Jefferson Transit Authority

Maintenance, Operations, and Administration Center

Bid Set

February 5, 2014

Volume 3 – Divisions 20 - 33

Project # 2013-006

TCF Architecture

PROJECT MANUAL

SPECIFICATIONS

FOR

Jefferson Transit Authority

Maintenance, Operations, & Administration Center

Bid Set

February 5, 2014

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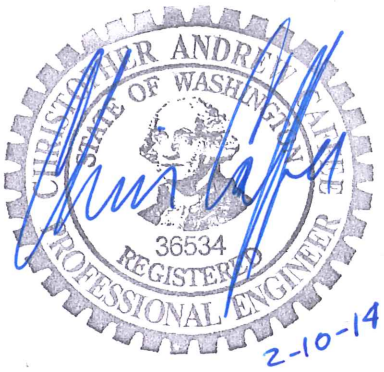
The undersigned Engineer of Record hereby certifies that the Technical Specifications for the Mechanical portions of this Project for the Bid Set Submittal for the Jefferson Transit Authority - Maintenance, Operations, & Administration Center were written by me, or under my direct supervision, and that I am duly registered under the laws of the State of Washington and hereby affix my Professional Seal and signature. Those sections prepared under my supervision and being certified by my seal and signature below are all mechanical specifications in Divisions 20, 21, 22 and 23.



The undersigned Engineer of Record hereby certifies that the Technical Specifications for the Electrical portions of this Project for the Bid Set Submittal for the Jefferson Transit Authority - Maintenance, Operations, & Administration Center were written by me, or under my direct supervision, and that I am duly registered under the laws of the State of Washington and hereby affix my Professional Seal and signature. Those sections prepared under my supervision and being certified by my seal and signature below are all mechanical specifications in Divisions 26, 27, and 28.

The undersigned Engineer of Record hereby certifies that the Technical Specifications for the Civil portions of this Project for the Bid Set Submittal for the Jefferson Transit Authority – Maintenance, Operations, & Administration Center were written by me, or under my direct supervision, and that I am duly registered under the laws of the State of Washington and hereby affix my Professional Seal and signature. Those sections prepared under my supervision and being certified by my seal and signature below are all Civil specifications in Divisions 31, 32, and 33.

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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 01 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 230593 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 01 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.

1. Washington State Energy Code -- Latest Approved Edition
2. International Building Code -- Latest Approved Edition
3. International Fire Code – Latest Approved Edition
4. International Mechanical Code -- Latest Approved Edition
5. Uniform Plumbing Code -- Latest Approved Edition
6. Local Sewer and Water District Requirements
7. State and County Department of Health
8. Local Fire Marshal
9. Puget Sound Air Pollution Control
10. State of Washington Boiler and Unfired Pressure Vessel Inspection Law
11. Occupational Safety and Health Administration (OSHA)
12. Washington Industrial Safety and Health Act (WISHA)
13. 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 to install 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 to meet 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 the following:

C. Drawing sheets developed sequentially by each trade with all components drawn to scale and color coded to represent each trade.

D. 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.

E. Make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. 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.

G. 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
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
MSS	Manufacturers Standardization Society
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NP	Non-Potable Water
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
UL	Underwriter's Laboratories
VFD	Variable Frequency Drive
VTR	Vent Thru Roof
w.g.	Water Gauge (inches of water)
W.P.	Working Pressure
WPL	Weatherproof Louver

WQA Water Quality Association

Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.15 SCHEDULE OF VALUES

A. General: Provide schedule of values per Division 01 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 200000 – 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 200000 – 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 200000 – 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 230800 – 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.*

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 01, 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 reserves 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:
    b. All required submittals (i.e. equipment cut sheets, shop drawings, etc.) per each specification section.
    c. Table of contents identifying each specification section, submittal requirement of each specification, and the manufacturer name and model number of each item submitted.
    d. Index sheet for each specification section.
    e. Submission of PDF files of individual specifications or equipment cuts will be automatically rejected.
    f. 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.
    g. 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.

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 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 01 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 indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item.

1.18 COMMISSIONING

A. General Requirements: The building 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 prepared 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 230593 and 230595.

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 shall be provided to the Owner. The Contractor is responsible to submit to the code official a signed letter by the Owner acknowledging the acceptance of the preliminary commissioning report. 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, and owner training as specified in this section.

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.

1.19 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:

B. 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.

C. Draft all revisions on the design drawings with a red color pencil.

D. This red lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions.

E. 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.

F. 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.

G. 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 2007 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 to accommodate 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.

1. Valves (shut off, balancing, control, trap primers, etc).
2. Dampers (control, balancing, fire, smoke, etc.).

B. 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)

C. 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.

B. 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:

HVAC System Controls	16 Hours
HVAC Equipment Maintenance	8 Hours
Plumbing Equipment	4 Hours

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. Reproducible As-Built drawings delivered to Architect
5. Air Balance Report
6. Asbestos Free Statement
7. Guarantees
8. Equipment Manufacturer of all HVAC compressor units shall provide start-up 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.

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 hot water tanks 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 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.

END OF SECTION 200000

SECTION 210000 - GENERAL FIRE PROTECTION 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. Drawings, General Conditions, and Supplementary Conditions of the Contract, including Division 0 and Division 1 Specification Sections apply to work of this Division.

C. The Fire Protection Contractor shall review all Architectural drawings to determine if the installed work is to be "Phased". The Fire Protection Contractor shall make the necessary accommodations on the submittal drawings to conform with the Architect's "Phasing Plan".

D. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the fire protection work.

E. The fire protection specifications are a mix of being performance based and prescriptive. It is the Fire Protection Contractor's responsibility to determine the exact pipe routing, elevations, and device locations that will meet N.F.P.A. #13, N.F.P.A. #24, local Authority Having Jurisdiction, and project specification requirements.

F. The Fire Protection Sprinkler System Contractor may request a pre-design meeting with the Architect, Fire Protection Engineer, Fire Protection Contractor, General Contractor, and building Owner Representative to answer any specification and contract design related questions during the early design phase of the project. The Fire Protection Sprinkler System Contractor shall provide a written request for this meeting to the General Contractor that is addressed to the Architect.

G. The Fire Protection Contractor for each Fire Protection Specification Section of this project shall submit the information described in paragraph 4.01.A of this Specification Section for the qualifications to bid this project prior to bid date for evaluation and approval prior to the bid date. Contractors that do not meet the qualifications to bid this project will not be allowed.

H. All fire protection sprinkler system components and devices shall be domestically made, imported components will not be allowed.

I. All piping over 6" in length shall have the manufacturers stenciling that is installed at the factory along the length of the pipe. The stenciling shall consist of the manufacturer's identifier (name or logo) at a minimum. Piping that does not contain the information described (i.e. no stenciling on black pipe, white dashes on black pipe, etc.) shall be assumed to be imported and shall be replaced at the contractors expense. All exposed piping that is to be painted shall be visually inspected by the engineer prior to being painted.

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.

1.3 RELATED SECTIONS

A. The following sections apply to this section:

1. Section 211123 "PRIVATE FIRE SERVICE MAINS".
2. Section 211313 "WET PIPE AUTOMATIC SPRINKLER SYSTEMS".

1.4 COORDINATION

A. The Fire Protection Contractor is responsible to initiate coordination meetings with the General Contractor. The General Contractor shall also involve the other contractors needing to coordinate spatial requirements such as the Electrical Contractor, Mechanical Contractor, Plumbing Contractor, etc. as part of these coordination meetings.

B. The fire protection sprinkler system contractor shall participate in the on-site coordination meetings to coordinate the sprinkler system installation with the H.V.A.C. ductwork, H.V.A.C. units, plumbing piping, hydronic piping, 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, Plumbing, 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.

F. The fire protection sprinkler system contractor shall be responsible for documenting the date and participants of each coordination meeting and providing record copies of this documentation to the Architect/Engineer.

1.5 PIPE PENETRATIONS

A. Provide pipe sleeves or core-drilled holes where piping passes entirely through concrete walls, floors, platforms, and foundations.

B. Secure sleeves in position and location during construction and provide sleeves of sufficient length to pass through entire thickness of walls, floors, platforms, and foundations.

C. Provide minimum clearances per N.F.P.A. #13 between exterior of piping and interior of sleeve or core-drilled hole.

D. Firmly pack annular space with mineral wool insulation and seal both ends of the sleeve or core-drilled hole with plastic waterproof cement.

E. Where piping passes through fire walls and fire floors, seal both end of pipe sleeves or core-drilled holes with U.L listed or Factory Mutual Global approved fill, void, or cavity material.

F. Refer to Division 07 for requirements on sealing of penetrations.

G. Requirements for utilizing pipe sleeves at penetrations.

1. Sleeves in masonry and concrete walls, floors, platforms, and foundations: Provide hot-dip galvanized steel, ductile-iron, cast-iron, or PVC sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.
2. Sleeves in other than masonry and concrete walls, floors, platforms, and foundations: Provide 26 gauge galvanized steel sheet material as a minimum thickness.
3. Sleeve Sizing: A nominal diameter of 2" larger than the nominal diameter of the pipe is acceptable for pipe sizes 1" through 3½" and a nominal diameter 4" larger than the nominal diameter of the pipe is acceptable for pipe sizes 4" and larger.
4. Clearance Omission: No clearance is necessary for piping passing through gypsum wallboard or equally frangible material that has no fire resistance rating or if flexible couplings are installed within 1'-0" of each side of the wall, floor, platform, or foundation.

H. Requirements for utilizing core drilled holes at penetrations.

1. Core Sizing: A diameter of 2" larger than the actual diameter of the pipe is acceptable for pipe sizes 1" through 3½" and a diameter 4" larger than the actual diameter of the pipe is acceptable for pipe sizes 4" and larger.
2. Clearance Omission: No clearance is necessary for piping passing through gypsum wallboard or equally frangible material that has no fire resistance rating or if flexible couplings are installed within 1'-0" of each side of the wall, floor, platform, or foundation.

I. The Fire Protection / Mechanical drawings do not specifically identify penetrations through walls, floors, platforms, and foundations.

J. The fire protection sprinkler system contractor shall review all architectural and structural drawings to determine all penetration locations.

K. All penetration locations through walls, floors, platforms, and foundations shall be coordinated with the General Contractor and all other trades.

L. All penetrations through walls, floors, platforms, and foundations are the responsibility of the fire protection sprinkler system contractor.

1.6 FIRE ALARM / ELECTRICAL CONNECTIONS

A. The fire protection contractor shall provide all new fire alarm devices associated with the fire protection system (flow switches, pressure switches, tamper switches, electric bells, etc.), as indicated on the contract documents.

B. The electric bell and back box shall be provided by the fire protection contractor, but shall be installed by the electrical contractor.

C. The low voltage electrical contractor shall make all connections and terminations of the fire alarm devices to the fire alarm system control panel.

D. 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.

E. 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 fire protection specifications and on the fire protection drawings (schedules and/or notes).

1.7 SITE INSPECTIONS OF EXISTING SITE CONDITIONS PRIOR TO BIDDING

A. The Fire Protection Contractor shall examine premises and understand the existing conditions that may affect performance of contractor's work of this Division before submitting proposals and/or bids for this work.

B. No subsequent allowance for time or costs will be considered for any consequence related to failure to examine site conditions.

C. Existing site conditions may not be fully depicted on the contract documents and is the bidding Fire Protection Contractor's responsibility to full understand the existing conditions of the project.

1.8 CONTRACT DOCUMENTS

A. Fire Protection drawings may show general arrangement of exposed piping in critical or highly sensitive areas of the building. Follow as closely as actual building construction and work of other trades will permit.

B. The Fire Protection Contractor shall be responsible for reviewing all architectural, civil, electrical, mechanical, plumbing, structural, and fire protection drawings. These drawings furnish information related to the design and construction of this project and it is the Fire Protection Sprinkler System Contractor's responsibility to review the design documents of all trades and to coordinate the design documents with the fire protection shop drawings.

C. Architectural drawings take precedence over Fire Protection drawings. Additional notes affecting the fire protection sprinkler system design may be contained in the drawings of other trades.

D. Because of small scale of fire protection drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

E. Fire Protection drawings may include enlarged plans or details for information already shown at a smaller scale. In the case that the information shown in a larger scale drawing conflicts with a smaller scale drawing the larger scale drawing shall take precedence.

F. Where new piping locations are shown on the contract documents, the piping shall be designed and installed in a similar fashion, unless accepted by the design team. The Fire Protection Contractor is responsible for providing the required elbows, fittings, transitions, and offsets to accommodate structural members, architectural features, and coordination with other trade work.

G. The fire protection system installation shall be made in accordance with the drawings, specifications, and applicable standards. Should a conflict occur between the drawings and specifications, the specifications shall prevail, refer to Division 1.

H. In the case that criteria contained on the drawings is omitted from the specifications or the specifications have criteria that is omitted from the drawings, the criteria given in one location shall apply as if shown in both the drawings and in the specifications (what's in one document applies to both documents). The drawings and specifications are complementary and what is called for in either is binding as if called for in both, see General Conditions of the Project Manual.

I. Fire Protection Drawings for the project have been developed by the Engineer using AutoCAD 2010 format. These drawing files will be made available to the 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.

1.9 SUBMITTALS

A. Refer to "Request for Proposal" Section 013300 for submittal procedures, and as noted herein.

B. All material used on the project shall be new and free of defects.

C. 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 substitution. 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 **7 days** 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 Specification Section 210000 Paragraph 2.1).

D. Provide copies as specified by Division 1 and at a minimum provide **six (6) sets** of shop drawings, calculations, 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, re-fabrication of piping, removal of installed system components, and the re-installation of the fire protection system shall not be charged as additional cost to the Owner or General Contractor.

E. Equipment submittals shall be presented to the Architect / Engineer for review and approval within 30 calendar days from the date of the Contract signing by the General Contractor.

F. Shop drawings, seismic brace calculations, and hydraulic calculations for overhead fire protection systems shall be presented to the Architect / Engineer for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

G. Shop drawings and thrust block calculations for underground fire protection piping shall be presented to the Architect / Engineer for review and approval within 60 calendar days from the date of the Contract signing by the General Contractor.

H. A colored bond copy of the "Graphical Map" shall be presented to the Architect / Engineer for review and approval prior to final system testing.

I. All items contained in the "Working Plans" section of the latest edition of N.F.P.A. #13 adopted by the Authority Having Jurisdiction shall be included as part of the submittal package.

J. Equipment submittals for each fire protection specification section shall be contained within 3-ring hard cover binders. A single 3-ringed hard cover binder may be used that is divided by specification section.

K. The hydraulic calculations and seismic bracing calculations for overhead fire protection systems shall be contained within a single 3-ring hard cover binders and provided with divider sheets that identify which fire protection specification section the subsequent calculations apply to.

L. Thrust block calculations shall be contained within a single 3-ring hard cover binder.

M. The information contained in the Equipment Submittals shall be grouped in an orderly arrangement by specification index within a single 3-ring hard cover binder. The Equipment Submittals shall have a typewritten index and divider sheets between categories with identifying tabs. The tabs shall be organized into the items described in the "Submittals" paragraph of each individual specification section associated with this project. The covers shall be imprinted with the name of the job, Owner, Architect, and Mechanical Contractor.

N. Equipment Submittals shall contain original brochures supplied by manufacturers (Xerox 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.

O. Each fire protection specification section shall be tabbed individually with a master index at beginning of each section identifying all subsequent tabs indicating the divisions within each specification section that match the equipment submittal tab requirements contained within Part 1 of each fire protection sprinkler system specification system.

P. Combining equipment submittals from multiple fire protection specification sections into a single equipment submittal will not be allowed.

Q. Submitting portions of the equipment submittals will not be accepted.

R. If the equipment submittals are being delivered electronically, each fire protection specification section shall be compiled into a single PDF that will include the "Table of Contents", manufacturer's literature, tabbed divider sheets that allow the submittal to be printed out in order. The manufacturer's literature and tabbed divider sheets shall be arranged as detailed within each fire protection specification section.

S. 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.

T. 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.

U. See each individual specification section associated with this project for the equipment submittals required.

V. Submit qualifications of welders that meet or exceed American Welding Society (AWS) B2.1 and ASME Boiler and Pressure Vessel Code, Section IX.

W. Submit welding procedures that comply with the qualification requirements of NFPA 13, and that meet or exceed AWS B2.1 "Standard Welding Procedure and Performance Qualifications" and ASME Boiler and Pressure Vessel Code, Section IX.

1.10 SCHEDULE OF VALUES

A. Provide schedule of values per Division 1 and related project requirements:

1. 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:
   a. Engineering
   b. Coordination Meetings
   c. Materials and Labor
   d. Closeout Materials
2. Engineering:
   a. The dollar value for "Engineering" work associated with each Fire Protection Specification Section shall in no case be less than 17.00% of the total dollar value of the Fire Protection work or as indicated in Division 1, whichever is higher. "Engineering" work shall be a lump sum line item for each fire protection specification section consisting of the following at a minimum:
      1) Shop Drawings
      2) Seismic Brace Calculations
      3) Hydraulic Calculations
      4) Thrust Block Calculations
      5) Equipment Submittals
      6) Permitting
      7) Architect and/or Engineer Approval

b. The Contractor is advised there will be no payments for "Engineering" until the submittal materials (Shop Drawings, Seismic Brace Calculations, Hydraulic Calculations, and Equipment Submittals) have been reviewed and approved by the Architect and/or Engineer.

3. Coordination Meetings:
   a. Provide a separate line item in the "Schedule of Values" for coordination meetings.
   b. The dollar value for "Coordination Meetings" shall be not less than 3.00% of the total dollar value of all Fire Protection work.
   c. The Contractor is advised there will be no payments for "Coordination Meetings" until the documentation required in Paragraph 1.02.F of this Specification Section is received by the Architect and/or Engineer.
4. Materials and Labor:
   a. Provide a separate line item in the "Schedule of Values" for "Materials and Labor" associated with each Fire Protection Specification Section.
   b. Each Fire Protection Specification Section shall be broken down into separate line items for rough-in and finish work in the "Schedule of Values" consisting of the following at a minimum.
      1) Each building shall have a line item
      2) Each system shall have a line item
      3) Each wing, each "Phased Area" of the project, or area defined on the Architectural documents shall have a line item.
   c. The dollar value for "Materials and Labor" shall be the remaining percentages of the total dollar value of all Fire Protection work.
5. Closeout Materials:
   a. Provide a separate line item in the "Schedule of Values" for each "Closeout Material" consisting of the following at a minimum.
      1) Punch List, Sprinkler List, Hydraulic Placards, General Information Sign, Graphical Map.
      2) Warranty Letters, Signed Test Certificates, As-Built Drawings, and Operations and Maintenance Manuals
      3) Owner Training
   b. The dollar value for "Closeout Materials" shall be not less than 3.00% of the total dollar value of all Fire Protection work or as indicated in Division 1, whichever is higher.
6. 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 approved.

