test pit TP-10. These soils extend to the depths explored, about 10 ft at test pit TP-4, about 7½ ft at test pit TP-5, about 9 ft at test pit TP-6, and about 10½ ft at test pit TP-10.

Test pits excavated in the upper portion of the site (TP-1 through TP-3 and TP-7 through TP-9), encountered an upper unit of loose, moist to wet, silty sand and sand with silt, with interbeds of medium stiff silt, sandy silt, and very sandy silt. The upper unit was observed to extend to the depth explored, about 8 ft in test pit TP-1; the depth explored, about 7 ft in test pit TP-2; the depth explored, about 7 ft in test pit TP-3; to a depth of about 8 ft in test pit TP-7 and to a depth of about 10 ft in test pits TP-8 and TP-9. Beneath the upper soil unit, soft, wet peat was encountered in test pits TP-7, TP-8, and TP-9. The peat was observed to extend to 11 ft in test pit TP-7; to the depth explored, about 11 ft in test pit TP-8; and to the depth explored, about 10½ in test pit TP-9. Medium dense, wet, silty sand was encountered beneath the peat in test pit TP-7 and extends to the depth explored, about 11½ ft.

In boring B-1, loose, moist to wet, silty sand and sand with silt was encountered to a depth of about 8 ft. Soft, wet peat was present between a depth of about 8 to 16 ft. The peat was underlain by medium dense, wet, sand with silt, silty sand, and stiff to very stiff, very sandy silt to a depth of about 41 ft. Very soft, wet silt is present between about a depth of 41 to 51 ft. A layer of medium dense to dense sand with silt and silty sand is present between 51 and 58 ft. Very soft, wet peat was encountered between a depth of 58 and 62 ft. Mudflow deposits consisting of soft to very soft silt and very loose silty sand were encountered to the depth explored, about 69 ft.

Groundwater was encountered at the time of exploration (March 16, 2004) in the test pits between depths of about 1½ to 7 ft below existing grades. Groundwater was encountered in boring B-1 at the time of drilling (March 17, 2004) at a depth of about 6 ft below the surface. A piezometer was installed in the boring to a depth of about 25 ft for subsequent groundwater measurements. Groundwater was measured at a depth of about 6.4 ft on March 23, 2004 and at a depth of 7.2 ft on April 23, 2004. Groundwater levels will fluctuate seasonally, with maximum groundwater levels typically occurring during the winter and spring months. During a preliminary site visit in February 2004, standing water was observed in the
lower, west portion of the site, indicating that groundwater levels likely rise to near the surface in the winter months.

**Geotechnical Considerations**

The following summarizes the relevant geotechnical issues that need to be addressed during design of the regional stormwater pond and the proposed reservoir.

**Regional Stormwater Facility**

We understand that the regional stormwater facility is planned for the western portion of the site. This area is underlain by about 4½ to 5½ ft of peat. The top of the peat is generally within 1½ to 4 ft of the surface. In the eastern portion of the site, the peat is deeper, typically below a depth of about 7 to 8 ft, and up to about 8 ft in thickness. During the winter months, groundwater is expected to rise to near the surface in the lower western portion of the site and to about 4 to 5 ft below the surface in the eastern portion of the site. Because of high wintertime groundwater conditions, if the pond is constructed in the lower, western portion of the site, the facility will need to be constructed above existing site grades to provide storage of stormwater, requiring above-grade berms to retain stormwater. The facility could be constructed partially below grade in the eastern portion of the site to provide some limited storage of stormwater. Because of the compressibility and low strength of the underlying peat deposits, the berms could be subject to substantial post-construction settlements. Because of the shallow depth of the peat in the lower western portion of the site, berms in this area could also be subject to foundation failure if constructed too fast and/or with too steep of side slopes. Several approaches could be used to mitigate settlement and reduce the likelihood of a foundation failure.

1. To fully mitigate settlement and foundation support issues, the peat within the footprint of the berms could be overexcavated. On both sides of the berm, the overexcavation will need to extend laterally beyond the base width of the berm, a distance equal to the height of the berm. The overexcavation would be backfilled with import structural fill. **Overexcavation depths will be between about 7 to 9 ft below existing site grades in the western portion of the site.** Overexcavation and replacement in the eastern portion of the site will likely be economically infeasible due to the greater depth of the peat. **Depending on the time of year, all or a portion of the overexcavation will be below the water table.** Fill placed below the groundwater table will need to consist of select granular material.

2. A second approach to mitigate post-construction settlement would be to construct the berms and add additional fill material as a surcharge to induce the expected amount of settlement that would occur under the planned final berm configuration. This alternative would be most effective if the pond is located in the higher eastern portion of the site. Once the expected amount of settlement has occurred, the extra fill material would be removed. Even with this approach, secondary consolidation of the peat will continue to occur over the life of the structure. Depending on the constructed berm height, secondary consolidation could be as much as 6 inches over the life of the facility. To reduce the likelihood of a foundation failure...
of berms in the western portion of the site, staged construction (placing fill in increments, allowing each increment of fill to settle prior to placing the next increment of fill, flatter side slopes, and/or the use of a reinforcing geogrid) may be required to construct stable berms.

Reservoir

Soil underlying the site of the proposed water reservoir will provide inadequate support of spread footing foundations. About 8 ft of compressible peat underlies the reservoir site at a depth of about 8 ft. A layer of medium dense sand and silty sand, and stiff to very stiff, very sandy silt is present between a depth of about 16 to 40 ft. Foundation support of the reservoir will need to be provided by piles bearing in this layer.

The site is underlain by saturated deposits of sand and sandy silt. The liquefaction susceptibility method of analyses was a simplified procedure originally proposed by Seed et al. (1983) and modified by Youd (1998). The liquefaction analyses assumed a peak horizontal ground acceleration of 0.30g and an earthquake magnitude of 7.5. These parameters are considered to be appropriate for a severe earthquake occurring in the region. The peak horizontal ground acceleration corresponds to a seismic event with a probability of exceedance of 10 percent in 50 years (average recurrence interval of 475 years). The value was obtained from the USGS seismic hazard web site (USGS 2004). The computed factor of safety against liquefaction was generally above 1.5. A factor of safety of 1.0 or less indicates that liquefaction is likely to occur during a design seismic with a magnitude of 7.5 or greater, producing a peak horizontal ground acceleration of 0.30g or greater. A factor of safety of 1.2 or greater is generally considered adequate.

The site is underlain to relatively great depth (over several hundred feet) by recent alluvium. For a Uniform Building Code (UBC) (ICBO 1997) based designed, the seismic zone factor is 0.30. The site classification would be Sc, soft soil profile. Therefore, significant amplification of bedrock ground motions is expected to occur at the site. The UBC amplification factors, CV and CA, are 0.36 and 0.84, respectively.

We trust this memorandum supplies you with the necessary preliminary information. Once decisions have been made regarding site and facility options, we can develop geotechnical design recommendations and criteria for the proposed facilities. If you have any questions or wish to further discuss the issues addressed in the memorandum, please contact us at 253-926-2493.
REFERENCES


Attachments: Figure 1 – Vicinity map
Figure 2 – Site and Exploration Plan
Figure 3 – Soil Classification System and Key
Figure 4 – Log of Boring B-1
Figures 5 through 9 – Summary Test Pit Logs
Figures 10 and 11 – Grain Size Distribution
## Soil Classification System

### Major Divisions

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Graphic Symbol</th>
<th>Letter Symbol</th>
<th>Typical Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel and Gravelly Soil</td>
<td>Clean Gravel</td>
<td>GW</td>
<td>Well-graded gravel; gravel/sand mixture(s), little or no fines</td>
</tr>
<tr>
<td></td>
<td>Gravel with Fines</td>
<td>GP</td>
<td>Poorly graded gravel; gravel/sand mixture(s); little or no fines</td>
</tr>
<tr>
<td></td>
<td>Clean Sand</td>
<td>GM</td>
<td>Silty gravel; gravel/sand/silt mixture(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GC</td>
<td>Clayey gravel; gravel/sand/clay mixture(s)</td>
</tr>
<tr>
<td>Sand and Sandy Soil</td>
<td>Clean Sand</td>
<td>SW</td>
<td>Well-graded sand; gravelly sand; little or no fines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP</td>
<td>Poorly graded sand; gravelly sand; little or no fines</td>
</tr>
<tr>
<td></td>
<td>Sand with Fines</td>
<td>SM</td>
<td>Silty sand; sand/silt mixture(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC</td>
<td>Clayey sand; sand/clay mixture(s)</td>
</tr>
<tr>
<td>Highly Organic Soil</td>
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</table>

### Other Materials

<table>
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<th>Graphic Symbol</th>
<th>Letter Symbol</th>
<th>Typical Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pave ment</td>
<td></td>
<td>AC or PC</td>
<td>Asphalt concrete pavement or Portland cement pavement</td>
</tr>
<tr>
<td>Rock</td>
<td></td>
<td>RK</td>
<td>Rock (See Rock Classification)</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
<td>WD</td>
<td>Wood, lumber, wood chips</td>
</tr>
<tr>
<td>Debris</td>
<td></td>
<td>DB</td>
<td>Construction debris, garbage</td>
</tr>
</tbody>
</table>

### Drilling and Sampling Key

#### Sample Number & Interval

<table>
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<tr>
<th>Sample Identification Number</th>
<th>Recovery Depth Interval</th>
<th>Sample Depth Interval</th>
<th>Portion of Sample Retained for Archive or Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 3.25-inch O.D., 2.42-inch I.D. Split Spoon</td>
<td>c Shelby Tube</td>
<td>g Grab Sample</td>
<td>e Other - See text if applicable</td>
</tr>
<tr>
<td>b 2.00-inch O.D., 1.50-inch I.D. Split Spoon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 300-lb Hammer, 30-inch Drop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e 140-lb Hammer, 30-inch Drop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Field and Lab Test Data

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<th>Code</th>
<th>Description</th>
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</thead>
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<tr>
<td>PP = 1.0</td>
<td>Pocket Penetrometer, tfs</td>
</tr>
<tr>
<td>TV = 0.5</td>
<td>Torvane, tfs</td>
</tr>
<tr>
<td>P/D = 100</td>
<td>Photolization Detector VOC screening, ppm</td>
</tr>
<tr>
<td>w = 10</td>
<td>Moisture Content, %</td>
</tr>
<tr>
<td>D = 120</td>
<td>Dry Density, gcf</td>
</tr>
<tr>
<td>-200 = 80</td>
<td>Material smaller than No. 200 sieve, %</td>
</tr>
<tr>
<td>GS</td>
<td>Grain Size - See separate figure for data</td>
</tr>
<tr>
<td>AL</td>
<td>Atterberg Limits - See separate figure for data</td>
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<tr>
<td>GT</td>
<td>Other Geotechnical Testing</td>
</tr>
<tr>
<td>CA</td>
<td>Chemical Analysis</td>
</tr>
</tbody>
</table>