1.11 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 each individual specification section associated with this project for the prior approved products.

C. Materials: Use domestic made pipe, fittings, valves, hangers, sprinklers, and devices on this Project.

1.12 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over Fire Protection installations.

1. International Building Code -- Latest Adopted Edition
2. International Fire Code – Latest Adopted Edition
3. Local Water District Requirements
4. State and County Department of Health
5. Local Fire Marshal
6. Occupational Safety and Health Administration (OSHA)
7. Washington Industrial Safety and Health Act (WISHA)
8. National Fire Protection Association (N.F.P.A.)

1.13 PRODUCT HANDLING AND PROTECTION

A. Contractor is responsible for protection of all piping, fittings, and devices provided under this specification section free from damage, water, corrosion, rust, or foreign matter build up both in storage and when installed, until final project acceptance.

B. Materials in the staging areas shall be protected by an approved means to prevent corrosion of the sprinkler system components. Failure to do so shall result in the material not being approved and if found installed will be replaced at the fire protection contractor's expense.

C. Equipment finish that is damaged by handling, storage, etc. shall be corrected by the Contractor at no additional cost to the Owner.

D. The Architect and/or Engineer reserves the right to reject any material, the appearance of which has been damaged on the site or in shipment.

1.14 OPERATION AND MAINTENANCE MANUAL FOR FIRE PROTECTION SYSTEMS

A. Bind Operation & Maintenance Manual for the Fire Protection System in a single 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 FIRE PROTECTION SYSTEMS

B. Equipment submittals for each fire protection specification section shall be contained within 3-ring hard cover binders. A single 3-ringed hard cover binder may be used that is divided by specification section.

C. Each fire protection specification section shall be tabbed individually with a master index at beginning of each section identifying all subsequent tabs indicating the divisions within each specification section that match the equipment submittal tab requirements contained within Part 1 of each fire protection sprinkler system specification system.

D. Combining Operations and Maintenance Manuals from multiple fire protection specification sections into a single Operations and Maintenance Manual will not be allowed.

E. 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.

F. Provide Section for each type of item of equipment.

G. Submit copies as specified by Division 1 and at a minimum provide three (3) copies of Operation & Maintenance Manual to Architect for approval.

H. Submit Operation and Maintenance manuals for each piece of equipment requiring instructions on operation and/or maintenance.

I. Operation and Maintenance 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.

J. 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.

K. Operation and Maintenance manuals shall contain original brochures supplied by manufacturers (Xerox copies of originals will not be accepted).

L. 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.

M. 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.

N. 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.

O. Operating Instructions shall include:

1. General description of each fire protection system.
2. Step-by-step procedure to follow shutting down each fire protection system.
3. Step-by-step procedure to follow putting each fire protection system back into operation.

P. A copy of N.F.P.A. #25 shall be provided as part of the Operations and Maintenance manual. The edition of N.F.P.A. #25 provided shall correspond to the edition of N.F.P.A. #13 utilized in the sprinkler system design.

Q. The Operation and Maintenance manual shall be assembled in a single 3-ring hard cover binder. The information contained in the Operation and Maintenance manuals shall be grouped in an orderly arrangement by specification index. The Operation and Maintenance manuals shall have a typewritten index and divider sheets between categories with identifying tabs. The covers shall be imprinted with the name of the job, Owner, Architect, Mechanical Contractor, and year of completion.

1.15 WARRANTY LETTER

A. In addition to the guarantee specified in General Conditions, the fire protection contractor shall guarantee that the fire protection systems are installed to N.F.P.A. code and approved shop drawings.

B. In order to be protected, secure proper guarantees from suppliers and any Subcontractors. Include all warranties/guarantees including extended warranties.

C. 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 and the "Certificate of Warranty" letter shall be signed by the fire protection sprinkler 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.

1.16 TEST CERTIFICATES

A. The following completed tests shall be contained as a minimum on "Test Certificates" provided to the Owner at completion of this project.

B. Water Based Sprinkler Systems

1. Private Fire Service Mains
   a. Underground lead-in hydrostatic testing
   b. Underground purification testing
   c. Underground lead-in flushing per N.F.P.A. #13 and N.F.P.A. #24 requirements
2. Wet pipe automatic fire protection sprinkler system
   a. Overhead hydrostatic testing
   b. Overhead fire alarm connection point interface testing

c. Purification of piping on the potable side of the backflow preventer
d. Full forward flow testing of the backflow preventer
e. Backflow preventer certification testing
f. Main drain testing

1.17 AS-BUILT DRAWINGS

A. The 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. The Contractor shall update all references to specific products to indicate products actually installed on project.

C. Upon completion of work, the Fire Protection Contractor shall deliver the red lined drawings and one set of neatly drafted As-Built drawings on electronic media in AutoCAD 2010 format to the Architect for the Engineer to review and accept prior to being forwarded to the Owner for their records.

D. Submit full-scale drawings that are not larger than the contract documents (out of scale drawings will not be allowed)

E. The As-Built drawings shall show actual installation from all change orders, field authorizations, design changes, installation modifications, etc.

F. As-Built drawings shall contain dimensions to all main piping (from structure or gridlines), elevations of all piping (both above finished floor and below structure), and pipe length for all piping including riser nipples, sprigs, drops, and dry sprinkler heads.

G. Schematic details provided on submittal drawings shall be changed to project specific details with all piping and devices sized and drawn to scale.

1.18 GRAPHICAL MAP

A. The fire protection sprinkler system contractor shall provide a "Graphical Map" in the main sprinkler system riser room for each building associated with this project and a "Graphical Map" to be placed in each of the Operations and Maintenance Manuals.

B. The "Graphical Map" shall identify the locations of all of the following:

1. Auxiliary Drain Valves
2. Remote Inspector’s Test Valves
3. Auxiliary Control Valves
4. Yard Post Indicating Valve (if installed as part of the project)
5. Access Panels
6. Main System Riser
7. Automatic Air Vents

C. The "Graphical Map" shall consist of the following items:

1. Color representation of the building(s) floor plan.
   a. Black: Building walls (interior and exterior)
   b. Black: Building Gridlines (optional)
   c. Black: "Graphical Map" title
   d. Black: North Arrow
   e. Black: Room Names and Room Numbers
   f. Black: Text and leader lines that identify locations of all valves
   g. Red: All horizontal sprinkler piping, elevation changes in piping are not required to be indicated on the "Graphical Map"
   h. Cyan: All Acoustical Tile Ceilings
   i. Blue: All Access Panels
2. All text shall be a minimum of 3/32" in height and placed to not be superimposed over walls or sprinkler piping. The text shall be legible and clear utilizing leader lines to move text to a clear location.
3. The "Graphical Map" shall be full color image printed on 8½"X11", 11"X17", or 24"X36" media, depending upon the size of the project and clarity of the information.

D. The "Graphical Map" in the main sprinkler system riser room for each building associated with this project shall be laminated and securely fastened to the wall adjacent to the spare sprinkler head cabinet.

E. The "Graphical Map" in each of the Operations and Maintenance Manuals shall be on bond paper and placed within a plastic sheet protector.

1.19 CLOSE OUT MATERIAL

A. The fire protection close out material shall be submitted to the Architect for review and approval by the Engineer 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:

1. Operations and Maintenance Manuals: See Paragraph 1.14 of this Specification Section for "Operations and Maintenance Manual" requirements.
2. Warranty Letters: See Paragraph 1.15 of this Specification Section for "Warranty Letter" requirements.
3. Test Certificates: See Paragraph 1.16 of this Specification Section for "Test Certificate" requirements.
4. As-Built Drawings: See Paragraph 1.17 of this Specification Section for "As-Built Drawing" requirements.
5. Graphical Map: See Paragraph 1.18 of this Specification Section for "Graphical Map" requirements.

1.20 DEFINITIONS

A. Cold Space: Spaces outside of the building's envelope in which ambient temperatures are expected to be below 40°F.

B. Warm Space: Spaces within the building's envelope in which ambient temperatures are not expected to be below 40°F.

C. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.

D. 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.

E. Exposed: Open to view i.e. a room that is not covered by other construction.

F. 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.

G. Replace: All existing fire protection piping, fittings, hangers, seismic brace components, and heads shall be demolished and discarded from the project site. New fire protection piping, fittings, hangers, seismic brace components, and heads shall be installed in the "Scope of Work" areas indicated on the contract documents.

H. Removed: All existing fire protection piping, fittings, hangers, seismic brace components, and heads identified on the contract documents shall be taken apart, taken down, and discarded from the project site. Removed items shall not be brought back to the project site for use or reinstallation.

I. Reinstall: Existing fire protection piping, fittings, hangers, seismic brace components, and heads identified on the contract documents that are to be taken down and relocated to a new location for use.

J. Trades: Design documents or work performed by architectural, civil, electrical, fire protection, landscape, mechanical, plumbing, and structural.

K. 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.

1.21 ABBREVIATIONS

ABOC	"Above Bottom of Ceiling" to the centerline of sprinkler piping
AEG	Above Exterior Grade
AFF	Above Finish Floor
AHJ	Authority having Jurisdiction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing & Materials
ATOD	"Above Top of Deck" to the centerline of sprinkler piping
ATOJ	"Above Top of Joist" to the centerline of sprinkler piping

AWWA	American Water Works Association
BFF	Below Finish Floor
BHP	Brake Horsepower
BOB	Below "Bottom of Beam" to the centerline of sprinkler piping
BOC	Below "Bottom of Ceiling" to the centerline of sprinkler piping
BOD	Below "Bottom of Deck" to the centerline of sprinkler piping
BOJ	Below "Bottom of Joist" to the centerline of sprinkler piping
CH	Ceiling Height
CPVC	Chlorinated Polyvinyl Chloride
EC	Electrical Contractor
FDC	Fire Department Connection
FM	Factory Mutual Global
GC	General Contractor
GPM	Gallons per Minute
HP	Horsepower
IFOW	"Inside Face of Wall" to the centerline of sprinkler piping
MC	Mechanical Contractor
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
NRS	Non Rising Stem
NTS	Not to Scale
OFOW	"Outside Face of Wall" to the centerline of sprinkler piping
OS&Y	Outside Screw and Yoke
PIV	Post Indicator Valve
POC	Point of Connection
PSI	Pounds per Square Inch Gauge Pressure
UFC	Unified Facilities Criteria (U.F.C.)
UL	Underwriter's Laboratories

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Any reference in the specifications or on the drawings to any article, device, product, or material, by manufacturer, name, make, model, 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 Manufacturer" has been approved for this project for the items indicated and does not require obtaining prior approval. Other manufacturers not listed shall require prior approval.

C. The listing of a manufacturer as an "Acceptable 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. A product provided by an "Approved Manufacturer" shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the contract documents 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 Architect/Engineer'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 to accommodate 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, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, and similar concerns.

H. If approval is received to use other than specified items, responsibility for 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, the Fire Protection Contractor assumes responsibility for replacement with items named in project specifications.

J. 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.

K. 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.

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, the Fire Protection 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 or General Contractor.

3.2 CLOSEOUT SUBMITTALS

A. Requirements: Final approval of fire protection installation will be recommended upon completion of the following:

1. Completion of all punch list items
2. Operation instruction period to Owner's satisfaction
3. Permit Submittal
4. As-Built drawings on electronic media in AutoCAD 2007 format delivered to Architect
5. Signed Warranty Letter
6. Operations and Maintenance Manuals
7. Completed and Signed Test Certificates
8. Backflow Preventer Full Forward Flow Test Certificate

3.3 FINAL INSPECTION

A. Prior to acceptance of the fire protection work, the Fire Protection Contractor shall put all fire protection 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.

B. The time of the final inspection shall be mutually agreed to by the Owner, Engineer, and Fire Protection Contractor.

3.4 OPERATION AND MAINTENANCE TRAINING

A. Upon completion of the work, and after all tests and final inspection of the work by the Authority Having Jurisdiction (AHJ), the Fire Protection Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various fire protection systems.

B. The Contractor shall arrange for scheduled instruction periods with the Owner.

C. The Contractor's representatives shall be Superintendents or Foremen knowledgeable in each system and Supplier's Representative when so specified.

D. All drain locations and inspector's test locations shall be shown in addition to showing the access required to obtain the valves.

E. A general description of each fire protection system shall be demonstrated including the following.

F. Step-by-step procedure to follow shutting down each fire protection system.

G. Step-by-step procedure to follow putting each fire protection system back into operation.

H. Dry system air compressor locations and procedure for replacement.

I. Scheduled instruction periods shall be based upon the complexity of the systems installed, but in no case be less than the following:

Underground Systems	1 Hour
Water Based Fire Protection Systems:	2 Hours for each system type

J. Costs for time involved by the Fire Protection Contractor shall be included in the bid.

3.5 FIRE PROTECTION CONTRACTORS RESPONSIBILITY FOR NEW BUILDINGS

A. The Fire Protection Contractor shall bear expense of cutting, patching, painting, repairing, and replacing of work of other trades that are required because of the Fire Protection Contractors fault, error, tardiness, or because of damage caused by the fire protection installation.

B. All fire protection sprinkler system components, devices, and materials installed as part of this project shall be new and free of corrosion or rust.

3.6 INSTALLATION

A. Install fire protection equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance can be readily removed.

B. Design and provide each system with full consideration to blind spaces, piping, electrical equipment, ducts, other construction, and equipment in accordance with detailed working drawings to be submitted to the Architect/Engineer for approval.

C. The Fire Protection Contractor shall modify or relocate all items that interfere with access to other trade work.

D. Provide access doors to access all valves installed in finished areas.

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. Provide separations between all dissimilar metals with a dielectric connection.

G. Provide offsets around all electrical panels and similar electrical equipment (transformers, main distribution panels, etc.) to maintain the clear space required by N.F.P.A. #70 (National Electrical Code). A 6'-0" clear space is required above all electrical panels, a 6'-6" clearance is required from the floor to the top of the electrical panel, and a clear space of 3'-6" is required directly in front of the panel, except where indicated otherwise or required by N.F.P.A. #70 (National Electrical Code) to be more. Such offsets are typically not shown on the contract documents, but are required per this paragraph.

H. All piping and related items installed by the Fire Protection Contractor shall not present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) or it will be required to be relocated at no additional cost to the Owner or General Contractor.

I. Access to equipment is of utmost importance. The Fire Protection Contractor shall apply extra attention to the laying out of pipe and in coordinating all work. Poor access to other trade work equipment will not be accepted.

J. 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.

K. 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 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response to any Request for Information (RFI) regarding the fire protection work. To further expedite this process, if a suggestion can be determined or derived at by the initiator of the Request for Information (RFI), it is required that this suggestion is 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 Protection 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.

PART 4 - CONTRACTORS

4.1 SPRINKLER CONTRACTOR QUALIFICATIONS TO BID THIS PROJECT

A. The Fire Protection Contractor Qualifications shall be forwarded to the Architect/Engineer.

B. Fire Protection Contractors that do not meet the minimum qualifications will not be allowed on the project.

C. Acceptable Fire Protection Contractors will be allowed to bid this project and will be notified in the last addendum for this project.

D. The Fire Protection Contractor shall following the approval process and timing identified in Part I of this specification and Division 0 and 1 of the project specifications to the Architect prior to the last addendum being released. Acceptable Contractors allowed to bid this project will be identified in the last addendum prior to this project bidding.

END OF SECTION 210000

CONTRACTOR QUALIFICATIONS FORM (PAGE 1 OF 3)

Item #1:

Project Name: _____

Item #2:

Company Name	Telephone Number
Address	E-Mail Address
Branch Office Address (If different)	Individual in Charge
Signature	Title

Item #3:

Date Company Opened: _____

Company History and past Name Changes (10 year minimum):

Item #4:

Attach a "Certificate of Insurance" showing a minimum of $2,000,000 liability insurance.

CONTRACTOR QUALIFICATIONS FORM (PAGE 2 OF 3)

Item #5:

Provide project name of the 5 most recent projects in which BCE was the engineer of record that your company was the installing Fire Protection Contractor.

Project #1: _____

Project #2: _____

Project #3: _____

Project #4: _____

Project #5: _____

Item #6:

Provide project name, contact person, and contact number for the 5 most recent projects that your company has designed and installed that are similar in nature to this specific project.

Project #1: _____

Contact Person: _____ Phone Number: _____

Project #2: _____

Contact Person: _____ Phone Number: _____

Project #3: _____

Contact Person: _____ Phone Number: _____

Project #4: _____

Contact Person: _____ Phone Number: _____

Project #5: _____

Contact Person: _____ Phone Number: _____

CONTRACTOR QUALIFICATIONS FORM (PAGE 3 OF 3)

Item #7:

Design must be by full time "in house" designers/engineers.

Provide documentation for a State of Washington Level III Certificate of Competency holder, a State of Washington Level U Certificate of Competency holder, and resumes of the designers/engineers to be working on this project for the dedicated fire protection underground work.

Provide documentation for a State of Washington Level III Certificate of Competency holder, NICET Level IV certification, and resumes of the designers/engineers to be working on this project for the sprinkler system work.

Item #8:

To achieve maximum quality control of materials and to facilitate meeting project scheduling, second party fabrication (sub-contracted out) will not be allowed. All fabrication shall be performed "In House" and not at an outside fabrication shop. The Fire Protection Contractor's fabrication shop shall contain the following items to qualify as a legitimate fabrication shop and shall be indicated below.

	Yes	No
A full-time, in house, certified welder on staff that meets the requirements of American Welding Standards (AWS) B2.1 and N.F.P.A. #13.	☐	☐
Sample of testing reports to be given to owner, generated by the welder to certify the corresponding welds.	☐	☐
The fabrication shop includes a hanger shop for cutting of all hanger materials.	☐	☐
The fabrication shop contains a stationary (floor mounted) threading machine.	☐	☐
The fabrication shop contains a plasma cutter.	☐	☐
The fabrication shop contains a "make-on" machine.	☐	☐

Verification that the Fire Protection Contractor has accurately indicated the above information may be required.