### Groundwater

- **ATD**: Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

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City of Pacific Regional Stormwater Facility & Reservoir
Pacific, Washington
<table>
<thead>
<tr>
<th>SAMPLE DATA</th>
<th>SOIL PROFILE</th>
<th>GROUNDWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (ft)</td>
<td>Graphic Symbol</td>
<td>Drilling Method: Mud Rotary</td>
</tr>
<tr>
<td>1 b2 3</td>
<td>SM</td>
<td>Ground Elevation (ft): Not Measured</td>
</tr>
<tr>
<td>2 b2 1</td>
<td>SP, SM</td>
<td></td>
</tr>
<tr>
<td>3 b2 1</td>
<td>PT</td>
<td></td>
</tr>
<tr>
<td>4 b2 1</td>
<td>SP, SM</td>
<td></td>
</tr>
<tr>
<td>5 b2 16</td>
<td>GS</td>
<td></td>
</tr>
<tr>
<td>6 b2 19</td>
<td>GS</td>
<td></td>
</tr>
<tr>
<td>7 b2 24</td>
<td>GS</td>
<td></td>
</tr>
<tr>
<td>8 b2 15</td>
<td>GS</td>
<td></td>
</tr>
<tr>
<td>9 b2 26</td>
<td>GS</td>
<td></td>
</tr>
<tr>
<td>10 b2 20</td>
<td>GS</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions. 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Blows/Foot</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USGS Symbol</th>
<th>Soil Profile</th>
</tr>
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<tbody>
<tr>
<td>11</td>
<td>b2</td>
<td>GS</td>
<td>4</td>
<td>W = 97</td>
<td>ML</td>
<td>Olive brown, SILT with sand and trace pumice and vegetative fibers (soft to very soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>b2</td>
<td></td>
<td>1</td>
<td>W = 48</td>
<td>SP-SM</td>
<td>Dark brown to black with trace red grains, fine to medium SAND with silt (dense, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>b2</td>
<td></td>
<td>34</td>
<td>W = 22</td>
<td>SM</td>
<td>Gray, silty fine SAND, (medium dense, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>b2</td>
<td>PT</td>
<td>7</td>
<td>W = 110</td>
<td>FT</td>
<td>Brown, PEAT, fibrous, with scattered twigs (soft to very soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>b2</td>
<td>ML</td>
<td>3</td>
<td>W = 53</td>
<td>ML</td>
<td>Brown, sandy SILT with trace vegetative matter (soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>b2</td>
<td>SM</td>
<td>1</td>
<td>W = 22</td>
<td>SM</td>
<td>Gray, very sandy SILT with gravel, wood fibers, and trace pumice (very loose, wet) (Mudflow deposit)</td>
<td></td>
</tr>
</tbody>
</table>

Boring Completed 03/17/04
Total Depth of Boring = 68.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Piezometer Completed 03/17/03
Total Depth of Piezometer = 25.0 ft.

Log of Boring B-1

Figure 4
(2 of 2)
### TP-1

<table>
<thead>
<tr>
<th>SAMPLE DATA</th>
<th>SOIL PROFILE</th>
<th>GROUNDWATER</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Description</th>
<th>Ground Elevation (ft)</th>
<th>Excavation Method</th>
<th>Groundwater</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
<td>Brown, silty, fine to medium SAND with roots and bioturbation (loose, moist to wet) (alluvium)</td>
<td>Not Measured</td>
<td>Rubber-tired Backhoe</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>ML</td>
<td></td>
<td>Brown with oxidation staining, very sandy, SILT (soft, moist to wet) (alluvium)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>W = 27</td>
<td>SP, SM</td>
<td></td>
<td>Light gray, SILT with trace roots, non plastic (medium stiff, moist to wet) (alluvium)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>W = 36</td>
<td>SM</td>
<td></td>
<td>Dark brown to black with trace red grains, fine to medium SAND with silt (medium dense, wet) (alluvium)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Pit Completed 03/16/04  
Total Depth of Test Pit = 8.0 ft.  

\[\hat{\n}\] Moderate groundwater seepage encountered at 7.0 ft.

### TP-2

<table>
<thead>
<tr>
<th>SAMPLE DATA</th>
<th>SOIL PROFILE</th>
<th>GROUNDWATER</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Description</th>
<th>Ground Elevation (ft)</th>
<th>Excavation Method</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
<td>Brown, silty, fine to medium SAND with roots and bioturbation (loose, moist to wet) (alluvium)</td>
<td></td>
<td>Rubber-tired Backhoe</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>W = 27</td>
<td>ML</td>
<td></td>
<td>Light brown with oxidation staining, very sandy, SILT (medium stiff to stiff, moist to wet) (alluvium)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP, SM</td>
<td></td>
<td>Medium gray with trace white grains, fine to medium SAND with silt (medium dense, wet) (alluvium)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Pit Completed 03/16/04  
Total Depth of Test Pit = 7.0 ft.  

\[\hat{\n}\] Moderate groundwater seepage encountered at 5.5 ft.