SECTION 211123 - PRIVATE FIRE SERVICE MAINS

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, the following:

1. The State of Washington "Washington Administrative Code" (WAC) 212-80-083(5) requires a State of Washington licensed professional engineer or a State of Washington Level III Certificate of Competency holder to design and prepare the fire protection underground drawings.
2. The State of Washington "Washington Administrative Code" (WAC) 212-80-043(2) requires a State of Washington Level U Certificate of Competency holder to perform the fire protection underground piping installation.
3. Provide all material, labor, equipment, design, and services necessary to perform the installation of private fire service mains supplying an automatic sprinkler system, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #24 accepted by the Authority having Jurisdiction (Jefferson County), and project specifications, except as modified herein.
4. The Underground Fire Protection Contractor shall install the private service main per the latest edition of N.F.P.A. #13 and N.F.P.A. #24 accepted by the Authority having Jurisdiction, from a point 5'-0" outside the building footing to the supply flange left approximately 6" above finished floor.
5. The Underground Fire Protection Contractor is to obtain a permit and final approval from Jefferson County for the private service main underground installation. All permits, fees for plan review, inspections, testing, etc. shall be included in the bid proposal.
6. **The Underground Fire Protection Contractor shall simultaneously submit shop drawings and manufacturers data sheets to the local Authority Having Jurisdiction and Architect/Engineer for review and shall be approved by the Architect/Engineer prior to the purchase, fabrication, or installation of any system component as detailed in paragraph 1.5 of Specification Section 211123. The Architect/Engineer submittal drawings shall be stamped and signed by the appropriate contractors performing the design and installation of the fire protection underground supply.**
7. **If another contractor is performing the underground installation from the "point of connection" to a point 5'-0" outside of the buildings footing, it shall be submitted by that contractor to the Architect/Engineer for review prior to any of the underground being purchased, fabricated, or installation of any system components.**
8. All fire protection equipment installed shall be by a manufacturer contained within "PART 2 – PRODUCTS" of this specification unless prior approval has been received for "Requests For Substitution" following the guidelines set forth in Specification Section 210000 paragraphs 1.9 and 2.1.
9. Contractor must perform asphalt cutting, trenching, select fill, asphalt patching, and pipe restraining required for proper installation of the new private fire service main(s).

10. **The Fire Protection underground Contractor shall provide a copy of the "Underground Test Certificate" to the Architect/Engineer for review and shall be approved by the Architect/Engineer prior to the overhead fire protection piping being connected to the underground piping. The "Test Certificate" shall be completely filled out and shall indicate the method used for flushing, standard the system was flushed in accordance with, and shall be signed by the Authority having Jurisdiction who witnessed the flushing test.**

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.

1.3 RELATED SECTIONS

A. The following sections apply to this section:

1. Section 210000 "GENERAL FIRE PROTECTION REQUIREMENTS".
2. Section 211313 "WET PIPE AUTOMATIC SPRINKLER SYSTEMS".

1.4 GENERAL SYSTEM REQUIREMENTS

A. The fire protection underground contractor shall coordinate with a locate company prior to beginning any excavation work. The fire protection underground contractor shall include all fees associated with the "locate" in the bid.

B. The underground supply piping and fire department connection piping shall be provided with a concrete thrust block at all changes of direction and at the elbow where the pipe turns from a horizontal installation to vertical installation.

C. The elbow located under the building on the fire protection underground supply piping and fire department connection piping shall also be provided with rodding as a second means of restraint. The elbow shall be rodded to the flange above finished floor in the vertical direction and rodded to the first joint outside of the buildings footing in the horizontal direction.

D. Minimum underground pipe size shall be 6", but shall be based upon the hydraulic calculation demands of the fire protection system being installed in the building by the project fire protection engineer.

E. If allowed by the local Authority Having Jurisdiction, the minimum depth of cover shall be no less than 3'-0" at finish grade. Otherwise, the minimum depth of cover shall be based upon Figure A.10.4.1 of the 2010 edition of N.F.P.A. #13 and N.F.P.A. #24, with the minimum depth of cover being no less than 4'-0" at finish grade.

F. The underground piping shall terminate with a flange left 6" above finished floor.

G. The supply flange shall be two-holed with respect to the back wall (the two closest flange holes to the back wall shall be at the same distance from the back wall) to assure that the sprinkler system riser will be aligned parallel with the back wall.

1.5 SUBMITTALS

A. See Specification Section 210000 Paragraphs 1.9 and 2.1 for "Submittal" requirements.

B. Follow the guidelines set forth in Specification Section 210000 Paragraphs 1.9 and 2.1 for "Requests For Substitution" procedures. 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.

C. Equipment submittal tabs shall include, at a minimum, the following:

1. Piping.
2. Fittings / Couplings.
3. Miscellaneous Equipment.

D. Equipment submittals shall include, at a minimum, the following:

1. Piping (Potable and Non-Potable).
2. Couplings / Fittings (Flanged, Grooved, Mechanical Joint, Etc.).
3. Buried Utility Warning and Identification Tape.
4. Elastomeric Seals.

E. All re-submitted drawings shall have the areas of revision clearly marked with revision clouds.

F. When the drawings are created in AutoCAD, the submittal drawings shall be in plotted to the following criteria:

1. Black and white plots shall consist of the following as a minimum:
   a. Light Black for drawing background.
   b. Dark Black for all underground related components and text.

1.6 PIPING SYSTEM LAYOUT

A. Prepare detailed working drawings that are not larger than the contract documents for the system layout in accordance with N.F.P.A. #13, “Working Drawings (Plans)". Show data essential for the proper installation of each fire protection underground system per N.F.P.A. #13 and N.F.P.A. #24.

B. The cover sheet of the shop drawings shall contain a site plan (1" = 50'-0" minimum) that clearly shows all fire service main routing with size and type of pipe indicated, fire hydrant locations, fire department connection location, devices, valves, and fittings, regardless of who performed the underground work.

C. A graphical scale shall be provided for each floor plan or detail on the shop drawings in accordance with N.F.P.A. #13, "Working Drawings (Plans)".

D. The minimum text size on full scale drawings shall be 1/8" high.

E. The cover sheet of the shop drawings shall clearly state the scope of Contractor's work, Contractor's exclusions, Contractor's start point, which version of N.F.P.A. #13 and N.F.P.A. #24 was used for the private fire service main design and current water flow information.

1.7 UNDERGROUND SYSTEM VELOCITY REQUIREMENTS

A. The maximum velocity allowed in the underground mains shall be 8 feet per second and the maximum velocity allowed through the backflow preventer shall be 16 feet per second maximum.

1.8 UNDERGROUND MAXIMUM PRESSURE LOSS REQUIREMENTS

A. The pressure loss associated with the fire protection sprinkler system underground supply shall not exceed 5.0 p.s.i. over the length of the entire dedicated underground supply piping. The pressure loss of the underground piping shall be based upon the flows of the sprinkler system demands and all interior hose stream requirements.

PART 2 - PRODUCTS

2.1 PRIVATE FIRE SERVICE MAIN PIPING SYSTEMS

A. All fire protection system components, devices, and materials installed as part of this project shall be new.

B. All fire protection underground components and devices shall be domestically made.

2.2 PRIVATE FIRE SERVICE MAIN PIPE AND FITTINGS

A. All underground system piping and fittings shall meet the following criteria:

1. Underground Supply Piping from a point 5'-0" Outside the Building Footing to the Supply Flange Left Approximately 6" Above Finished Floor: Provide cement mortar lined Class 52 ductile iron piping. If acceptable by the Authority Having Jurisdiction, AWWA standard bell and spigot Class 150 ductile iron piping, C-900 Class 200 DR14 U.L. labeled PVC pipe, type 304 or 316 stainless steel piping or type K roll grooved drawn copper tubing may be installed. All fittings shall be U.L listed or F.M. approved for fire protection installations, shall utilize full flow standard radius fittings, and shall match the type of underground piping to be installed.

2. Fire Department Connection Piping From a Point 5'-0" Outside of the Building Footing to the Flange Left Approximately 6" Above Finished Floor: Provide cement mortar lined Class 52 ductile iron piping. If acceptable to the Authority having Jurisdiction, AWWA standard bell and spigot Class 150 ductile iron piping, or C-900 Class 200 DR14 U.L. labeled PVC pipe. All fittings shall be U.L listed or F.M. approved for fire protection installations, shall utilize full flow standard radius fittings, and shall match the type of underground piping to be installed.
3. Approved manufacturers are as follows:
    a. Flanged Products: American Cast Iron Pipe Company, Anvil International, Merit Manufacturing (Mueller), Trinity Valley Iron & Steel Company, Pacific Coast Flange Incorporated, Tyler Pipe, Union Foundry Company, U.S. Pipe and Foundry Company, Ward, or prior approved equal.
    b. Mechanical Joint Fittings and Retainer Glands: American Cast Iron Pipe Company, Ford Meter Box Company, Tyler Pipe, U.S. Pipe and Foundry Company, or prior approved equal.
    c. Ductile Iron Pipe: American Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or prior approved equal.
    d. Mechanical Joint Products: American Cast Iron Pipe Company, EBBA Iron Incorporated, Pacific States Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or prior approved equal.
    e. P.V.C. Pipe: Diamond Plastics Corporation, Johns Manville (Blue Brut), North American Pipe Corporation, PW Pipe, or prior approved equal.
    f. Stainless Steel Fittings: Anvil International, Fablok (Allied Tube and Conduit), Greensboro Pipe Company, Victaulic, or prior approved equal.
    g. Stainless Steel Pipe: Alaska Copper and Brass, American Pipe and Supply, Greensboro Pipe Company, or prior approved equal.
    h. Copper Fittings: Alaska Copper and Brass, Nibco, Victaulic, or prior approved equal.
    i. Copper Pipe: Alaska Copper and Brass, Cerro Flow Products Inc., Mueller Industries Incorporated, Victaulic, or prior approved equal.

2.3 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Provide electronically detectable aluminum foil plastic backed tape or electronically detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping.

B. Provide identification tape that has a 3" minimum width roll, a minimum of 4 mil thick, and color coded for the utility involved. Identification tape shall have bold black letters imprinted with "CAUTION BURIED WATER PIPING BELOW" or similar wording continuously and repeatedly over entire tape length.

C. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

D. Approved manufacturers are as follows:

1. Buried Utility Warning and Identification Tape: Pro-Line Safety Products Company, Tek Identification Products, or prior approved equal.

2.4 ELASTOMERIC SEALS

A. Where openings below exterior grade present the possibility of water entering the building, the Fire Protection Contractor shall provide a modular, mechanical type of interlocking synthetic rubber links shaped to continually fill the annular space between the pipe and the wall opening.

B. The elastomeric element shall be sized and selected per manufacturer's recommendations.

C. Each individual link shall be permanently identified with the name of the manufacturer and model number.

D. Approved manufacturers are as follows:

1. Seals For Openings Below Grade: Link-Seal, MetraSeal, or prior approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERGROUND PIPING SYSTEMS

A. The State of Washington "Washington Administrative Code" (WAC) Section 212-80-083(5) requires a State of Washington licensed professional engineer or a State of Washington Level III Certificate of Competency holder to design and prepare the fire protection underground drawings.

B. The State of Washington WAC 212-80-043(2) requires a State of Washington Level U Certificate of Competency holder to perform the fire protection underground piping installation.

C. The installing Contractor shall have a minimum of five (5) years experience in the design, installation, and testing of wet pipe automatic fire protection sprinkler systems, or similar fire protection systems. A list of installations of a similar nature and scope shall be provided on request.

D. All piping and fittings installed prior to the backflow preventer are considered part of the potable water system and shall be required to be of a type that maintains a clean and rust free potable system. The use of black and galvanized pipe and fittings on the potable waterside of the backflow preventer will not be allowed.

E. The Contractor shall be responsible for the design, material, fabrication, workmanship, assembly, examination, testing, and certification that the underground installation meets local and N.F.P.A. codes.

F. The installing Contractor shall have a minimum of five (5) years experience in the design, installation and testing of private fire service mains.

G. A list of installations of a similar nature and scope shall be provided on request.

H. The fire protection sprinkler system contractor shall remove and replace any piping joints deemed improperly installed or show signs of leakage.

3.2 FLUSHING OF UNDERGROUND PIPING

A. Flush piping with potable water in accordance with N.F.P.A. #13 and N.F.P.A. #24 at a minimum velocity of 10 feet per second.

B. Flow for Class 52 Ductile Iron piping shall be at least 290 g.p.m. for 3-inch pipe, 440 g.p.m. for 4-inch pipe, 970 g.p.m. for 6-inch pipe, 1,725 g.p.m. for 8-inch pipe, 2,650 g.p.m. for 10-inch pipe, and 3,800 g.p.m. for 12-inch pipe.

C. Flow for Class 200 C-900 PVC piping shall be at least 450 g.p.m. for 4-inch pipe, 920 g.p.m. for 6-inch pipe, 1,590 g.p.m. for 8-inch pipe, 2,485 g.p.m. for 10-inch pipe, and 3,370 g.p.m. for 12-inch pipe.

D. Flow for Type 304 or Type 316 Stainless Steel piping shall be at least 235 g.p.m. for 3-inch pipe, 400 g.p.m. for 4-inch pipe, 905 g.p.m. for 6-inch pipe, 1,560 g.p.m. for 8-inch pipe, 2,460 g.p.m. for 10-inch pipe, and 3,535 g.p.m. for 12-inch pipe.

E. Flow for Type K copper piping shall be at least 210 g.p.m. for 3-inch pipe, 365 g.p.m. for 4-inch pipe, 810 g.p.m. for 6-inch pipe, 1,410 g.p.m. for 8-inch pipe, 2,190 g.p.m. for 10-inch pipe, and 3,135 g.p.m. for 12-inch pipe.

F. Continue flow for a sufficient time to ensure thorough cleaning.

3.3 PURITY TESTING OF PIPING INSTALLED BEFORE BACKFLOW PREVENTION DEVICE

A. Disinfect the new water supply piping affected by Contractor's operations in accordance with the health authority, water purveyor having jurisdiction and AWWA C651.

B. Exercise caution when mixing chlorine disinfectant solutions.

C. Fill piping systems or piping affected by Contractor’s operations with solution containing a minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours or use a solution containing a minimum of 200 parts per million of chlorine and allow solution to stand for minimum of 3 hours.

D. Following the required standing time, the piping shall be flushed with clean potable water until the maximum residual chlorine content is not greater than that of the domestic water supply or 0.2 part per million.

E. Have a certified laboratory analyze the results from two consecutive satisfactory bacteriological samples and submit these results before the piping is placed into service.

F. Purity testing of piping supplied by non-potable water sources will not be required.

3.4 WIRE AND MARKING TAPE TO LOCATE PIPING

A. Install marking tape at an elevation approximately 1'-0" above the underground piping. Install a continuous 12 gauge copper wire (where required by the Authority Having Jurisdiction) to the topside of all underground piping.

3.5 HYDROSTATIC TEST

A. Hydrostatically test each system at 200 P.S.I. or 50 P.S.I. in excess of the systems working pressure (whichever is greater), for a 2-hour period.

B. The amount of leakage at the joints shall not exceed (2) quarts per hour per (100) gaskets or joints irrespective of pipe diameter.

C. The amount of leakage shall be increased by (1) fluid ounce per inch valve diameter per hour for each metal seated isolating the test section.

D. When tests have been completed and corrections made, submit a signed and dated certificate similar to that specified in N.F.P.A. #13 and N.F.P.A. #24.

3.6 INITIAL BACKFILL MATERIAL

A. Initial backfill consists of select granular material or satisfactory materials free from rocks 1/2" or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

B. When the pipe is coated or wrapped for corrosion protection, the initial backfill consists of select granular material or satisfactory materials free from rocks 1/4" or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

3.7 OFFSITE SOILS REQUIREMENTS

A. Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity.

B. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test.

C. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1.

D. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311.

E. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site.

F. Do not bring material onsite until approved test results are submitted to the Architect/Engineer for review and acceptance.

3.8 INITIAL BACKFILLING AND COMPACTION

A. Backfill the trench to the top of pipe prior to performing the required hydrostatic pressure test.

B. Leave the joints and couplings uncovered during the pressure test.
   1. Replacement of Unyielding Material: Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.
   2. Replacement of Unstable Material: Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6" loose thickness.

C. Place initial backfill material and compact it with approved tampers to a height of at least 1'-0" above the water piping.

D. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe.

E. Take care to ensure thorough compaction of the fill under the haunches of the pipe.

F. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein.

G. Compact backfill to top of pipe to 95 percent of ASTM D 698 maximum density.

H. Provide plastic piping with bedding to spring line of pipe.

I. Provide materials as follows:

   1. Class I: Angular, 6 to 40 mm 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
   2. Class II: Coarse sands and gravels with maximum particle size of 1½", including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.
   3. Clean coarse-grained sand in accordance with industry standard methods and procedures.
   4. Clean, coarsely graded natural gravel, crushed stone or a combination thereof in accordance with industry standard methods and procedures. Do not exceed maximum particle size of 3".

3.9 FINAL BACKFILLING AND COMPACTION

A. Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material.

B. Place backfill material and compact as follows:
   1. Roadways: Place backfill up to the required elevation as specified. Water flooding or jetting methods of compaction will not be allowed.
   2. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 1'-0" loose thickness, and compact it to 85% maximum density for cohesive soils and 90% maximum density for cohesionless soils. Water flooding or

jetting methods of compaction for granular noncohesive backfill material will be allowed, provided the water jetting does not penetrate the initial backfill.

3.10 DISPOSITION OF SURPLUS MATERIAL

A. The fire protection underground contractor shall haul away all surplus material or other soil material that is not required or suitable for filling or backfilling including brush, refuse, stumps, roots, and timber.

3.11 FORMAL TESTS AND INSPECTIONS

A. Do not submit a request for formal test and inspection until the preliminary test and corrections are completed and approved.

B. Submit a written request to local fire protection authority for formal inspection at least 15 days before the inspection date.

C. An experienced technician regularly employed by the system installer shall be present during the inspection.

D. At this inspection, repeat any or all of the required tests as directed.

E. Correct defects in work provided by the Contractor and make additional tests until the system(s) comply with contract requirements.

F. Furnish appliances, equipment, electricity, instruments, connecting devices and personnel for the tests.

G. The Owner will furnish water for the tests.

H. Furnish Architect with three (3) copies of certificates required by testing agencies.

3.12 TRAINING PERIOD

A. Upon completion of the work and after all tests and inspections by the authority(s) having jurisdiction, the Fire Protection Contractor shall demonstrate and train the Owner's designated operation and maintenance personnel in the operation and maintenance of the fire protection system.