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**Notes:**
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to “Soil Classification System and Key” figure for explanation of graphics and symbols.
### TP-3

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>SOIL PROFILE</th>
<th>GROUNDWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>d4</td>
<td>W = 23</td>
<td>SM</td>
<td>ML</td>
<td>Brown, silty, fine to medium SAND with roots (loose, moist to wet) (alluvium)</td>
<td>Rapid groundwater seepage encountered at 3.5 ft.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP-SM</td>
<td>Light brown with oxidation staining, SILT, non-plastic (soft, moist to wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Black with trace red and orange grains, fine to medium SAND with silt (loose, moist to wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oxidized grains no longer apparent at 4 ft.</td>
<td></td>
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Test Pit Completed 03/16/04
Total Depth of Test Pit = 7.0 ft.

### TP-4

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>SOIL PROFILE</th>
<th>GROUNDWATER</th>
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<tr>
<td>1</td>
<td>1</td>
<td>d4</td>
<td>W = 14</td>
<td>ML</td>
<td></td>
<td>Brown with oxidation mottling, SILT, non-plastic (medium stiff, moist to wet) (alluvium)</td>
<td>Moderate groundwater seepage encountered at 3.8 ft.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>d4</td>
<td>W = 36</td>
<td>PT</td>
<td></td>
<td>Dark brown, PEAT, fibrous with trace twigs (soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>SP-SM</td>
<td></td>
<td>Dark brown to black with trace red grains, fine to medium SAND with silt (medium dense, wet) (alluvium)</td>
<td></td>
</tr>
</tbody>
</table>

Test Pit Completed 03/16/04
Total Depth of Test Pit = 10.0 ft.

**Notes:**
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
## TP-5

<table>
<thead>
<tr>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Soil Profile</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2.5 tsf</td>
<td>ML</td>
<td></td>
<td>Brown with oxidation mottling, SILT, non plastic (soft, moist to wet) (alluvium)</td>
<td>Rapid groundwater seepage encountered at 1.8 ft.</td>
</tr>
</tbody>
</table>

Test Pit Completed 03/16/04
Total Depth of Test Pit = 7.5 ft.

---

## TP-6

<table>
<thead>
<tr>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Soil Profile</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>d4</td>
<td>PP = 1.5 tsf/W = 39</td>
<td>ML</td>
<td></td>
<td>Brown with oxidation mottling, SILT, non plastic (medium stiff to stiff, moist to wet) (alluvium)</td>
<td>Rapid groundwater seepage encountered at 2.5 ft.</td>
</tr>
<tr>
<td>2</td>
<td>d4</td>
<td>W = 816</td>
<td>PT</td>
<td></td>
<td>Dark brown, PEAT, fibrous with trace twigs (soft, wet) (alluvium)</td>
<td></td>
</tr>
</tbody>
</table>

Test Pit Completed 03/16/04
Total Depth of Test Pit = 9.0 ft.

---

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
### TP-7

<table>
<thead>
<tr>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Sample Data</th>
<th>Soil Profile</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>1</td>
<td>Medium brown, silty, fine to medium SAND with roots (loose, moist to wet) (alluvium)</td>
<td>Slight groundwater seepage encountered at 4.5 ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 17</td>
<td></td>
<td>SP-SM</td>
<td>2</td>
<td>Light brown with orange mottling, fine to medium SAND with silt (loose, moist to wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 29</td>
<td></td>
<td></td>
<td>3</td>
<td>Gray, very sandy SILT, non-plastic (soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 40</td>
<td></td>
<td>ML</td>
<td></td>
<td>Gray, PEAT, fibrous with trace twigs (soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 478</td>
<td></td>
<td>PT</td>
<td></td>
<td>Gray, silty, fine to medium SAND (medium dense, wet) (alluvium)</td>
<td></td>
</tr>
</tbody>
</table>

Test Pit completed 03/16/04
Total Depth of Test Pit = 11.5 ft.

### TP-8

<table>
<thead>
<tr>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
<th>Sample Data</th>
<th>Soil Profile</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>W = 45</td>
<td></td>
<td>SM</td>
<td>1</td>
<td>Medium brown, silty, fine to medium SAND with roots (loose, moist to wet) (alluvium)</td>
<td>Moderate groundwater seepage encountered at 7.0 ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP-SM</td>
<td>2</td>
<td>Gray to black with oxidation mottling, fine to medium SAND with silt (loose, moist to wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>Oxidation no longer apparent at 3 ft</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ML</td>
<td></td>
<td>Light brown, SILT with trace vegetative matter, (soft, wet) (alluvium)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PT</td>
<td></td>
<td>Dark brown, PEAT, fibrous (soft, wet) (alluvium)</td>
<td></td>
</tr>
</tbody>
</table>

Test Pit completed 03/16/04
Total Depth of Test Pit = 11.0 ft.

**Notes:**
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

**City of Pacific Regional Stormwater Facility & Reservoir, Pacific, Washington**

**Log of Test Pits**

**Figure 8**
TP-9

SAMPLE DATA

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>d4</td>
<td>W = 27</td>
<td></td>
<td>SM</td>
<td>Brown, silty, fine to medium SAND with roots and bioturbation (loose, moist to wet) (alluvium)</td>
</tr>
<tr>
<td>4</td>
<td>d4</td>
<td>W = 34</td>
<td></td>
<td>SP-SM</td>
<td>Brown, fine to medium SAND with silt (loose, damp) (alluvium)</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Orange brown, SILT, non plastic (medium stiff, moist to wet) (alluvium)</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dark brown to black with trace oxidation to 4 ft, fine to medium SAND with silt, (loose, moist to wet) (alluvium)</td>
</tr>
</tbody>
</table>

SOIL PROFILE

Excavation Method: Rubber-tired Backhoe

Ground Elevation (ft): Not Measured

GROUNDWATER

Moderate groundwater seepage encountered at 6.3 ft.

Test Pit Completed 03/16/04
Total Depth of Test Pit = 10.5 ft.

TP-10

SAMPLE DATA

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Number &amp; Interval</th>
<th>Sampler Type</th>
<th>Test Data</th>
<th>Graphic Symbol</th>
<th>USCS Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>d4</td>
<td>W = 61</td>
<td></td>
<td>ML</td>
<td>Brown, sandy SILT, non plastic (soft, moist to wet) (alluvium)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>PT</td>
<td>Dark brown, PEAT, fibrous with distinctive structure (soft, wet) (alluvium)</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gray, very silty, fine SAND (medium dense, wet) (alluvium)</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dark brown to black with trace red grains, fine to medium SAND with silt (medium dense, wet) (alluvium)</td>
</tr>
</tbody>
</table>

SOIL PROFILE

Excavation Method: Rubber-tired Backhoe

Ground Elevation (ft): Not Measured

GROUNDWATER

Moderate groundwater seepage encountered at 1.5 ft.

Test Pit Completed 03/16/04
Total Depth of Test Pit = 10.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
### Table: Grain Size Distribution

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Exploration Number</th>
<th>Sample Number</th>
<th>Depth (ft)</th>
<th>Natural Moisture (%)</th>
<th>Soil Description</th>
<th>Unified Soil Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td>B-1</td>
<td>6</td>
<td>17.5</td>
<td>27</td>
<td>Fine SAND with silt</td>
<td>SP-SM</td>
</tr>
<tr>
<td>■</td>
<td>B-1</td>
<td>7</td>
<td>22.5</td>
<td>33</td>
<td>Silty fine SAND</td>
<td>SM</td>
</tr>
<tr>
<td>△</td>
<td>B-1</td>
<td>8</td>
<td>27.5</td>
<td>35</td>
<td>Very sandy SILT</td>
<td>ML</td>
</tr>
</tbody>
</table>

City of Pacific Regional Stormwater Facility & Reservoir  
Pacific, Washington
Appendix C:  
Additive 1  
Public Works Office Deck
NOTES

1. SEE NOTES ON SHEET 2.
2. SEE DETAILS ON ATTACHED SHEETS FROM WYBUILDINGPRINTS.COM.
**Stair treads and risers:** The largest tread or riser within any flight of stairs is not to exceed the smallest by more than 3/8". (R311.7.5)

**Illumination:**
- Interior stairways shall be provided with an artificial light source to illuminate landings and treads. There shall be a wall switch at each floor level to control the light source where the stairway has 6 or more risers. (R303.7)
- Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway, and located at the bottom landing where accessing a basement. (R303.8)

**Handrails:** Handrails are required on at least one side for stairways with four or more risers. See Tip Sheet 2 for additional information regarding handrails. (R311.7.8)

**Landings required:** Landings are required at the top and the bottom of stairways. A floor landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs. (R311.7.6)

**Landing dimensions:** A landing extending the width of the stair and measuring a minimum of 36" in the direction of travel is required at the top and bottom of every stairway. (R311.7.6)

**Circular, winding or spiral stairways:** For exceptions related to the construction of circular, winding, or spiral stairways. (R311.7.5.2.1 & R311.7.10)

**GENERAL INFORMATION:**
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
Stair runs with 4 or more risers require a handrail. See Tip Sheet 2 for more information on the requirements for handrails. R311.7.8

Minimum required stairway width is 36". R311.7.1

Typical Stair Elevation

Overhead obstruction

The minimum headroom of a stair is 6'-8". (Measured vertically from the sloped plane adjoining the tread nosing)

No more than 147 inches between floor levels or landings. R311.7.3

GENERAL INFORMATION:

- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
Handrails are required on at least one side of each continuous run of treads or flight with four or more risers.

Typical Handrail Elevation
R311.7.8

Type I Handrails
R311.7.8.3
Type II Handrails
R311.7.8.3
(At handrails with a perimeter greater than 6-1/4")

Unacceptable Handrails

GENERAL INFORMATION:
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
This Tip Sheet reflects code requirements of the 2015 International Residential Code (IRC) with Washington State Amendments.

This guard diagram illustrates both open and solid guards.

Guard Elevation
R312

Note: Guards shall be structurally designed to comply with IRC Table R301.5.
CONSTRUCTION TIP SHEET 5
Basic Decks w/ 60 psf Live Loading
September 18, 2018

This Tip Sheet reflects code requirements of the 2015 International Residential Code (IRC) with Washington State Amendments which update the live load to 60 psf.