B. The Fire Protection Contractor shall arrange scheduled instruction periods with the Owner’s designated operation and maintenance personnel.

C. The Fire Protection Contractor's representatives shall be superintendents or foremen who are knowledgeable in each system and suppliers representatives when so specified.

D. Scheduled training periods shall be based upon complexity of the system installed, but in no case be less than indicated in Paragraph 3.04 of Specification Section 210000.

E. Upon request of the Owner, a DVD of the training period shall be made available by the Fire Protection Contractor at no additional cost to the Owner.

END OF SECTION 211123

SECTION 211313 - WET PIPE AUTOMATIC SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, the following:

1. Provide all material, labor, equipment, design, and services necessary to perform the installation of (1) wet pipe automatic fire protection sprinkler system for complete fire protection coverage through out, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #13 accepted by the Authority having Jurisdiction (Jefferson County), and project specifications, except as modified herein.
2. The Contractor is to obtain a permit and final approval from Jefferson County for the fire protection sprinkler system. All permits, fees for plan review, inspections, testing, etc. shall be included in the bid proposal.
3. **The Contractor shall simultaneously submit shop drawings, hydraulic calculations, seismic bracing calculations, and manufacturer's data sheets to the local Authority Having Jurisdiction and Architect/Engineer for review and shall be approved by the Architect/Engineer prior to the purchase, fabrication, or installation of any system component as detailed in paragraph 1.13 of Specification Section 211313.**
4. All fire protection equipment installed shall be by a manufacturer contained within "PART 2 – PRODUCTS" of this specification unless prior approval has been received for "Requests For Substitution" following the guidelines set forth in Specification Section 210000 paragraphs 1.9 and 2.1.

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.

1.3 RELATED SECTIONS

A. The following sections apply to this section:

1. Section 210000 "GENERAL FIRE PROTECTION REQUIREMENTS".
2. Section 211123 "PRIVATE FIRE SERVICE MAINS".

1.4 GENERAL SYSTEM REQUIREMENTS

A. Notify the Architect, Fire Protection Engineer, General Contractor, and building Owner to coordinate the pre-design meeting stated in Specification Section 210000 Paragraph 1.1.F, if the fire protection sprinkler system contractor decides a pre-design meeting is warranted.

B. The sprinkler riser detail shown on the contract documents is conceptual in nature with the minimum quantity and types of sprinkler risers being required for this project. Actual quantity and types of system risers required for this project shall be determined by the fire protection sprinkler system contractor. If additional system risers are necessary, the fire protection sprinkler system contractor shall include them in their scope of work, prior to bidding.

C. A table shall be placed adjacent to the fire protection sprinkler system riser detail that indicates the actual "Floor Area" protected by each system riser on each floor of the building it serves.

D. Devices and equipment for fire protection service shall be U.L. listed or Factory Mutual Global approved for use in wet pipe sprinkler systems.

E. All H.V.A.C. mechanical units and associated ductwork larger than 10" shall be shown on the drawings as part of the backgrounds.

F. All H.V.A.C grilles, electrical lights, and fire alarm devices that are to be installed at the ceiling level shall be shown on the submittal drawings to verify sprinkler head placements.

1.5 LOCATION OF SPRINKLER HEADS

A. Sprinkler heads located in acoustical ceiling tiles shall be installed in a consistent pattern, centered both directions within the ceiling tiles (12" from a ceiling grid), and placed to avoid all lights, air diffuser grilles, and obstructions.

B. Sprinkler heads located in rooms that contain entire gypsum wallboard ceilings shall be installed in a consistent pattern within the gypsum wallboard ceiling and placed to avoid all surface mounted lights, air diffuser grilles, and obstructions.

C. Sprinkler heads located in soffits shall be installed in a consistent pattern and placed to avoid all lights (surface mounted and/or recessed), air diffuser grilles, and obstructions.

D. Sprinkler heads in exposed areas shall be installed in a consistent pattern while avoiding all lights, ductwork, and structural members.

E. All semi-recessed sprinkler heads shall be installed in such a manner that the deflector distance shall be within ½" of each other as measured from the ceiling. Sprinkler heads that are determined to be installed outside of this installation range shall be modified to meet these criteria.

F. All semi-recessed sprinkler heads shall be installed in such a manner that the center part of the escutcheon that is attached to the sprinkler head does not protrude beyond the trim ring that conceals the ceiling or wall penetration.

G. All pendent sprinkler heads with 2-piece escutcheons shall be installed in such a manner that the deflector distances shall be within ½" of each other as measured from the ceiling. Sprinkler heads that are determined to be installed outside of this installation range shall be modified to meet these criteria.

H. Sprinkler heads shall be installed within all ceiling pockets except when all of the following criteria of N.F.P.A. #13 are met:

1. The total volume of the unprotected ceiling pocket does not exceed 1,000 cubic feet.
2. The depth of the unprotected pocket does not exceed 3'-0".
3. The entire floor under the unprotected ceiling pocket is protected by sprinklers at the lower ceiling elevation.
4. Each unprotected ceiling pocket is separated from any adjacent unprotected ceiling pocket by a minimum 10'-0" horizontal distance.
5. The unprotected ceiling pocket is constructed of non-combustible or limited combustible construction.
6. Quick response sprinkler heads are utilized throughout the compartment.

I. All semi-recessed and pendent sprinkler heads installed below a ceiling within each room shall have the frame arms aligned parallel to each other. Multiple heads installed in a single room shall not be allowed to have the frame arms not parallel to each other.

J. All upright sprinkler heads shall be installed with the frame arms parallel to the branch line.

K. The "Area of Coverage" per sprinkler head installed beneath roll back garage style doors shall be based upon the occupancy classification of the floor area beneath the roll back garage style door, not Light Hazard Occupancy as indicated by N.F.P.A. #13.

L. Spacing of sprinkler heads shall not exceed that permitted by N.F.P.A. #13 for occupancy, except where the fire protection sprinkler system contractor elects to utilize extended coverage sprinklers.

1.6 WATER DISTRIBUTION

A. Sprinkler head discharge shall be uniform throughout the area in which the sprinkler heads will open. Discharge from individual heads in the hydraulically most remote area shall be at a minimum of 100% the specified density.

1.7 SPRINKLER DENSITY AND DISCHARGE AREA OF OPERATION

A. Size piping to provide the required density when the system is discharging over the entire most demanding area.

B. Using the "Pipe Schedule" method to determine pipe sizing will not be allowed.

C. Basing hydraulic calculations upon the "Room Design" method to determine pipe sizing will not be allowed.

D. Application rates to horizontal surfaces below the sprinklers (floor area) shall be 0.10 g.p.m. per square feet over the hydraulically most demanding 1,500 square feet for light hazard occupancy (Offices, Restrooms, heated combustible attic spaces, Vestibule, Lobby, Hallways, Reception, Showers, Work Room, Work Station, Board Room, Mail Box, Commons and dry sidewall coverage under exterior canopies or overhangs).

E. Application rates to horizontal surfaces below the sprinklers (floor area) shall be 0.15 g.p.m. per square feet over the hydraulically most demanding 1,500 square feet for ordinary hazard group I occupancy (Custodian Rooms, Lost and Found, and Kitchen Areas).

F. Application rates to horizontal surfaces below the sprinklers (floor area) shall be 0.20 g.p.m. per square feet over the hydraulically most demanding 1,500 square feet for ordinary hazard group II occupancy (Electrical Rooms, Mechanical Areas, dry sidewall coverage under exterior canopies or overhangs over Loading Docks and Receiving Areas, Common Work, Vault, Facilities, Shop, Utility Room, Service Room, Parts Room, Maintenance Bays, Parts Room Mezzanine, Mechanical Mezzanine, and Storage Rooms).

G. Application rates to horizontal surfaces below the sprinklers (floor area) shall be 0.40 g.p.m. per square feet over the entire area for extra hazard group II occupancy (Lube Room).

H. A reduction in remote area may be used where quick response sprinkler heads are utilized in light or ordinary hazard occupancy where there are no unprotected ceiling pockets and the maximum ceiling height is 20'-0".

I. When sloped ceilings or roofs are present and the slope exceeds 2" per foot, the remote area shall be increased by 30%.

J. For buildings having unsprinklered combustible spaces (including areas used for roof venting), the minimum area of sprinkler operation shall be 3,000 square feet after all other remote area modifications have been made.

1.8 HOSE STREAM ALLOWANCES

A. Hose stream allowances for hydraulic calculations shall be per N.F.P.A. #13.

B. Light hazard occupancy shall require 100 g.p.m. combined hose streams.

C. Ordinary hazard occupancy shall require 250 g.p.m. combined hose streams.

D. Extra hazard occupancy shall require 500 g.p.m. combined hose streams.

1.9 PIPE C-VALUES FOR CALCULATING FRICTION LOSSES

A. Calculate losses in piping in accordance with Hazen-Williams equation using a 'C' value of:

1. 100 for unlined cast iron or unlined ductile iron.
2. 120 for black steel or galvanized steel wet systems.
3. 140 for cement lined cast iron or ductile iron.
4. 150 for listed P.V.C., copper tube, or stainless steel.

1.10 WATER SUPPLY

A. Base hydraulic calculations (for the bid) on a computer generated flow test performed on August 10, 2012 of 82.4 p.s.i. static pressure with a residual pressure of 20 p.s.i. while flowing 1,105.9 g.p.m. Test hydrant elevation is approximately 136.5 feet (from Google Earth) and is located along Four Corners Road near entrance to site. Flow test information provided by Jefferson County Public Utilities Department.

B. After award of the project, the Contractor shall verify available water supply with a flow test recorded on the new site hyrdrants. The Contractor shall coordinate with local authorities for a new flow test and the fees associated with a new flow test shall be included in the bid. Information obtained from this flow test and indicated on the drawings shall be: test hydrant static pressure, test hydrant residual pressure, associated pitot reading from flowing hydrant, test hydrant location, test hydrant elevation, and underground water main configuration.

1.11 PIPE HANGER DETAILS

A. Provide pipe hanger details and seismic bracing details in strict accordance with N.F.P.A #13 and manufacturer’s literature.

B. Details shall be unique to each installation configuration with all components clearly identified including the means of attachment and structure to be attaching to.

C. For all trapeze hangars, provide a table indicating the size of the pipe to be supported, size and type of the trapeze member, section modulus of the trapeze member, distance from the structure to pipe being supported (A and B dimensions), and the section modulus required.

1.12 SEISMIC BRACING

A. Calculations.

1. Seismic brace calculation requirements shall be based upon Section 1613.1 of the 2009 Edition of the International Building Code (I.B.C.) and Chapter 13 of ASCE 7-05.
2. The "General Notes" sheets for the structural drawings contained in the contract documents defines the "Seismic Design Category" for this project.
3. Per Section 13.6.8 of ASCE 7-05:
    a. Seismic brace calculations for "Seismic Design Category A and B" are not required for this project.
    b. Seismic brace calculations for "Seismic Design Category C", fire protection sprinkler systems designed and constructed in accordance with N.F.P.A. #13 shall be deemed to meet the other requirements of this section for this project.
    c. Seismic brace calculations for "Seismic Design Category D through F", the fire protection seismic brace calculations shall comply with section 13.6.8.3.
4. Provide seismic calculations for each seismic brace configuration showing the total calculated load, size of bracing material, type of bracing material, length of bracing material, seismic brace design angle, allowable load of the bracing component, allowable horizontal bracing load of the sprinkler system, structure for bracing connection, size of fastener, length of fastener, allowable load per fastener, and the number of braces required.

5. Each seismic brace configuration shall have a unique identifier associated with the calculation to easily and readily identify which seismic brace calculation it is.
6. Seismic bracing members for connections to structural members shall be sized per assigned load tables in N.F.P.A. #13 with a maximum L/R ratio of 200.
7. **The "Total Calculated Load" divided by the "Allowable Load per Fastener" shall not exceed a maximum value of 0.90.**

B. Drawings.

1. The submittal drawings shall identify the "Zone of Influence" for each seismic brace configuration that is provided with a seismic brace calculation.
2. The submittal drawings shall identify each seismic brace on the submittal drawings by the same unique identifier indicated in the seismic brace calculations to easily and readily cross reference the seismic brace calculation associated with that particular seismic brace.

C. Details.

1. Seismic bracing details may be incorporated into the seismic bracing calculations to form a single detail for each brace configuration.
2. The seismic brace details shall identify the seismic brace member, length of brace member, angle of brace member installation, the structural member the seismic brace is attaching to, the fastener to be utilized, and all seismic brace components by Manufacturer and model number.

1.13 SUBMITTALS

A. See Specification Section 210000 Paragraphs 1.9 and 2.1 for "Submittal" requirements.

B. Sprinklers shall be referred to in the equipment submittals by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

C. Follow the guidelines set forth in Specification Section 210000 Paragraphs 1.9 and 2.1 for "Requests For Substitution" procedures. 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.

D. Equipment submittal tabs shall include, at a minimum, the following:

1. Piping.
2. Fittings / Couplings.
3. Sprinkler Heads and Accessories.
4. Backflow Preventers.
5. Valves.
6. Electrical / Fire Alarm Components.
7. Pipe Hangers.
8. Seismic Bracing Components.
9. Access Doors.
10. Miscellaneous Equipment.

E. Equipment submittals shall include, at a minimum, the following:

1. Piping (Potable and Non-Potable).
2. Fittings / Couplings (Flanged, Grooved, Threaded, Etc.).
3. Sprinkler Heads / Head Guards.
4. Wall Post Indicators.
5. Backflow Preventers.
6. Fire Department Connections.
7. Hose Valves for Full Forward Flow testing of the Backflow Preventer.
8. Valves.
9. Alarm Valves.
10. Local Alarm Devices.
11. Flow Switches.
12. Tamper Switches.
13. Inspector's Test Assemblies.
14. Adjustable Drop Nipples.
15. Flexible Piping Serving Pendent Sprinkler Heads.
16. Seismic Separation Assemblies.
17. Pipe Hangers.
18. Seismic Bracing Components.
19. Pressure Relief Valves.
20. Water Pressure Gauges.
21. Automatic Air Vents.
22. Access Doors.
23. Decorative Coverings.
24. Elastomeric Seals.

F. All re-submitted drawings shall have the areas of revision clearly marked with revision clouds.

G. When the drawings are created in AutoCAD, the submittal drawings shall be in plotted to the following criteria:

1. Black and white plots shall consist of the following as a minimum:
   a. Light Black for drawing background.
   b. Dark Black for all sprinkler related components and text.

1.14 PIPING SYSTEM LAYOUT

A. Prepare detailed working drawings that are not larger than the contract documents for the system layout in accordance with N.F.P.A. #13, "Working Drawings (Plans)". Show data essential for the proper installation of each fire protection sprinkler system per N.F.P.A. #13 consisting of floor plans (1/8" = 1'-0" minimum), building sections, piping details, and elevations to clearly show pipe routing, head spacings, system water supply, devices, valves, and fittings.

B. The cover sheet of the shop drawings shall contain a site plan (1" = 50'-0" minimum) that clearly shows all fire service main routing with size and type of pipe indicated, fire hydrant locations, fire department connection location, devices, valves, and fittings, regardless of who performed the underground work.

C. A graphical scale shall be provided for each floor plan or detail on the shop drawings in accordance with N.F.P.A. #13, "Working Drawings (Plans)".

D. The minimum text size on full scale drawings shall be 1/8" high.

E. The cover sheet of the shop drawings shall clearly state the scope of Contractor's work, Contractor's exclusions, Contractor's start point, which version of N.F.P.A. #13 was used for the sprinkler design, sprinkler system design density, remote area size for all occupancies, and current water flow information used in the hydraulic calculations.

F. Projects that require more than one sheet to show the entire fire protection sprinkler system shall require a key plan.

G. The key plan shall be located in the lower right hand corner of the drawing, shall identify the location of the fire protection sprinkler system that is contained on that sheet, and shall contain a reference north arrow.

H. All sheets shall contain a "Matchline" designation to indicate where the building and fire protection sprinkler system continue, even if on the same sheet.

I. All flexible grooved couplings that are to be installed to meet the requirements of N.F.P.A. #13 for vertical and horizontal pipe runs shall be designated on the drawings.

J. Sprinklers shall be referred to in the sprinkler legend by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.15 SPRINKLER SYSTEM DESIGN

A. Hydraulic calculations for the fire protection sprinkler system design are to be based upon the area/density method.

B. Hydraulic calculations for all tree type, looped type, and gridded type sprinkler systems shall be performed on a computer utilizing an approved fire protection hydraulics program.

C. Tree type sprinkler systems may utilize "Excel" to perform the hydraulic calculations.

D. Hydraulic calculations performed by hand will not be accepted.

E. Small rooms (closets, restrooms, etc.) contained within the remote area shall be included in the hydraulic calculations. Omission of small rooms will not be allowed.

F. 1" piping shall not serve (2) upright or (2) pendent sprinkler heads unless hydraulic calculations are provided to verify the pressure losses associated with multiple flows through 1" pipe.

G. An equivalent length of 1'-0" shall be added to the hydraulic calculations for each roll groove installed on the piping and shall be added to the pipe containing the roll groove.

H. An equivalent length of pipe for flexible piping drops (manufacturer's submittal literature) shall be added to the hydraulic calculations, shall be added to the pipe containing the flexible sprinkler drop, and shall be based upon the U.L. listed equivalent lengths documented in the manufacturer's submittal literature.

I. All changes in piping elevation shall be reflected in the hydraulic calculations at the point in which the elevation change occurs. Adding an accumulated total for elevation at a single point will not be allowed.

J. A margin in the hydraulic calculations shall be maintained between the system demands and water availability. The margin shall consist of 5 p.s.i. or 10% depending upon whichever is greater and is based upon the available static pressure.

K. Hydraulic node numbers shall be unique for each remote area, shall not be duplicated for auxiliary remote areas, shall not be duplicated for other sprinkler systems installed as part of this project, and shall be shown on the submittal drawings.

L. Hydraulic node numbers shall be unique for each reference point and only used once per system. A common reference point for multiple hydraulic calculations shall only have one hydraulic node designation, multiple references to the same hydraulic reference point will not be accepted.