This document provides building code information applicable to prescriptive residential wood deck design. You may need to hire a licensed architect or an engineer to design a deck where any of the following conditions apply:

- The deck serves other than a one- or two-family dwelling building
- The deck design includes more than one level
- The deck will support a hot tub, spa or other heavy object, including heavy deck covering (such as pavers)
- The walking surface is more than 10' above grade
- The deck ledger is attached to house overhangs, bay windows, bricks, stone or concrete block
- The deck is bearing on ground with a slope greater than 1' horizontal for every 1' vertical
- The deck is self-supporting (not attached to an exterior wall)

**Typical Deck**

![Typical Deck Diagram]

**Note:** Guards are required when the deck walking surface is more than 30" above grade.

---

**GENERAL INFORMATION:**

- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local code enforcement officer and participating jurisdiction.
Deck Construction Notes
- Please note that due to the new 60 psf loading, previous lumber spans and footling sizes have changed.
- The illustrations and information in this Tip Sheet may be used for decks whether or not they require a permit. See Tip Sheet 0 for when a permit is required.
- All wood must be pressure treated or naturally resistant to decay. Treat cuts, holes and notches with end-cut solution.
- Fasteners, hangers, nails, etc., must be stainless steel, hot-dipped galvanized, or as specifically required for the specified wood preservative used. The coating weights for zinc-coated fasteners to be in accordance with ASTM A 153. Provide documentation for the field showing the required fastener protection for the wood chosen for your deck.
- You may modify any components of this Tip Sheet using accepted engineering practices. Any modifications must be reviewed prior to permit issuance. All attachments must be per manufacturer's installation instructions.
- This Tip Sheet is intended to represent good construction practices for deck construction and related IRC requirements. See related Tip Sheets: 1 for stairs, 2 for handrails, 3 for guards and 11 for notching and boring.

Typical Deck Section

[Diagram of deck section with notations and dimensions]

Note:
Contractor to field verify adequacy of solid lumber for ledger connection.

GENERAL INFORMATION:
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
Post to Beam Connection w/ Knee Brace
(Knee braces are required on posts greater than 4 feet in height.)

Beam splices must occur over posts with 1-1/2" min. bearing

Corrosion resistant, metal column cap.
Follow manufacturer's installation instructions.

Alternate Knee Brace Detail:
2x4 knee brace face nailed ea. side of post and beam with 4-16d nails at each face and connection

(1) 3/8" diameter thru-bolt or 1/2" lag screws with washers, top & bottom
(typical)
Pressure treated wood post

Guardrail Attachment
(Guardrails are required when the deck is more than 30 inches above grade.)

5/8" O.D. galvanized bolt or threaded rod w/ nuts & washers

2x8 min. deck joists & rims

Note:
Use above details for guard connections or provide engineered design that shows Guards can resist a single concentrated load of 200 lbs applied in any direction at any point along the top and have attachment devices and supporting structure to transfer this load to appropriate structural elements of the building per IBC sec 1607.7.1.1

Section A

4x4 min. post @ 6'0" o.c. max., Typ

Min. 1800# tension device

5/8" O.D. galvanized bolt or threaded rod w/ nuts & washers

Section B

2x8 min. blocking

Min. 1800# tension straps

2' min

2' min

2' min

2' min

GENERAL INFORMATION:
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
**Detail 1 – Ledger Attachment for Lateral Loads**
(Knee braces are required on posts greater than 4 feet in height.)

**Option # 1**
- Hold-down or tension device with 1500 # capacity
- Floor sheathing nailing at 6" o.c. (max) to joist with hold-down

**Option # 2**
- 750# capacity holddown device at 4 locations evenly distributed along the deck and within 2 ft of each end. Install per manufacturer
- Fully threaded 3/8" diameter lag screw predrilled with a minimum of 3 in embedment into solid framing

---

**Deck Connections**
(All fasteners, nails, bolts, screws and connectors must be corrosion resistant.)

<table>
<thead>
<tr>
<th>Connection:</th>
<th>Fastening:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufactured Connectors</td>
<td>Follow manufacturer’s instructions</td>
</tr>
<tr>
<td>Post to Footing</td>
<td>Post base is required</td>
</tr>
<tr>
<td>Post to Footing (High Winds)</td>
<td>Consult with jurisdiction about additional uplift loads where wind exposure is greater than Risk Category B.</td>
</tr>
<tr>
<td>Post to Beam</td>
<td>Connector is required</td>
</tr>
<tr>
<td>Ledger to House Framing</td>
<td>See information on Sheet 5 and Sheet 6</td>
</tr>
<tr>
<td>Joist to Beam or Girder</td>
<td>(3) 8d – Toe nailed</td>
</tr>
<tr>
<td>Blocking or Bridging to Joist</td>
<td>(2) 10d – Toe nailed @ each end</td>
</tr>
<tr>
<td>Wooden Deck Boards</td>
<td>(2) 8d threaded nails OR (2) No. 8 screws</td>
</tr>
<tr>
<td>Composite Decking</td>
<td>Follow manufacturer’s instructions</td>
</tr>
</tbody>
</table>

---

**GENERAL INFORMATION:**
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.

Page 4 of 6
## Span Table and Footing Schedule for Decks

Spans and footings assume the maximum 24" cantilever using Hem-Fir/Doug Fir No. 2 or better framing lumber. Table uses 70 psf, loading (10 psf, dead load + 60 psf live load) and 2000 psf, soil bearing pressure.