M. An equivalent "K-factor" for sprinkler head drops or sprigs (stub-ups) will not be acceptable. The actual "K-factor" of the sprinkler head, associated lineal pipe footage, equivalent lineal footage for associated pipe fittings, and elevations shall be part of the main body of the hydraulic calculations. Separate one line calculations to determine an equivalent "K-factor" that is inserted into the hydraulic calculations will not be acceptable.

1.16 SPRINKLER SYSTEM VELOCITY REQUIREMENTS

A. Maximum permissible velocity in branch lines 2" and less in gridded systems shall be 20 feet per second.

B. Maximum permissible velocity in tree-type branch lines and mains shall be 26 feet per second.

C. The maximum velocity in the piping containing a vane type water flow detector shall be 18 feet per second.

D. The maximum velocity allowed in the underground mains shall be 8 feet per second.

E. The maximum velocity allowed through the backflow preventer shall be 16 feet per second maximum.

PART 2 - PRODUCTS

2.1 ABOVEGROUND PIPING SYSTEMS

A. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing pipe fittings and perform all welding in the shop. Bushings and field welding will not be permitted.

B. Conceal all piping in areas with suspended and hard ceilings.

C. All fire protection system piping and fittings installed outside of the building's envelope shall be hot dipped galvanized.

D. All fire protection system components, devices, and materials installed as part of this project shall be new.

E. All fire protection system components and devices shall be domestically made.

2.2 SPRINKLER PIPE AND FITTINGS

A. All above-ground wet pipe automatic sprinkler system piping and fittings shall meet the following criteria:

1. Threaded or Cut Groove: Black and galvanized steel pipe Schedule 40 for sizes less than 8 inches. Black and galvanized steel Schedule 30 for sizes 8 inches and greater. Piping with a lesser schedule value (thinner walled pipe i.e. "Dyna-Thread", XL, Schedule 10, or other Schedule 40 "Replacement" pipe) will not be allowed for threaded or cut groove connections regardless of the corrosion resistance ratio.
2. Roll Groove or Welded: Black and galvanized steel pipe to be either having a minimum wall thickness in accordance with Schedule 10, Schedule 40, U.L. listed, or Factory Mutual Global approved pipe having a U.L. corrosion resistance ratio equal to or greater than 1.0.
3. Grooved Fittings and Couplings: All grooved fittings and couplings shall be manufactured to ASTM A536 requirements for ductile iron castings. The couplings shall consist of two ductile iron housing segments with an elastomer pressure responsive gasket and zinc electroplated bolts and nuts.
    a. Rigid Style Grooved Couplings: All rigid style couplings shall consist of housings casted with an offset, angle pattern bolt pads to provide rigidity and system support. The coupling installation shall be complete at visual, pad–to-pad offset contact. Rigid couplings that require exact gapping of bolt pads at specified bolt torques are not permitted.
    b. Flexible Style Grooved Couplings: All flexible style couplings shall consist of housings casted with parallel pattern bolt pads to provide flexibility for vibration attenuation, stress relief, or seismic movement. The coupling installation shall be complete at visual, pad–to-pad contact. Flexible couplings that require exact gapping of bolt pads at specified bolt torques are not permitted.
    c. Gaskets: All gaskets for wet systems shall be Grade "A" EPDM.
    d. All grooved couplings and fittings shall be the products of a single manufacturer.
    e. Grooving tools shall be of the same manufacturer as the grooved components.

4. All fire protection piping and fittings (above-ground) shall be threaded, grooved, flanged, or welded fittings. The use of plain end, lock-type, friction type, compression type, or any other type of fitting that is plain end ("prepared end", "polished end", beveled end, "FIT" end such as Victaulic "FIT", Gruvlok "Sock-It", Victaulic "Pressfit") is not permitted.
5. Welded Outlets and Drilled Outlets for Mechanical Tees: Use outlets for main, branch line, arm-overs, drops, and sprigs only and shall be U.L. listed or Factory Mutual Global approved. Welded outlets with grooved ends shall have a nominal diameter equal to or smaller than the pipe to which they are attached. Welded outlets with threaded ends and drilled outlets for mechanical tees shall have nominal size outlets at least one pipe diameter smaller than the pipe to which they are attached.
6. Supply Piping From the Flange Above Finished Floor to the Backflow Preventer: Provide cement mortar lined Class 52 ductile iron piping. If acceptable by the Authority Having Jurisdiction, type 304 or 316 stainless steel piping or type K roll grooved drawn copper tubing may be installed. All fittings shall be U.L listed or F.M. approved for fire protection installations, shall utilize full flow standard radius fittings, and shall match the type of underground piping to be installed.
7. Approved manufacturers are as follows:
    a. Black and Galvanized Pipe: Allied Tube and Conduit, AMS Tube Corporation, Bull Moose Tube Company, North West Pipe and Casing, State Pipe and Supply Company, Wheatland Tube Company, or prior approved equal.
    b. Threaded Products: Anvil International, Ward, or prior approved equal.
    c. Grooved Products: Gruvlok, Tyco (Central), Victaulic, or prior approved equal.
    d. Factory Segmentally Welded Grooved Products: Fablok (Allied Tube and Conduit), Iowa Fittings, TexLine, Victaulic, or prior approved equal.
    e. Flanged Products: American Cast Iron Pipe Company, Anvil International, Merit Manufacturing (Mueller), Trinity Valley Iron & Steel Company, Pacific Coast Flange Incorporated, Tyler Pipe, Union Foundry Company, U.S. Pipe and Foundry Company, Ward, or prior approved equal.
    f. Welded outlets: Anvil International, Island Fitting, Merit Manufacturing (Mueller), NAP (North Alabama Pipe Corporation), Ward, or prior approved equal.
    g. Ductile Iron Pipe: American Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or prior approved equal.
    h. Stainless Steel Fittings: Anvil International, Fablok (Allied Tube and Conduit), Greensboro Pipe Company, Victaulic, or prior approved equal.
    i. Stainless Steel Pipe: Alaska Copper and Brass, American Pipe and Supply, Greensboro Pipe Company, or prior approved equal.
    j. Copper Fittings: Alaska Copper and Brass, Nibco, Victaulic, or prior approved equal.
    k. Copper Pipe: Alaska Copper and Brass, Cerro Flow Products Inc., Mueller Industries Incorporated, Victaulic, or prior approved equal.

2.3 SPRINKLER HEADS

A. Provide minimum nominal ½-inch orifice commercial sprinkler heads with a release mechanism meeting the requirements of N.F.P.A. #13 for thermal sensitivity and temperature rating. Commercial sprinkler heads less than ½-inch orifice will not be allowed unless prior approval is obtained.

B. Sprinkler body shall be die cast with the wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

C. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss.

D. Sprinkler head wrenches or other means of removing sprinkler heads not approved by the sprinkler manufacturer will not be allowed.

E. Extended coverage sprinkler heads will be allowed, but it will be the fire protection sprinkler Contractor's responsibility to assure proper implementation.

F. Extended coverage sprinkler heads will not be allowed in areas requiring sprinkler head guards unless a U.L. listed or Factory Mutual Global approved sprinkler head guard is available.

G. Provide white finished semi-recessed sprinklers with escutcheons of matching finish in acoustical ceiling tile ceilings.

H. Provide white finished semi-recessed sprinklers with escutcheons of matching finish in soffits or other gypsum wallboard ceilings that do not contain surface mounted light fixtures.

I. Provide white finished pendent sprinklers with 2-piece escutcheons of matching finish in rooms that contain entire gypsum wallboard ceilings containing surface mounted light fixtures.

J. Provide white finished semi-recessed horizontal sidewall sprinklers with escutcheons of matching finish in walls of normally occupied rooms or in rooms that are finished and painted.

K. Provide chrome finished semi-recessed dry style sprinklers (pendent or sidewall) with escutcheons of matching finish for all installation locations.

L. Provide bronze uprights in exposed areas (no ceilings) and in ceiling voids.

M. All quick response sprinkler heads shall be glass bulb style.

N. All sprinkler heads that utilize "O-Rings" will not be allowed.

O. Provide corrosion-resistant sprinkler heads (Lead coated or Nickel-Teflon coated) in Kitchen Areas, under exterior roofs and overhangs, or as required by N.F.P.A. #13.

P. The fire protection sprinkler system contractor shall provide intermediate temperature sprinkler heads for all locations previously required by N.F.P.A. #13 to be of ordinary temperature rating. The 2010 Edition of N.F.P.A. #13 allows intermediate temperature and ordinary temperature sprinkler heads to be installed throughout buildings, thereby reducing the necessity for multiple temperature ratings of sprinkler heads to be installed.

Q. Provide sprinkler head guards on exposed piping installed at an elevation less than 8'-0", or in areas subject to mechanical damage. Head guards shall be specifically listed for the sprinkler head in which they are protecting.

R. All sprinkler head guards shall be specifically listed for use with the proposed sprinkler head.

S. Approved manufacturers are as follows:

1. Sprinkler Heads: Globe, Reliable, Tyco, Victaulic, Viking, or prior approved equal.
2. Sprinkler Head Guards: Globe, Reliable, Tyco, Victaulic, Viking, or prior approved equal.

2.4 SPARE HEAD CABINET

A. Provide a metal cabinet for the storage of spare sprinkler heads and head wrenches (adjacent to the sprinkler riser) for each building receiving a fire protection sprinkler system.

B. The number and types of extra sprinkler heads shall be as specified in N.F.P.A. #13 with one sprinkler wrench being provided for each type of sprinkler head installed.

C. Sprinkler wrenches shall be provided by the manufacturer of the sprinkler heads and shall be approved by the manufacturer for removal and installation of the sprinkler heads. Providing crescent wrenches or other means to remove and install sprinkler heads that is not specifically approved by the sprinkler head manufacturer shall not be provide and will not be acceptable.

2.5 BACKFLOW PREVENTER

A. Provide a letter of certification to the Owner after testing.

B. The backflow preventer type shall conform to local water purveyor requirements.

C. The backflow preventer shall be a double detector check valve assembly style made from cast iron or fabricated steel consisting of (2) independent check valves, (2) OS&Y shut-off valves, ball type test cocks, a bypass valve, and meter trim.

D. The backflow preventer shall conform to U.L., Factory Mutual Global, FCCC, and HR flow rate with maximum velocity across the backflow preventer of 16 feet per second.

E. The backflow preventer type and installation configuration shall be listed in the "Backflow Prevention Assemblies Approved for Installation in Washington State" from the Washington State Department of Health.

F. Approved manufacturers are as follows:

1. Backflow Preventers: Ames, Conbraco, Watts, Wilkins, or prior approved equal.

2.6 HOSE VALVES FOR FULL FORWARD FLOW TESTING OF THE BACKFLOW PREVENTER

A. Provide full forward flow testing hose valves approximately 2'-0" to 4'-0" above the finished grade in a location (on the wall).

B. Provide downstream of the backflow prevention assembly either 2½" angled hose valves or 2½" straight pattern hose valves for full forward flow testing of the backflow preventer.

C. Provide (1) 2½" hose valve for each 250 g.p.m. of system demand.

D. Provide a brass valve body with a rising stem, brass internal parts, natural rubber seal, ductile iron hand wheel, 2½" National Pipe Thread by male hose thread outlet.

E. Provide each hose valve with a cap and chain.

F. Valve shall be rated for a working pressure of at least 300 p.s.i.

G. Approved manufacturers are as follows:

1. Angle Hose Valves: Croker, Elkhart, Guardian, Nibco, Potter Roemer, Powhattan, or prior approved equal.

2.7 VALVES

A. Provide valves of types approved for fire service in accordance with N.F.P.A. #13.

B. Control valves for fire protection systems shall be either NRS, OS&Y or butterfly style. All butterfly style valves shall be provided with an integral tamper switch and weatherproof actuator.

C. Check valves shall be grooved or flanged clear opening spring assisted swing-check type for vertical or horizontal installation of sizes 2½" and larger (butterfly style check valves are not allowed).

D. Gate valves shall open by counterclockwise rotation.

E. Provide a normally closed butterfly valve on the piping utilized for full forward flow testing of the backflow preventer. A valve that is normally open in which the wiring of the integral tamper switch is reversed for a normally closed position will not be allowed. The integral tamper switch shall be listed for monitoring of the valve in a closed position such that the slightest opening of the valve will send a signal to the fire alarm system.

F. Approved manufacturers are as follows:

1. Butterball Valves: Milwaukee, Nibco, Victaulic, or prior approved equal.
2. Butterfly Valves: Anvil International (Gruvlok), McWane (Kennedy), Nibco, Tyco, Victaulic, or prior approved equal.
3. Ball Valves: Anvil International, Milwaukee, Nibco, United Brass, Victaulic, Watts, or prior approved equal.
4. Check Valves: Anvil International (Gruvlok), Reliable, Tyco, United Brass, Victaulic, Viking, or prior approved equal.
5. N.R.S. Gate Valves: McWane (Kennedy), Mueller, Nibco, Victaulic, Wilkins, or prior approved equal.
6. OS&Y Gate Valves: AVK, McWane (Kennedy), Mueller, Nibco, Victaulic, Wilkins, or prior approved equal.

2.8 ALARM VALVES

A. Provide a variable pressure alarm valve for each system complete with the manufacturer's standard trim, including but not limited to a retard chamber, main drain valve, pressure gauges, and all accessories for a code compliant fire protection riser. The internal components of the alarm valve shall be replaceable without removing the alarm valve from the installed position.

B. In lieu of an alarm valve, a shotgun riser may be installed consisting of a main drain valve, flow switch, pressure gauge, and all accessories for a code compliant fire protection riser. A shop fabricated piece of pipe containing welded outlets (for the required components) will be acceptable.

C. Approved manufacturers are as follows:

1. Alarm Valves: Reliable, Tyco, Victaulic, Viking, or prior approved equal.
2. Shotgun Riser Assemblies: Central, Reliable, Tyco, Victaulic, Viking, or prior approved equal.

2.9 LOCAL ALARM DEVICE

A. Provide a 10" electric alarm bell and back box of the approved weatherproof and guarded type that sounds locally upon the flow of water actuating the paddle of the water flow indicator.

B. The electric bell shall be tied into the fire alarm system and operate on a 24 volts D.C. power source that is powered through the Fire Alarm Control Panel allowing the electric bell to be on a battery back-up supply.

C. If a fire alarm system is not installed, the electric bell shall operate on a 120 volts A.C. power source. The Fire Sprinkler Contractor shall cover all costs associated with the installation, power connection, and low voltage connection for the electric bell.

D. Mount the alarm bell on the outside of the exterior wall of the building and coordinate with the electrical Contractor the power available for the alarm bell.

E. Provide a mechanical sprinkler alarm assembly complete with separate supply and discharge piping located on exterior of building in a location suitable with the authority having jurisdiction.

F. Approved manufacturers are as follows:

1. Electric Bells: Potter Electric, System Sensor, or prior approved equal.
2. Mechanical Sprinkler Alarms: Reliable, Tyco, Victaulic, Viking, or prior approved equal.

2.10 FLOW SWITCH (RISER)

A. The flow switch shall be vane type with a pipe saddle and cast aluminum housing.

B. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe.

C. The flow switch shall sense water movements and be capable of detecting a sustained flow of 10 g.p.m. or greater.

D. The flow switch shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges and shall be set to actuate the local alarm device in 60 seconds or less.

E. The flow switch shall contain (2) sets of single pole / double throw (SPDT) Form "C" contacts for the automatic transmittal of an alarm over the facility fire alarm system.

F. The flow switch shall be tamper resistant and shall be equipped with a silicone rubber gasket to assure a positive water seal and a dustproof cover to seal the flow switch mechanism from dirt and moisture.

G. Do not install the flow switch within 6" of a fitting that changes direction of the water flow or within 24" of a valve or drain.

H. The flow switch is to be installed by the sprinkler Contractor and wiring of the flow switch is be performed by the electrical Contractor.

I. Approved manufacturers are as follows:

1. Flow Switches: Potter Electric, System Sensor, or prior approved equal.

2.11 TAMPER SWITCHES

A. Provide tamper switches that are suitable for mounting to the type of control valve to be supervised either in the open or closed position.

B. The tamper switch shall contain (1) set of single pole / double throw (SPDT) Form "C" contacts arranged to transfer upon opening or closing of the valve of more than two rotations of the valve stem.

C. Tamper switches shall be tamper resistant and shall be provided for all control valves, backflow preventer valves, post indicating valves, or any other valve used for system shutdown.

D. Approved manufacturers are as follows:

1. Tamper Switches: Potter Electric, System Sensor, or prior approved equal.

2.12 INSPECTOR'S TEST CONNECTION

A. Provide test connections approximately 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device.

B. The Inspector’s test connection shall be located at the most remote part of each system.

C. All inspectors’ test connection drain discharges shall be piped down the wall to an elevation approximately 6" above exterior grade before penetrating the exterior wall.

D. Provide test connection discharge piping to a location where the discharge will be readily visible and where water may be discharged without property damage.

E. All pipe and fittings outside of the building's envelope shall be hot dipped galvanized and the drain discharge shall terminate with a down turned 45° elbow.

F. Exterior discharge shall be placed to minimize impacts on landscaping features and coordinated with the General Contractor and building Owner.

G. Inspector's test valves installed in finished areas shall be recessed in the wall and provided with a lockable access panel.

H. The Inspector's test discharge orifice shall be a smooth bore corrosion resistant orifice giving a flow equivalent to one sprinkler of a type having the smallest orifice installed on that system.

I. If permitted by the authority having jurisdiction the inspector's test valve may be located at the system riser and tied into the main drain discharge.

J. For inspector's test valves installed at the remote end of the sprinkler system, the inspector's test discharge shall not terminate on the roof or on the roof of a building overhang.

K. The inspector's test discharge shall be piped down to discharge just above exterior grade level.

L. The piping shall be located inside a wall or vertical shaft in finished areas.

2.13 COMBINED INSPECTOR'S TEST AND DRAIN ASSEMBLY

A. The inspector's test connection and the main drain (or auxiliary drain) valve may be combined into a listed unit that performs both functions.

B. The assembly shall be capable of providing a discharge flow equivalent to one sprinkler of a type having the smallest orifice installed on that system or full flow equivalent to the pipe size serving the assembly.

C. The assembly shall also contain a site glass that allows for visual verification of water flow.

D. The combined inspector's test and drain discharge shall be piped down the wall to an elevation approximately 6" above exterior grade before penetrating the exterior wall.

E. All pipe and fittings outside of the building's envelope shall be hot dipped galvanized and the drain discharge shall terminate with a down turned 45° elbow.