<table>
<thead>
<tr>
<th>Joist Size</th>
<th>Joist Spacing</th>
<th>Max. Joist Span</th>
<th>Girder Beam Size and Max. Span Between Support Posts / Footing Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x6</td>
<td>12&quot; o.c.</td>
<td>7'-5&quot;</td>
<td>5'-11&quot; 14x14 4'-11&quot; 14x14 6'-6&quot; 16x16 8'-3&quot; 18x18 10'-0&quot; 20x20 11'-1&quot; 18x18</td>
</tr>
<tr>
<td>2x6</td>
<td>16&quot; o.c.</td>
<td>6'-9&quot;</td>
<td>5'-11&quot; 14x14 7'-9&quot; 16x16 9'-6&quot; 18x18 11'-1&quot; 18x18</td>
</tr>
<tr>
<td>2x6</td>
<td>24&quot; o.c.</td>
<td>5'-9&quot;</td>
<td>6'-3&quot; 14x14 8'-9&quot; 16x16 11'-0&quot; 18x18 12'-10&quot; 18x18</td>
</tr>
<tr>
<td>2x8</td>
<td>12&quot; o.c.</td>
<td>9'-7&quot;</td>
<td>4'-11&quot; 14x14 6'-6&quot; 16x16 8'-3&quot; 18x18 10'-0&quot; 20x20 11'-1&quot; 18x18</td>
</tr>
<tr>
<td>2x8</td>
<td>16&quot; o.c.</td>
<td>8'-6&quot;</td>
<td>4'-11&quot; 14x14 6'-6&quot; 16x16 8'-3&quot; 18x18 10'-0&quot; 20x20 11'-1&quot; 18x18</td>
</tr>
<tr>
<td>2x8</td>
<td>24&quot; o.c.</td>
<td>7'-7&quot;</td>
<td>5'-11&quot; 14x14 7'-9&quot; 16x16 9'-6&quot; 18x18 11'-1&quot; 18x18</td>
</tr>
<tr>
<td>2x10</td>
<td>12&quot; o.c.</td>
<td>13'-3&quot;</td>
<td>3'-6&quot; 14x14 4'-8&quot; 16x16 5'-11&quot; 18x18 7'-2&quot; 18x18</td>
</tr>
<tr>
<td>2x10</td>
<td>16&quot; o.c.</td>
<td>11'-6&quot;</td>
<td>4'-1&quot; 14x14 5'-5&quot; 16x16 6'-11&quot; 18x18 8'-5&quot; 20x20</td>
</tr>
<tr>
<td>2x10</td>
<td>24&quot; o.c.</td>
<td>9'-5&quot;</td>
<td>4'-11&quot; 14x14 6'-6&quot; 16x16 8'-3&quot; 18x18 10'-0&quot; 20x20</td>
</tr>
<tr>
<td>2x12</td>
<td>12&quot; o.c.</td>
<td>15'-5&quot;</td>
<td>3'-1&quot; 14x14 4'-1&quot; 16x16 5'-2&quot; 16x16 6'-3&quot; 18x18</td>
</tr>
<tr>
<td>2x12</td>
<td>16&quot; o.c.</td>
<td>13'-4&quot;</td>
<td>3'-6&quot; 14x14 4'-8&quot; 16x16 5'-11&quot; 18x18 7'-2&quot; 18x18</td>
</tr>
<tr>
<td>2x12</td>
<td>24&quot; o.c.</td>
<td>10'-11&quot;</td>
<td>4'-1&quot; 14x14 5'-5&quot; 16x16 6'-11&quot; 18x18 8'-5&quot; 18x18</td>
</tr>
</tbody>
</table>

Footings must have a minimum reinforcement of (2) #4 bars each way with a 3" clearance to the bottom of the footing.

Note: Footing sizes are based on decks designed with single span joists where there is no center bearing beam.

## Deck Ledger Connection to Band Joist

(Reference IRC Table R507.2 - Deck live load = 80 psf, deck dead load = 10 psf, snow load ≤ 40 psf)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

<table>
<thead>
<tr>
<th>Connection Details</th>
<th>Joist Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6' and less</td>
</tr>
<tr>
<td>½ inch diameter lag screw with ½ inch maximum sheathing a, b, c, d, e</td>
<td>22</td>
</tr>
<tr>
<td>½ inch diameter bolt with ½ inch maximum sheathing d</td>
<td>30</td>
</tr>
<tr>
<td>½ inch diameter bolt with 1 inch maximum sheathing e</td>
<td>26</td>
</tr>
</tbody>
</table>

a. Ledger shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
b. Snow load shall not be assumed to act concurrently with live load.
c. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
d. Sheathing shall be wood structural panel or solid sawn lumber.
e. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to ½-inch thickness of stacked washers shall be permitted to substitute for up to ½-inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

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**General Information:**
- The intent of this data is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local Code Enforcement. Participating Jurisdiction
Placement of Lag Screws and Bolts in Ledgers and Band Joists

(Reference IRC Table 507.2.1)

<table>
<thead>
<tr>
<th>Minimum End and Edge Distance and Spacing Between Rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Edge</td>
</tr>
<tr>
<td>Ledger</td>
</tr>
<tr>
<td>Band joist</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4mm

a. Lag screws or bolts must be staggered from the top and bottom along the horizontal run. See figure below.
b. Maximum 5 inches.
c. For engineered rim joists, the manufacturer's recommendations govern.
d. The minimum distance from the bottom row to the top edge of the ledger must be in accordance with figure below.
e. 2 inches may be reduced to 3/4 inch when the band joist is directly supported by a mudsill, header, or by double top wall plates.

Placement of Lag Screws and Bolts in Ledgers

(Reference IRC Figure 507.2.1(1))

Placement of Lag Screws and Bolts in Ledgers

(Reference IRC Figure 507.2.1(2))

*DISTANCE CAN BE REDUCED TO 4.5' IF LAG SCREWS ARE USED OR IF BOLT SPACING IS REDUCED TO THAT OF LAG SCREWS TO ATTACH 2X6 LEDGERS TO 2X8 BAND JOISTS.