F. Exterior discharge shall be placed to minimize impacts on landscaping features and coordinated with the General Contractor and building Owner.

G. The combined inspector's test discharge and main drain (or auxiliary drain) valve discharge shall not terminate on the roof or on the roof of a building overhang.

H. The inspector's test discharge shall be piped down to discharge just above exterior grade level.

I. The piping shall be located inside a wall or vertical shaft in finished areas.

J. Approved manufacturers are as follows:

1. Combined Inspector's Test and Drain Assemblies: AGF Manufacturing, GG/J Innovations Inc. (Sure-Test), Victaulic (TestMaster II), or prior approved equal.

2.14 DRAINS

A. Provide main drain discharge piping to a safe point outside the building.

B. Provide auxiliary drains for trapped sections of system piping and route all drain discharge piping to a safe point outside the building.

C. All auxiliary drain valves shall be piped down to an elevation less than 6'-0" above finished floor.

D. All auxiliary drain discharges shall be piped down the wall to an elevation approximately 6" above exterior grade before penetrating the exterior wall.

E. Auxiliary drain valves installed in finished areas shall be recessed in the wall and provided with a lockable access panel.

F. Coordinate all drain locations with the General Contractor and building Owner.

G. All pipe and fittings outside of the building's envelope shall be hot dipped galvanized and the drain discharge shall terminate with a down turned 45° elbow.

H. Exterior discharge shall be placed to minimize impacts on landscaping features and coordinated with the General Contractor and building Owner.

I. Termination of main drains or auxiliary drains that allow the discharged water to flow across concrete, asphalt, roof, building overhang roof, gutter, or other finished material will not be allowed.

2.15 ADJUSTABLE DROP NIPPLES

A. If the Contractor chooses to, provide adjustable drop nipples that are cold formed from steel tube conforming to ASTM A53 that contain (2) ethylene propylene (EPDM) O-rings for sealing of the independent barrels.

B. The adjustable drop nipples shall be U.L listed or Factory Mutual Global approved for installation in accordance with N.F.P.A. #13.

C. Approved manufacturers are as follows:

1. Adjustable Drop Nipples: Cold Extrusion Company of America (CECA), Merit Manufacturing, or prior approved equal.

2.16 FLEXIBLE PIPING SERVING PENDENT SPRINKLER HEADS

A. If the Contractor chooses to, provide flexible pipe assemblies for drops to pendent sprinkler heads that are U.L listed or Factory Mutual Global approved for use in fire protection sprinkler systems.

B. The flexible pipe assembly shall utilize 304 stainless steel braided 1" corrugated hose with factory installed adapters (1" MPT for connection to the sprinkler system and ½" or ¾" FPT for connection of the sprinkler head) that are fully welded (no compression fittings) as a unit.

C. The flexible piping unit shall be held securely to acoustical ceiling assemblies by using a mounting bracket that snaps onto the ceiling runners and utilizes a self-tapping screws or shall be held securely to acoustical ceiling assemblies by using a tube steel cross sectional member that is secured to the ceiling runner with clips having set screws through the center tab of each mounting bracket and the ceiling runner.

D. The flexible piping unit shall be held securely to gypsum wallboard ceilings by securing the mounting bracket with four self tapping screws (two on each end) into the metal or wood stud ceiling framing members.

E. Flexible piping shall be installed to limit the bends from branch lines to the sprinkler heads. Flexible piping drops shall not be installed to form a loop and shall be limited to a change in three directions not exceeding 270° over the length of the installation.

F. Approved manufacturers are as follows:

1. Flexible Piping Serving Pendent Sprinkler Heads: Fast Flex (Tyco), FlexHead (Flexhead Industries), VicFlex (Victaulic) or prior approved equal.

2.17 PIPE HANGERS

A. Hanger components that attach directly to sprinkler piping or the building structure shall be U.L listed or Factory Mutual Global approved.

B. All C-clamp type hangers shall be fitted with retainer straps.

C. Hangers consisting of a hanger ring, all thread rod, and a hanger ring attached to a pipe at a higher elevation will not be allowed.

D. All pipe stands shall be a minimum of 2" or can be sized in accordance with Table 6.3.2.2.1 and Table 6.3.2.2.2 of the 2007 edition of N.F.P.A. #15 for size, height, and spacing.

E. The only kwik bolt listed and approved for support in cracked concrete is Hilti Kwik Bolt Model KB-TZ, which has passed the ACI 355.2 cracked concrete test. All other kwik bolts will not be allowed.

F. Approved manufacturers are as follows:

1. Hangers: Afcon, Anvil International, Erico, Nibco (Tolco), PHD, or prior approved equal.

2. Attachments: Hilti, ITW Ramset, Simpson Manufacturing Company, Speedy Products (Sammy Super Screw), Textron (HangerMate), or prior approved equal.

2.18 SEISMIC BRACING COMPONENTS

A. Seismic braces shall be connected to major frame members wherever possible with connections to joists being made only when necessary and must be coordinated with the Structural Engineer.

B. The only kwik bolt listed and approved for seismic bracing in concrete is Hilti Kwik Bolt Model KB-TZ, which has passed the ACI 355.2 cracked concrete test. All other kwik bolts will not be allowed.

C. Approved manufacturers are as follows:
1. Seismic Braces: Afcon, Erico, Nibco (Tolco), or prior approved equal.
2. Attachments: Hilti, ITW Ramset, Simpson Manufacturing Company, or prior approved equal.

2.19 PRESSURE RELIEF VALVES

A. Each system riser shall be provided with a pressure relief valve not sized less than ½" in size.

B. The pressure relief valve shall be cast bronze with a rough brass finish.

C. The pressure relief valve shall be set to operate at a minimum pressure of 175 p.s.i. or 10 p.s.i. in excess of the maximum system pressure, whichever is greater.

D. In lieu of a pressure relief valve, an auxiliary air reservoir listed for fire protection use that can absorb pressure increases can be provided.

E. Approved manufacturers are as follows:

1. Pressure Relief Valves: AGF Manufacturing, Watts, or prior approved equal.

2.20 WATER PRESSURE GAUGES

A. Each system shall have a stainless steel pressure gauge to provide visual supervision of the water pressure.

B. Provide a minimum 3½" diameter pressure gauge with a ¼" national pipe thread connection.

C. The pressure gauge shall have an accuracy of 3-2-3% over the range of the gauge per ASME B40.100 (3% over the first ¼ of the gauge range, 2% over the middle ½ of the gauge range, and 3% over the last ¼ of the gauge range).

D. The pressure gauge shall be calibrated to register up to a maximum of 300 p.s.i. for static water pressures less than 175 p.s.i. and a minimum of 50 p.s.i. above static water pressure when the static water pressure exceeds 175 p.s.i.

E. Provide a water pressure gauge in the following locations at a minimum.

F. Supply side of the backflow preventer check valves to read the system supply pressure.

G. On the system riser above all check valves or alarm valves to read the system pressure.

H. Approved manufacturers are as follows:

1. Water Pressure Gauges: Argco, Ashcroft, Moeller Instrument Company Inc., Potter Roemer, Reliable, US Gauge Products, Victaulic, Wika, or prior approved equal.

2.21 AUTOMATIC AIR VENTS

A. Provide an automatic float type air vent to reduce the amount of trapped air within all wet pipe based automatic fire protection sprinkler systems.

B. Provide a ball valve in an accessible location between the system piping and the automatic air vent to facilitate maintenance of the automatic air vent.

C. An automatic air vent shall be installed at the following locations for each sprinkler system installed.

1. Highest point of the system piping.
2. The most remote point of the sprinkler system, unless the most remote point contains an inspector's test valve.
3. On each floor level that the sprinkler system is installed.

D. The contract documents indicate the conceptual location of where all automatic air vents are anticipated to be installed.

E. The fire protection sprinkler system contractor shall determine the exact location of the automatic air vents based upon the piping layout indicated on the contractor's shop drawings.

F. The automatic air vent discharge shall not terminate in the building.

G. The automatic air vent discharge shall be piped down to discharge just above exterior grade level.

H. If discharging to the exterior of the building is not practical, the fire protection sprinkler system contractor shall provide sketches that identify the proposed interior discharge location to the Architect/Engineer for approval prior to the contractor performing the work.

I. Approved manufacturers are as follows:

1. Automatic Air Vents: Fire Protection Systems Corrosion Management Inc, Potter Electric, Spirotop, Viking, or prior approved equal.

2.22 ACCESS DOORS

A. Provide access doors for auxiliary drain valves installed in finished areas, inspector's test valves installed in finished areas.

B. Access doors shall be installed at an elevation approximately 5'-0" above finished floor.

C. Access doors in rated walls shall be fire rated with 2" of insulation sandwiched between an inner and outer door panels.

D. Access doors in non-rated walls are not required to be fire rated.

E. The access doors shall be cold rolled steel and constructed with a minimum 18 gauge frame and an 18 gauge door panel minimally.

F. Access doors shall be a minimum of 9"x9" for auxiliary drain valves.

G. Access doors shall mount flush to the finished wall and are not allowed to be surface mounted, unless the wall is CMU or concrete.

H. Access doors shall be U.L. listed or Factory Mutual Global approved and shall have a continuous hinge, self latching, key operated cylinder lock, and a baked-on primer coating.

I. All doors shall have an interior latch release mechanism.

J. Approved manufacturers are as follows:

1. Access Doors: Acudor, Elmdor, Greenheck, JL Industries, Milcor, Nystrom, or prior approved equal.

2.23 WALL PLATES

A. Provide a split hinge type metal plate for piping passing through walls, floors, platforms, and ceilings installed in exposed spaces.

B. Wall plates shall either be chrome plated or factory painted to match the surrounding color scheme.

2.24 OVERSIZED ESCUTCHEON TRIM RINGS

A. The fire protection sprinkler system contractor shall provide oversized escutcheon trim rings to conceal the ceiling system penetrations that are oversized to meet the requirements of the International Building Code (I.B.C.) and ASCE 7.

B. The fire protection sprinkler system contractor shall verify with the local Authority Having Jurisdiction that oversized penetrations and escutcheon trim rings for existing ceiling system penetrations to meet the International Building Code (I.B.C.) and ASCE 7 will not be required.

C. The oversized escutcheon trim rings shall be the same finish as the sprinkler head and escutcheon in which it is to be installed.

D. The oversized escutcheon trim rings shall be made of cold rolled steel.

E. To maintain the fire ratings, plastic or other materials that will not maintain a rating will not be allowed.

F. Approved manufacturers are as follows:

1. Oversized Escutcheon Trim Rings: Fire Lock (Victaulic), Reliable, or prior approved equal.

2.25 LIST OF SPRINKLERS

A. The fire protection sprinkler system contractor shall provide a typed list of all sprinkler heads installed in the project per the requirements of N.F.P.A. #13.

B. The typed list shall be placed within the spare sprinkler cabinet and shall identify each sprinkler by Sprinkler Identification number, manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure rating.

C. The typed list shall also provide a general description, the quantity of each type of sprinkler provided within the spare head cabinet, and the date the list was generated.

2.26 IDENTIFICATION SIGNS

A. Provide a permanently marked metal or engraved rigid plastic identification sign with proper lettering and secured with corrosion resistant wire, chain, or other approved methods for all control valves, drains, inspector's test valves, and fire department connection zones in accordance with N.F.P.A. #13.

2.27 HYDRAULIC SIGNS (PLACARDS)

A. Each sprinkler system riser shall have the N.F.P.A. #13 required hydraulic sign placed near the control valve that is permanently marked and made either of weatherproof metal, rigid plastic, or weatherproof tyvek.

B. The hydraulic sign shall be permanently secured with corrosion resistant wire, chain, or adhesive backing.

C. The hydraulic sign shall identify the location of the design area, discharge density, design area size, system demands at the base of riser, hose stream allowances, current water flow information, auxiliary design parameters (densities and areas) associated with the system installed, and the name of the installing contractor.

2.28 GENERAL INFORMATION SIGNS (PLACARDS)

A. Each sprinkler system riser shall have the N.F.P.A. #13 required general information sign placed near the control valve that is permanently marked and made either of weatherproof metal, rigid plastic or weatherproof tyvek.

B. The general information sign shall be permanently secured with corrosion resistant wire, chain, or adhesive backing.

C. The general information sign shall identify the name and location of the facility protected, the presence of high piled and/or rack storage, maximum height of storage planned, aisle width planned, commodity classification, encapsulation of pallet loads, presence of solid shelving, flow test data, presence of flammable/combustible liquids, presence of hazardous materials, presence of other special storage, location of all auxiliary drains and low pint drains, original results of main drain flow test, name of installing contractor or designer, and the indication of presence or location of anti-freeze or other auxiliary systems.

2.29 FULL FORWARD FLOW TEST SIGNS (PLACARDS)

A. The fire protection sprinkler system contractor shall provide a sign that is to be attached to the backflow preventer that is permanently marked and made either of weatherproof metal, rigid plastic or weatherproof tyvek.

B. The full forward flow test sign shall be permanently secured with corrosion resistant wire, chain, or adhesive backing.

C. The full forward flow test sign shall indicate the following information:

1. Pressure on the supply side of the backflow preventer assembly prior to testing.
2. Pressure on the discharge side of the backflow preventer assembly prior to testing.
3. Pressure on the supply side of the backflow preventer assembly during testing.
4. Pressure on the discharge side of the backflow preventer assembly during testing.
5. Total pressure drop across the backflow preventer assembly during testing.
6. System test flow rate based upon hydraulic system demands.
7. Manufacturer’s documented pressure drop data from the pressure drop flow curve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The State of Washington "Washington Administrative Code" (WAC) Section 212.80.043(9) requires a State of Washington Level III Certificate of Competency holder to prepare the layout drawings for the fire protection work.

B. Only a designer that is certified as a Level III technician by National Institute for Certification in Engineering Technologies (NICET) in the automatic sprinkler system layout sub field of fire protection engineering technology (in accordance with NICET 1014-7) shall be allowed to perform the fire protection work on this project.

C. The installing Contractor shall have a minimum of five (5) years experience in the design, installation, and testing of wet pipe automatic fire protection sprinkler systems, or similar fire protection systems. A list of installations of a similar nature and scope shall be provided on request.

D. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with N.F.P.A. #13, except as modified herein.

E. All piping and fittings installed prior to the backflow preventer are considered part of the potable water system and shall be required to be of a type that maintains a clean and rust free potable system. The use of black and galvanized pipe and fittings on the potable waterside of the backflow preventer will not be allowed.

F. Grooved couplings and fittings shall be installed in accordance with the manufacturer's recommendations. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove. Grooved coupling gaskets shall be molded and produced by the coupling manufacturer.

G. The fire protection sprinkler system contractor shall remove and replace any piping joints deemed improperly installed or show signs of leakage.

H. The fire protection sprinkler system contractor shall remove and replace any piping that has been damaged upon installation and shows signs of being bent, warped, or dented.

I. Do not install sprinklers heads that have been dropped, damaged, show signs of corrosion, show signs of foreign matter buildup, show signs of a cracked glass bulb, or show a visible loss of fluid.

J. The glass bulb protector shall remain in place until the sprinkler head is completely installed. The fire protection sprinkler system contractor shall remove the glass bulb protector by hand after installation and prior to the sprinkler system being placed in service.

K. Install piping straight and true to bear evenly on hangers and supports. Hangers for piping to attach to structural members with no hanger being attached to acoustical ceiling tiles or gypsum wallboard ceilings.

L. All sprinkler heads installed to protect the area under ductwork or similar obstructions shall be restrained from lateral movement.

M. Ends of new piping and existing piping affected by Contractor's operations shall be thoroughly cleaned of water, cutting oil, and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods and securely close open ends of piping when work is not in progress to prevent entry of foreign matter. Inspect all piping before placing into position for foreign matter and remove as necessary.

N. All piping in finished areas shall be installed concealed above the ceiling space unless specifically noted otherwise.

O. Any portion of the sprinkler system that is not indicated on the contract documents to be installed exposed shall be addressed in writing with sketches (prior to the piping being fabricated or installed) to the Architect and Engineer to evaluate.

P. Install piping at such heights and in such a manner so as not to obstruct any portion of windows, doorways, passageways, or lights. Coordinate installation of piping with all trades (mechanical, electrical, plumbing, and structural) to avoid conflicts and offset piping as required to clear any interferences that may occur.

3.2 CEILING SYSTEM PENETRATIONS

A. All pendent sprinkler heads installed in ceiling systems shall meet the requirements of the International Building Code (I.B.C.) and ASCE 7 by one of the following options:
   1. Oversized ceiling system penetrations shall be required on all hard piped pendent sprinkler heads installed in ceiling systems. The oversized ceiling system penetration shall have a 1" annular space around the ceiling penetration that will allow free movement of at least 1" in all directions.
   2. Tight ceiling system penetrations shall be allowed when a swing joint is installed at the top of the sprinkler head drop that can accommodate 1" of ceiling movement in all directions.
   3. Tight ceiling system penetrations shall be allowed when a flexible sprinkler drop is installed that can accommodate 1" of ceiling movement in all directions
   4. Tight ceiling system penetrations shall be allowed when the sprinkler system and ceiling system are tied together as an integral unit and evaluated by a registered design professional hired by the fire protection sprinkler system contractor.

3.3 RESTRAINT OF SPRINKLER SYSTEM BRANCH LINES

A. Sprinkler system branch lines shall be laterally restrained at intervals not exceeding those specified in Table 9.3.6.4(a) or Table 9.3.6.4(b) of the 2010 Edition of N.F.P.A. #13 and are based upon the branch line diameter and the seismic coefficient value of Cp.
   1. Table 9.3.6.4(a) of the 2010 Edition of N.F.P.A. #13.

Steel Piping Pipe Diameter (in)	Seismic Coefficient (Cp)		
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$C_p > 0.71$
1	43	36	26
1¼	46	39	27
1½	49	41	29
2	53	45	31

   2. Table 9.3.6.4(a) of the 2010 Edition of N.F.P.A. #13.

C.P.V.C. and Copper Piping Pipe Diameter (in)	Seismic Coefficient (Cp)		
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$C_p > 0.71$
¾	31	26	18
1	34	28	20
1¼	37	31	22
1½	40	34	24
2	45	38	27

B. Means of providing branch line restraint shall comply with one of the means contained within Section 9.3.6.1 of the 2010 Edition of N.F.P.A. #13.
   1. A listed sway brace assembly.
   2. A wraparound U-hook satisfying the requirements of Section 9.3.5.3.10.
   3. Number 12 440 pound wire installed at least 45° from the vertical plane and anchored on both sides of the pipe.
   4. Other prior approved means by the Architect/engineer.
   5. An additional hanger maybe used where all of the following criteria are met:
      a. Is installed not less than 45° from vertical.
      b. Is installed within 6" of the vertical hanger.

c. Is arranged for restraint against vertical upward movement.
d. The l/r ratio does not exceed 300.
e. The rods extend to the pipe or have a surge clip installed.

3.4 RESTRAINT OF SPRINKLER DROPS

A. All sprinkler system drops shall be restrained against excessive movement per the following minimum criteria listed below.

B. Pendent sprinkler heads or drops to pendent sprinkler heads that move more than 3" from the stagnant position (from a light push) after installation of the system or allows the pendent sprinkler head or drops to pendent sprinkler heads to oscillate without dampening to the stagnant position (in a reasonable amount of time) shall be provided with additional restraint.

C. Means of providing restraint to drops shall comply with one of the means contained within Section 9.3.6.1 of the 2010 Edition of N.F.P.A. #13.
1. A listed sway brace assembly.
2. A wraparound U-hook satisfying the requirements of Section 9.3.5.3.10.
3. Number 12 440 pound wire installed at least 45° from the vertical plane and anchored on both sides of the pipe.
4. Other prior approved means by the Architect/engineer.
5. An additional hanger maybe used where all of the following criteria are met:
   a. Is installed not less than 45° from vertical.
   b. Is installed within 6" of the vertical hanger.
   c. Is arranged for restraint against vertical upward movement.
   d. The l/r ratio does not exceed 300.
   e. The rods extend to the pipe or have a surge clip installed.

D. When flexible piping assemblies are installed, the piping drops will be allowed to have more movement. The movement of the piping drops shall be less than the amount allowed by the flexible piping assembly. When the piping drops have sufficient movement to cause the flexible piping to pull on the installed sprinkler head, additional restraint shall be provided, as detailed in the section above.

3.5 SPRINKLER PROTECTION OF EXTERIOR OVERHANGS AND CANOPIES

A. Provide sprinkler protection beneath all exterior overhangs and canopies that exceed 4'-0" in depth in which any member that comprises the exterior overhang and canopy is of combustible construction (entire canopy construction, not just exposed surface).

B. Provide sprinkler protection beneath all exterior overhangs and canopies that exceed 2'-0" in depth, where the area underneath the exterior overhang and canopy is used for the storage of combustibles regardless of the construction type.

C. Provide sprinkler protection inside all exterior overhangs and canopies comprised of combustible construction and the clear space between framing members exceeds 6" in height.

D. Provide sprinkler protection inside and beneath all exterior overhangs and canopies required by the local Authority Having Jurisdiction.

3.6 PURITY TESTING OF PIPING INSTALLED BEFORE BACKFLOW PREVENTION DEVICE

A. Disinfect the new potable water piping affected by Contractor's operations in accordance with the health authority, water purveyor having jurisdiction, AWWA C651, and AWWA C652.

B. Exercise caution when mixing chlorine disinfectant solutions.

C. Fill piping systems or piping affected by Contractor's operations with solution containing a minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours or use a solution containing a minimum of 200 parts per million of chlorine and allow solution to stand for minimum of 3 hours.

D. Following the required standing time, the piping shall be flushed with clean potable water until the maximum residual chlorine content is not greater than that of the domestic water supply or 0.2 part per million.

E. Have a certified laboratory analyze the results from two consecutive satisfactory bacteriological samples and submit these results before the piping is placed into service.

F. Purity testing of piping supplied by non-potable water sources will not be required.

3.7 PREPARATION OF SPRINKLER PIPING FOR PAINTING IN EXPOSED AREAS

A. The fire protection sprinkler system contractor shall clean the exterior surface to the sprinkler piping that is to be painted. The piping shall be cleaned and prepped in the following manner.
   1. The fire protection sprinkler system contractor shall remove all pipe tags or fabrication labels that have been adhered to the sprinkler system piping as part of the listing/fabrication process.
   2. Any adhesive that remains on the sprinkler piping after removal of the pipe tags or fabrication labels shall be removed with an acceptable adhesive solvent.
   3. All sprinkler piping and fittings that show signs of surface rust shall be sanded to remove the rust from the sprinkler piping.
   4. Sprinkler system piping shall be wiped down with a solvent soaked rag to remove cutting oil residue, finger prints, adhesive solvents, and other foreign materials that could prevent the primer and/or finished color coats of paint from adhering properly to the sprinkler system piping.

3.8 PROTECTION OF SPRINKLER HEADS DURING PAINTING OR SPRAY APPLICATIONS

A. The fire protection sprinkler system contractor shall provide and install a suitable means of protecting the sprinkler heads against the accumulation of foreign matter build up during the time that the exposed structure is either being painted, having fire proofing applied, or during other applications that put particulates into the air that potentially could collect upon the sprinkler heads.

B. At the conclusion of the processes listed above, the fire protection sprinkler system contractor shall be responsible for removing the protective coverings, visually inspecting the sprinkler heads for foreign matter build-up, and shall replace all sprinkler heads where build-up of foreign matter is observed at no additional cost to the owner.

3.9 HYDROSTATIC TEST

A. Hydrostatically test each system at 200 P.S.I. or 50 P.S.I. in excess of the systems working pressure (whichever is greater), for a 2-hour period with no leakage or reduction in pressure.

B. Piping above ceilings shall be tested, inspected, and approved before installation of ceiling material.

C. When tests have been completed and corrections made, submit a signed and dated certificate similar to that specified in N.F.P.A. #13.

3.10 WATER FLOW TEST

A. Test the alarms and other devices by flowing water through the inspector's test connection.

B. Upon activation of the inspector’s test vale, the time to sound the local alarm device shall not be greater than 60 seconds.

C. When tests have been completed and corrections made, submit a signed and dated certificate similar to that specified in N.F.P.A. #13.

3.11 FLUSHING OF PIPE

A. Flush piping with potable water in accordance with N.F.P.A. #13 at a minimum velocity of 10 feet per second.

B. Flow for Class 52 Ductile Iron piping shall be at least 290 g.p.m. for 3-inch pipe, 440 g.p.m. for 4-inch pipe, 970 g.p.m. for 6-inch pipe, 1,725 g.p.m. for 8-inch pipe, 2,650 g.p.m. for 10-inch pipe, and 3,800 g.p.m. for 12-inch pipe.

C. Flow for Class 200 C-900 PVC piping shall be at least 450 g.p.m. for 4-inch pipe, 920 g.p.m. for 6-inch pipe, 1,590 g.p.m. for 8-inch pipe, 2,485 g.p.m. for 10-inch pipe, and 3,370 g.p.m. for 12-inch pipe.

D. Flow for Type 304 or Type 316 Stainless Steel piping shall be at least 235 g.p.m. for 3-inch pipe, 400 g.p.m. for 4-inch pipe, 905 g.p.m. for 6-inch pipe, 1,560 g.p.m. for 8-inch pipe, 2,460 g.p.m. for 10-inch pipe, and 3,535 g.p.m. for 12-inch pipe.

E. Flow for Type K copper piping shall be at least 210 g.p.m. for 3-inch pipe, 365 g.p.m. for 4-inch pipe, 810 g.p.m. for 6-inch pipe, 1,410 g.p.m. for 8-inch pipe, 2,190 g.p.m. for 10-inch pipe, and 3,135 g.p.m. for 12-inch pipe.

F. Continue flow for a sufficient time to ensure thorough cleaning.

3.12 FULL FORWARD FLOW TESTING OF THE BACKFLOW PREVENTER

A. The backflow preventer assembly shall be tested at system flow demand, including all applicable inside hose stream allowances.

B. The fire protection sprinkler system contractor shall provide all equipment and instruments necessary to conduct a complete full forward flow test of the backflow assembly including 2½" hoses for each angled hose valve installed, calibrated pressure gauges, playpipe nozzles, and pitot tube gauge.

3.13 FORMAL TESTS AND INSPECTIONS

A. Do not submit a request for formal test and inspection until the preliminary test and corrections are completed and approved.

B. Submit a written request to local fire protection authority for formal inspection at least 15 days before the inspection date.

C. An experienced technician regularly employed by the system installer shall be present during the inspection.

D. At this inspection, repeat any or all of the required tests as directed.

E. Correct defects in work provided by the Contractor and make additional tests until the system(s) comply with contract requirements.

F. Furnish appliances, equipment, electricity, instruments, connecting devices and personnel for the tests.

G. The Owner will furnish water for the tests.

H. Furnish Architect with three (3) copies of certificates required by testing agencies.

3.14 TRAINING PERIOD

A. Upon completion of the work and after all tests and inspections by the authority(s) having jurisdiction, the Fire Protection Contractor shall demonstrate and train the Owner's designated operation and maintenance personnel in the operation and maintenance of the fire protection system.

B. The Fire Protection Contractor shall arrange scheduled instruction periods with the Owner’s designated operation and maintenance personnel.

C. The Fire Protection Contractor's representatives shall be superintendents or foremen who are knowledgeable in each system and suppliers representatives when so specified.

D. Scheduled training periods shall be based upon complexity of the system installed, but in no case be less than indicated in Paragraph 3.04 of Specification Section 210000.

E. Upon request of the Owner, a DVD of the training period shall be made available by the Fire Protection Contractor at no additional cost to the Owner.

END OF SECTION 211313

SECTION 220523 - VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, valve installation for all systems with domestic water.

1.2 RELATED DOCUMENTS

A. General Conditions, Division 01

B. Section 200000 – General Mechanical Requirements

C. Section 220719 – Piping Insulations

D. Section 221119 – Piping Specialties

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.0 for building service piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve material for potable-water service.

1.4 SUMMARY

A. Section Includes:
1. Gate valves.
2. Globe Valves
3. Ball valves.
4. Check valves.
5. Balancing valves.

1.5 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Product Data: For each type of valve indicated.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure rating indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option. Valves shall be of same make for all these services.

2.2 GATE VALVES

A. Packing - Select valves, equipped with packing suitable for intended service. (Under no circumstances is asbestos acceptable.) Select valves designed so back seating protects packing and stem threads from media when valve is fully opened, and equipped with gland follower. Guides for disc on rising stem valves must be machined for accurate fit.

B. Comply with the following standards:

1. Cast-Iron Valves: MSS SP - 70
2. Bronze Valves: MSS SP – 80

C. Valves:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, solid wedge: Milwaukee UP148 or equal. (Non-rising stem gate valves may be used where headroom prevents full extension of rising stems: Nibco T-113-LF, Milwaukee UP667 or equal.)
2. Solder Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, solid wedge: Milwaukee UP149 or equal. (Non-rising stem gate valves may be used where headroom prevents full extension of rising stems: Nibco S-113-LF, Milwaukee UP668 or equal.)

D. Manufacturer: Subject to compliance with requirements, provide gate valves of one of the following:
1. Nibco
2. Milwaukee Valve Company
3. Stockham

2.3 GLOBE VALVES

A. Packing - Select valves, equipped with packing suitable for intended service. (Under no circumstances is asbestos acceptable.) Select valves designed so back seating protects packing and stem threads from media when valve is fully opened, and equipped with gland follower.

B. Composition Discs - Where required, provide suitable material for intended service.

C. Comply with the following standards:

1. Cast-Iron Valves: MSS SP - 85
2. Bronze Valves: MSS SP - 80

D. Valves:
1. Threaded Ends 2" and Smaller: Class 125, bronze body, union bonnet, rising stem, Teflon disc: Nibco T-211-Y, Milwaukee UP502 or equal.
2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, bronze disc (swivel type): Nibco S-211-Y, Milwaukee UP1502 or equal.

E. Manufacturers: Subject to compliance with requirements, provide globe valves of one of the following:

1. Nibco
2. Milwaukee Valve Company
3. Stockham

2.4 BALL VALVES

A. General - Select with FULL port opening blow-out proof stem, hard chrome plated bronze ball, rated not less than 600# W.O.G.

B. Comply with the following standards:

C. MSS SP-110 Ball Valves - THREADED, SOLDER JOINT

D. Valves:

1. Threaded Ends 2" and Smaller: 600# W.O.G., bronze two piece body, full port hard chrome plated bronze ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Nibco T-585-70, Apollo 77CLF Series, Milwaukee UPBA400 or equal.
2. Soldered Ends 2” and Smaller: 600# W.O.G., bronze two piece body, full port hard chrome plated bronze ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Nibco S-585-70, Apollo 77CLF Series, Milwaukee UPBA-400S, or equal.

E. Manufacturers: Subject to compliance with requirements, provide ball valves of one of the following:

1. Nibco
2. Milwaukee Valve Company
3. Apollo (By Conbraco Industries)

2.5 SWING CHECK VALVES

A. General - Construct pressure containing parts of Valves as follows:

1. Bronze Valves, 125 or 150 psi: ANSI/ASTM B 62
2. Iron Body Valves: ANSI/ASTM A-126, Grade B

B. Comply with the following standards for design, workmanship, material and testing:

1. Bronze Valves: MSS SP-80
2. Cast Iron Valves: MSS SP-71

C. Construct valves of pressure castings free of any impregnating materials.

D. Construct disc and hanger as one piece. Support hanger pins by removable side plug.

E. Valves:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, 5 degree seated swing, bronze disc: Nibco T-413-Y-LF, Milwaukee UP509 or equal.
2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, 5 degree seated swing, bronze disc: Nibco S-413-Y-LF, Milwaukee UP1509 or equal.
3. Manufacturer: Subject to compliance with requirements, provide Swing Check valves of one of the following:
   a. Nibco Valve
   b. Milwaukee Valve Company
   c. Stockham Valve
   d. Victaulic

2.6 SPRING IN-LINE CHECK VALVES

A. General - Construct pressure containing parts of Valves as follows:
1. Bronze Valves, 125 or 150 psi: ANSI/ASTM B 62
2. Iron Body Valves: ANSI/ASTM A-126, Grade B

B. Comply with the following standards for design, workmanship, material and testing:
1. Bronze Valves: MSS SP-80
2. Cast Iron Valves: MSS SP-71

C. Construct valves of pressure castings free of any impregnating materials.

D. Construct disc and hanger as one piece. Support hanger pins by removable side plug.
1. Valves:
   a. Threaded Ends 2" and Smaller: Class 125, bronze body, bronze or stainless steel spring and disc holder, buna or PTFE disc ring, silent closing: Nibco T-480-Y-LF, Milwaukee UP548T, Apollo CVB-LF or equal.
   b. Soldered Ends 2" and Smaller: Class 125, bronze body, bronze or stainless steel spring and disc holder, buna or PTFE disc ring, silent closing: Nibco S-480-Y-LF, Milwaukee UP1548T, Apollo CVB-LF-800 or equal.
   c. Manufacturer: Subject to compliance with requirements, provide Swing Check valves of one of the following:
      1) Nibco Valve
      2) Milwaukee Valve Company
      3) Stockham Valve

2.7 BACKFLOW PREVENTION DEVICES

A. See Section 221119.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements.

B. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

C. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable.

1. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.
2. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
    a. Tube Size 2" and Smaller: Soldered-joint valves.
    b. Pipe Size 2" and Smaller: One of the following at installer's option:
        1) Threaded Valves
        2) Grooved-end Valves
    c. Pipe Size 2-1/2" and Larger: One of the following at installer's option:
        1) Threaded end Valves
        2) Butt-weld end Valves
        3) Flanged end Valves
        4) Wafer Type Valves
        5) Mechanical joint end Valves
        6) Grooved end Valves

3.2 INSTALLATION OF CHECK VALVES

A. Swing Check Valves: Install in horizontal position, unless otherwise shown on drawings, with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL

A. Includes:

1. Pipe Hangers and Supports
2. Mechanical Equipment Anchors and Supports

1.2 RELATED SECTIONS

A. General Conditions, Division 1

B. Section 200000 – General Mechanical Requirements

C. Section 220719 – Piping Insulations

D. Section 221119 – Piping Specialties

E. Section 222000 – Excavation and Backfill for Mechanical Underground Utilities

F. Section 230548 – Vibration and Seismic Control

1.3 QUALITY ASSURANCE

A. Pipe Hanger Standards: (MSS) Manufacturers Standardization Society Standards SP-58-2002, SP-89-2003, and SP-69-2003.

B. All methods, materials, and workmanship shall conform to the International Building Code (IBC) and International Mechanical Code (IMC), as amended and adopted by the authority having jurisdiction.

1.4 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Hangers.

B. Struts.

C. Anchors.

D. Shop drawings are required for all equipment supports and fabricated supports or assemblies.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Hangers and Supports: Elcen, Grinnell, B-Line Systems, Unistrut, Michigan, Tolco, PHD.

B. Anchors: Rawplug, Phillips, Hilti, Michigan.

2.2 GENERAL HANGERS AND SUPPORTS

A. Hanger Rods: Threaded hot rolled steel, electro-galvanized or cadmium plated. Hanger rods shall be sized so that the total load (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds

B. Hanger Straps: Galvanized steel. Straps shall be sized so that the total load does not exceed the following:

Strap Size	Maximum Load
1” x 22 Gauge	230 Pounds
1” x 20 Gauge	290 Pounds
1” x 18 Gauge	380 Pounds
1” x 16 Gauge	630 Pounds

C. Beam Attachments: Shall be of the following type:

MSS Type	Elcen Figure No.	Grinnel Figure No.
21	33, 34	131
22	67	66
23	29A	87
28	95	292, 228
30	95	229

D. Anchors: Masonry anchors shall be Phillips wedge anchors, Phillips "Red Head" or Rawl "Saber-Tooth".

E. Steel: Structural steel per ASTM A36.

F. Wood: Shall be fire treated.

2.3 PIPE HANGERS AND SUPPORTS

A. All hangers used directly on copper pipe shall be copper plated or have a factory applied 1/16-inch thick (minimum) plastic coating on all contact surfaces.

B. All other hangers, supports, and hardware shall be cadmium plated or galvanized.

C. Fire sprinkler supports shall comply with NFPA-13.

D. Pipe Hangers and Supports: Shall be of the following type (numbers are 'MSS'):

Maximum System Temperature	Insulated Pipe Type
120 to 450 Degrees	1, 3, 7, 9, 10, 41, 42, 43, 44, 45, 46, E
60 to 120 Degrees	1, 3, 7, 9, 10
33 to 59 Degrees	1, 3, 5, 7, 9, 10, 41, 42, 43, 44, 45, 46, E

E. Vertical Pipe Supports: MSS Type 8 riser clamp (Elcen Fig. 39 and 339; Grinnel Fig. 261 and 261C).

F. Trapeze Hangers: Shall be constructed of carbon steel angles, channels, or other structural shapes with flat surface for point of support. Trapeze hangers shall be supported with hanger rods suspended from concrete inserts or approved structural clips. Provide a steel washer plate (Elcen Fig. 84 or equal) where hanger rod nuts bear on trapeze hanger.