GENERAL INFORMATION:
- The intent of this Tip Sheet is to provide a general understanding of the code requirements and does not address the subject in great detail.
- Additional information can be obtained from your local participating jurisdiction.
Permit(s)

Right of Way Permit
### Building Permit Application

**City of Pacific**

**PERMIT APPLICATION**

**BUILDING DEPARTMENT**

**JOB ADDRESS**

224 Central Ave., SW

**LEGAL DESC.**

LOT NO.

ACREAGE

TRACT OR PARCEL

0.91

252106

252106

**OWNER**

MAIL ADDRESS

PHONE

**TELLER**

MAIL ADDRESS

PHONE

**CONTRACTOR**

MAIL ADDRESS

PHONE

STATE LICENSE NUMBER

**TYPE OF PERMIT**

- [ ] BUILDING
- [ ] RESIDENTIAL OR
- [ ] COMMERCIAL

**CLASS OF WORK**

- [ ] NEW
- [ ] ALTERATION
- [ ] MOVE
- [ ] ADDITION
- [ ] REPAIR
- [ ] DEMO

**DESCRIPTION OF WORK:**

- [ ] MECHANICAL
- [ ] PLUMBING
- [ ] MOBILE HOME
- [ ] SIGN
- [ ] FIRE

**TYPE OF HEAT AND ENERGY SOURCE:**

- [ ] Electricity
- [ ] Heat Pump/Others

---

### Building Details

<table>
<thead>
<tr>
<th>PLAN REVIEW</th>
<th>BUILDING</th>
<th>PLUMBING</th>
<th>MECHANICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO.</td>
<td>ITEM</td>
<td>FEE</td>
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<tr>
<td>FLOOR AREA</td>
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</tr>
<tr>
<td>USE ZONE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>NO. OF STORIES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Water Closet-Urinal</td>
<td>Forced Air Heat BTU</td>
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<tr>
<td></td>
<td></td>
<td>Sink-Faucet</td>
<td>Floor-Wall Heater</td>
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<td></td>
<td></td>
<td>Tub-Shower</td>
<td>Boiler or Heat Pump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clothes Washer-Dishwasher</td>
<td>Air Conditioner-Unit Cooler</td>
</tr>
<tr>
<td></td>
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<td>Water Heater-Floor Drain</td>
<td>Ventilation: System Exhaust Hood</td>
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<tr>
<td></td>
<td></td>
<td>Backflow/Lawr/Fire Sprinkler</td>
<td>Gas Piping</td>
</tr>
<tr>
<td></td>
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<td>Pool-Hot Tub</td>
<td></td>
</tr>
</tbody>
</table>

**PERMIT FEE**

$419.60

**PLAN CHECK FEE**

$212.74

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**NOTICE TO APPLICANT**

This permit becomes null and void if the work or construction authorized is not commenced within 180 days, or if work or construction is suspended or abandoned for 180 days at any time after work is commenced or if work is not completed within two years from date of issue.

All work shall be done in accord with the approved plans, except, where such approval is in conflict with other codes. The approved plans shall not be changed or modified without the prior approval of the Building Official.

It is the responsibility of the permittee to obtain the required inspections. Failure to notify this department that the work is ready for inspection may necessitate the removal of some of the construction materials at the owners expense in order to perform such inspection. The following inspections are required by Section 110 of the IBC and Section 109 IRC LOCAL ORDINANCE.

1. FOUNDATION — When forms are in place, prior to placement of any concrete,
2. FOUNDATION AND ROOF DRAINS — Prior to backfilling,
3. CONCRETE SLAB, GROUNDWORK — When all service equipment and piping is in but prior to placement of any concrete.
4. UNDERFLOOR
5. FRAMING — After all framing, bracing, blocking, piping, wiring and ducting are complete, but prior to covering,
6. INSULATION
7. DRYWALL — After drywall is in place, prior to taping or covering of fasteners,
8. FINAL — Work completed, but prior to occupancy.

**FOR INSPECTION, CALL (253) 929-1110**

24 HOUR NOTICE REQUIRED FOR ALL INSPECTIONS.

I hereby certify that I have read and examined this application and know the same to be true and correct. All Provisions of laws and ordinances governing this type of work will be complied with whether specified herein or not. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other State or local law regulating construction or the performance of construction.

**Signature of Owner/Contractor/Authorized Agent (Date)**

**FEES COLLECTED**

**PLUMBING & MECHANICAL**

<table>
<thead>
<tr>
<th>DATE</th>
<th>AMOUNT</th>
<th>RECEIPT NO.</th>
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<tbody>
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</table>

**PERMIT AND PLAN CHECK**

<table>
<thead>
<tr>
<th>DATE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25.00</td>
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</tbody>
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**PERMIT IS APPROVED FOR WORK DESCRIBED ABOVE IN ACCORDANCE WITH THE APPROVED PLANS AND SPECIFICATIONS.**

- [ ] Approved for Issuance - Planning Department
- [ ] Approved for Issuance - Building Department

**Conditions**

Per 2015 IRC

2015 IRC

2015 IRC

**Applicant Signature**

**Effective August 1, 1987 - Building permits to be surcharged $4.50**

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**STATE SURCHARGE PERMIT**

25.00

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**SIGNATURE**

**WHITE** - Inspector  **CANARY** - Assessor  **PINK** - File  **BUFF** - Applicant