G. Insulated Pipe Supports and Insulation Shields:

H. Insulation material at pipe support shall consist of expanded perlite insert with flame resistant jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation, with sheet metal shield. Expanded perlite shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.32 Btu/hr./sq. ft./degree F/1-inch thick.

1. Expanded perlite insert shall be same thickness as adjoining pipe insulation and sized to match pipe in which it is used on. See Section 220719 for insulation sizes.
2. Provide shield per Section 221119 Piping Specialties.
3. Manufacturer: Michigan Hanger Company, Model Nos. 1031 and 4031.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Provide all necessary bolts, nuts, washers, turnbuckles, rod connectors, and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment.

B. Install steel or wood backing in walls (anchored to studs) as required to provide support for items hung from walls.

C. Install concrete inserts and anchors in accordance with manufacturer's instructions.

D. All welded steel support assemblies shall have a power wire brush and primer paint finish.

E. Maximum spans between piping supports may be significantly less than the maximum spans allowed herein due to structural limitations of allowable loads on hangers. The most restrictive criteria governs. Reference structural drawings.

3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Pipe which is not run underground, shall be adequately anchored to the structure to prevent sagging and to keep pipe in alignment.

B. All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

C. Installation and sizing of pipe supports and accessories shall be in accordance with the manufacturer's recommendations and standard MSS SP-89 and MSS SP-69, NFPA #13 for fire protection piping, UPC, and IMC.

D. Provide supports at each change in direction of piping; and on cast iron soil pipe at each branch connection and at each side of concentrated loads.

E. Where mechanically coupled piping is used, a hanger shall be placed within 2 feet on each side of couplings, with hanger spacing in no case to exceed the following:

Nominal Pipe Diameter	**Maximum Span Mechanically Coupled Piping**
¾ to 1 Inch	7 Feet
1 ¼ to 1 ½ Inch	7 Feet
2 Inches	10 Feet
2 ½ Inches	10 Feet
3 Inches and Larger	12 Feet

NOTE: Manufacturer's support instructions shall be used where it is more restrictive than the above. Above is for rigid coupled piping systems. Follow manufacturer's requirements for flexible piping systems, except that in no case are spacing to be more than the above.

F. Steel Pipe: Maximum spacing between supports:

Nominal Pipe Diameter	**Maximum Span Steel Pipe**
½ Inch	6 Feet
¾ to 1 Inch (¾ Inch to 1 Inch)	8 Feet
1 ¼ to 2 ½ Inch (1 ¼ Inch or Larger)	10 Feet
3 Inches and Larger	12 Feet

G. Copper Tubing: Maximum spacing between supports:

Nominal Tubing Diameter	**Maximum Span Copper**
½ Inch	5 Feet
¾ to 1 ¼ Inch	6 Feet
1 ½ to 2 ½ Inch	8 Feet
3 Inches and Larger	10 Feet

H. Cast Iron Soil Pipe: Maximum spacing between supports shall be 5 feet, except when the pipe length between joints exceeds 5 feet, in which case the maximum spacing between supports may be 10 feet.

I. No-Hub Cast Iron Soil Pipe: Shall be supported at every other joint, except when the pipe length between joints exceeds 4 feet, in which case the pipe shall be supported at each joint.

Supports shall be provided at each horizontal branch connection and shall be adjacent to couplings.

J. Three or more pipes running parallel may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Where trapeze width exceeds 24 inches, provide three (3) hanger rod supports.

K. Provide additional supports at concentrated loads (such as valves, in-line pumps, etc.) on each side of the load. Such supports are in addition to the ones otherwise required.

L. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable hanger. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure to provide rigid anchoring of pipe drop.

M. Insulated Pipe Supports and Insulation Shields: Protect insulated pipe at point of support with pipe insert and shield as required by the following table:

Nominal Pipe Diameter in Inches	Insulation Length in Inches	Shield Length in Inches	Minimum Shield Gauge
½ to 2	6	6	20
2 ½ to 3 ½	6	6	18

Such supports shall be in place at the time of installing pipe.

N. Underground Pipe: Shall be evenly supported on approved bedding materials, as specified for the type of piping being used. Such bedding and backfilling shall be as specified in Section 222020.

3.3 INSTALLATION OF MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

A. Provide anchoring and supports for all mechanical equipment.

B. Equipment shall be supported and anchored in such a way so that no equipment vibration is transmitted to the building structure.

C. Added supports and bracing shall be provided per Section 220548.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, vibration and seismic control installation for all equipment, ducts and piping.

1.2 RELATED SECTIONS

A. General Conditions, Division 01

B. Section 200000 – General Mechanical Requirements

1.3 SUBMITTAL REQUIREMENTS

A. Submittal Requirements of this Section

1. Isolation pads
2. Spring isolators

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. 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 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.

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. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 40 feet.
2. Longitudinal bracing shall occur at maximum intervals of 80 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 NFPA-13 and but in no case be less than that required in this Section.
5. Provide seismic bracing for hot water tanks.

END OF SECTION 220548

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.

PART 2 - PRODUCTS

2.1 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.

2.2 PLASTIC TAPE

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6".

2.3 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.

2.4 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.

2.5 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.

2.6 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 intermediately 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 intermediately 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).

Service/Stencil	**Color**	**Stencil**
Domestic Cold Water	Green	White
Domestic Hot Water	Green	White
Domestic Hot Water Recir.	Green	White
Waste & Vent Piping	Orange	Black
Sprinkler Work	Red	White
Compressed Air	Blue	White

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 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign on or near each major item of mechanical 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.

1. Pumps and similar motor-driven units.
2. Tanks and pressure vessels.

3.6 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:

ITEM	COLOR
Domestic Plumbing System Component	Blue
Fire Protection System Component	Red

END OF SECTION 220553

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 220529 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 220529.

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 220529 – Hangers and Supports for Plumbing Equipment

C. 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

PART 2 - PRODUCTS

2.1 PIPE INSULATIONS

A. Glass Fiber: Meeting ASTM C547; rigid molded, noncombustible.
1. 'K' Value: 0.23 Btu-in/hr. Ft^2 °F at 75 degrees F.

2. Maximum Service Temperature: 850 degrees F.
3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed.
4. Approved Manufacturers:
   a. Manville
   b. Armstrong
   c. Knauf
   d. Owens Corning

B. Field Applied Jackets:

1. PVC Plastic: One piece molded type fitting covers and jacketing material, gloss white.
   a. Connections: Tacks; Pressure sensitive color matching vinyl tape.
   b. Manville Zeston 2000.
2. Canvas Jacket: UL listed fabric, 6 oz/sq yd (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.
3. 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.

C. 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.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that piping has been tested for leakage in accordance with U.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 dual temperature pipes or 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.

3.3 PIPING INSULATION SCHEDULE

INSULATION TYPE	PIPE SIZE INCH	THICKNESS INCH
Glass Fiber Insulation:		
Domestic Hot Water, Aboveground	All Sizes	1"
Cold Water	All Sizes	1"
Piping Exposed to Freezing or Semi-Heated Spaces	All Sizes	1½"

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 0and 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 220719

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 220529 – Hangers and Supports for Plumbing Equipment

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

A. ASTM E814: Fire Tests of Through-Penetration Fire Stops.

B. UL 1479: Through-Penetration Fire Stop Systems.

PART 2 - PRODUCTS

2.1 PIPE (FOR POTABLE SYSTEMS)

A. Underground Piping (Outside Building Perimeter):
   1. Schedule 80 PVC

B. Underground Piping (Inside Building Perimeter):
   1. Type K Copper

C. Above Ground Piping:

1. Type L Copper:
   a. Fittings:
      1) Solder type (all sizes), or
      2) Mechanical press type (all sizes)
      3) Approved Manufacturers:
         a) Viega ProPress
         b) Nibco

2.2 CONDENSATE PIPING

A. Schedule 40 PVC

B. Copper if installed in air plenum.

C. Copper if penetrating a firewall.

D. Insulate per Section 220719.

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.

1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
2. Remove burr and cutting slag from pipes.
3. Make changes in direction with proper fittings.

C. 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.

D. Coordinate installation of piping with all trades which are affected by installation to avoid conflicts.

E. 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.

F. Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

G. Make connections of dissimilar metals with insulating couplings. (di-electric unions). See Section 221119 – Piping Specialties.

H. 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.

I. Do not use reducing bushings, street elbows, or close nipples.

J. T-drill procedure for connecting pipes will not be allowed.

K. Wrought tees shall be used on all branch piping and branch to main connections.

L. Bury water piping 6 inches minimum below bottom of slab and encase in 2 inches minimum of sand.

M. 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.

N. Approved Manufacturers:

1. Canfield
2. J.W. Harris
3. Aqua-Clean

O. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

P. Pitch all piping and provide drain valves so that all piping and equipment can be drained.

Q. Provide escutcheons where pipe passes through walls, floors, or ceilings.

R. 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 221116

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

D. Section 221123 - Pumps

E. Section 222020 – Excavation and Backfill for Mechanical Underground Utilities

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Thermometers

B. 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

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:

Measuring	**Range Degree F.**	**Increments Degree F**
Domestic Cold Water	0 – 100	1
Domestic Hot Water	30 – 180	2

C. Approved Manufacturers:

1. Ashcroft
2. March
3. Taylor
4. Tel-Tru
5. Winters

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:

Measuring	**Range PSIG**	**Numeral Intervals PSIG**	**Inter - Graduations**
Domestic Hot Water	0 – 160	20	2
Domestic Cold Water	0 – 160	20	2
Compressed Air	0 – 160	20	2

C. Approved Manufacturers:

1. Ashcroft
2. Marsh
3. Taylor
4. Tel-Tru
5. Winters

2.3 STRAINERS

A. Water Strainers: "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. Air Strainers: Unless otherwise noted, air and gas line strainers shall be Y-pattern, iron body, 250 psi working pressure, with 40 mesh Monel screen packed with Everdur wool. Air line strainers shall be fitted with brass blowoff cock.

C. 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

1. 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.
2. Approved Manufacturers:
   a. Metraflex
   b. Minnesota Flex
   c. Resistoflex

2.6 PIPE SHIELDS (SADDLES)

A. Saddles shall be minimum, 20 gauge dimpled galvanized sheet steel covering 40% of the circumference of the insulation. Length shall be a minimum of 6". See Section 220529 Hangers and Supports for longer shields.

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 and atmospheric vacuum breaker, preset 24 hour clock, manual over ride 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 Domestic Water:

1. Recirculation Station: Recirculation station shall consist of thermostatic mixing valve in combination with piping assembly, inlet/outlet shutoff valves, pressure/temperature gauges, circulation pump (see pump schedule), circuit setter balancing valve, and GFCI outlet. All components pre-assembled to enamel coated strut and tested by manufacturer.

2. Thermostatic Mixing Valves: The thermostatic water mixing valve (TMV) shall consist of a liquid-filled thermal motor or a solid bimetal control mechanism with a positive shut-off of hot water when cold water supply is lost. The TMV shall allow a restricted cold flow in the event of loss or interruption of the hot water supply. All flow is shut off in the event of thermostat failure. The TMV shall be constructed of bronze bodies with corrosion resistant components and shall be equipped with integral checkstops, thermometer, outlet temperature gauge, and removable strainers. The TMV shall control the temperature to within +/- 3 degrees from low flow to the maximum flow rate scheduled.
3. Approved Manufacturers:
   a. Bradley
   b. Apollo Conbraco

B. 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

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 control at minimum interval of every 15 minutes. 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. Non-ASME Domestic Water Thermal Expansion Tank (For Systems With Water Heaters Less Than or equal to 119 Gallons and/or 199 mbh):

1. The non-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. Expansion tank pressure is to 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.

END OF SECTION 221119

SECTION 221121 - LUBRICATION EQUIPMENT

PART 1 - GENERAL

The General Provisions of the Contract, including General and Special Conditions and the requirements of Division 1, apply to the Work in this Section.

1.1 WORK INCLUDED

A. Equipment items as listed below by Equipment Mark Number:

1. PUMP, AIR PISTON (ATF), 4.25”, 10:1 (Ref. Part 2.1)
2. PUMP, AIR PISTON (EO), 4.25”, 10:1 (Ref. Part 2.3)
3. PUMP, DIAPHRAM, MIXING (EC) (Ref. Part 2.4)
4. PUMP, AIR PISTON (CG), 3”, 50:1 (Ref. Part 2.5)
5. REEL BANKS – GENERAL (Part 2.6)
6. REEL BANK (EO, ATF, CG, EC) (Ref. Part 2.7)

B. Roughing-in, installation of equipment, and final connection of utilities, with labor, services, and incidentals necessary for complete and operational equipment installation.

C. Piping between equipment and utilities.

1.2 ALTERNATIVE BIDS

A. Refer ASO to Division 1 - General Requirements for possible effect on Work of this Section.

1.3 QUALITY ASSURANCE

A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years experience supplying specified equipment.

B. Manufacturer's Representative:

C. Installation: Provide a qualified manufacturer's representative at site to supervise work related to equipment installation, check-out, and start-up.

D. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.4 SUBMITTALS

A. Product Data:

1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.

2. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

B. Operation and Maintenance Manual:

1. Provide complete parts, operating, and maintenance manual covering equipment at time of installation including, but not limited to:
   a. Description of system and components.
   b. Schematic diagrams of plumbing and compressed air systems.
   c. Manufacturer's printed operating instructions.
   d. Printed listing of periodic preventive maintenance items and recommended frequency required to validate warranties. Failure to provide maintenance information will indicate that preventive maintenance is not a condition for validation of warranties.
   e. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.
2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.

1.5 WARRANTY

A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.

B. Warranty shall include materials and labor necessary to correct defects.

C. Defects shall include, but not be limited to noisy, rough or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.

D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.

E. All parts shall be readily available locally in the United States.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's containers, appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

B. Indelibly label all containers, including those contained in others, on outside with item description(s) per title and Mark Number of this specification.

C. Provide equipment and materials specified complete in one shipment for each equipment item. Split or partial shipments are not permissible.

1.7 LABELING

A. Manufacturer shall securely attach in a prominent location on each major item of equipment a non-1corrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.

B. A metal nameplate with pump commodity shall be attached to each pump.

C. A metal nameplate with reel commodity shall be attached to each hose reel guide roller plate.

D. All electrical equipment and materials shall be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.) in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 - PRODUCTS

2.1 PUMP, AIR PISTON, AUTOMATIC TRANSMISSION FLUID (ATF)

A. Capacities and Dimensions:

1. Ratio: 10 to 1.
2. Cycles per gallon: 20 cycles.
3. Flow rate: 3 GPM.
4. Air motor diameter: 4-1/4 inches.
5. Air socket inlet: 1/2 inch NPT (F).
6. Material outlet: 3/4 inch NPT (F).
7. Material inlet: 1-1/2 inch NPT(F).

B. Features and Construction:

1. Air motor: Differential air motor powered by compressed air shall drive piston up and down inside cylinder to draw material in through pump intake and force it out pump outlet.
2. In-line design: Air motor, air motor valves, and lower pump shall be of the in-line design and air motor shall be balanced with no metal to metal seals.
3. Air valve: Pump shall have pneumatically actuated air valve.
4. Construction: Air cylinder shall have hard coat aluminum body with corrosive resistant steel inserts.
5. Piston ball and intake ball: Pump shall have piston ball check valve and intake ball check valve.
6. Double acting: Pump shall provide equal delivery of material on up and down strokes.
7. Variable volume: Pump shall adjust speed to match system demands.
8. Mounting method: Pump shall be bung mounted and configured to draw from a bulk storage tank.

C. Accessories:

1. Overrun air shut-off valve: Graco No. 224-040, one each.

2. Combination filter, regulator, pressure gauge, lubricator and connection fittings: Graco No. 217-072, one each.
3. Bleed type shut-off valve (1/2 inch): Graco No. 110-225, one each.
4. Product line shut-off valve (3/4 inch): Graco No. 108-537, one each.
5. 72 inch hose and fitting kit: Graco No. 222-066, one each.
6. Low level cutoff: Graco No. 203-688, one each.
7. Thermal relief valve: Graco No. 240-429, one each.
8. Bung adapter: Graco No. 214-583, one each.
9. 1-1/2 inch riser tube, one each.

D. Utilities Available: Air, 100 PSI, 40 CFM.

E. Finish:

1. Air motor: Durable enamel in manufacturer's standard color.
2. Pump: Carbon steel with zinc plating.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
   a. Graco Inc.
      P.O. Box 1441
      Minneapolis, MN 55440
      Phone: (612) 623-6000, (800) 533-9655
      Website: www.graco.com
   b. Model: 205-626 with Accessories
2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.
   a. Lincoln Industrial Corporation
      One Lincoln Way
      St. Louis, MO 63120
      Phone: (314) 679-4200, (800) 804-4135
      Website: www.lincolnindustrial.com
   b. Ingersoll-Rand, Fluid Products
      One Aro Center
      Bryan, OH 43506
      Phone: (419) 636-4242
      Fax: (419) 633-1674
      Website: www.arozone.com

2.2 PUMP, AIR PISTON, ENGINE OIL (EO)

A. Capacities and Dimensions:

1. Ratio: 10 to 1.
2. Cycles per gallon: 20 cycles.
3. Flow rate: 3 GPM.

4. Air motor diameter: 4-1/4 inches.
5. Air socket inlet: 1/2 inch NPT(F).
6. Material outlet: 3/4 inch NPT(F).
7. Material inlet: 1-1/2 inch NPT(F).

B. Features and Construction:

1. Air motor: Differential air motor powered by compressed air shall drive piston up and down inside cylinder to draw material in through pump intake and force it out pump outlet.
2. In-line design: Air motor, air motor valves, and lower pump shall be of the in-line design and air motor shall be balanced with no metal to metal seals.
3. Air valve: Pump shall have pneumatically actuated air valve.
4. Construction: Air cylinder shall have hard coat aluminum body with corrosive resistant steel inserts.
5. Piston ball and intake ball: Pump shall have piston ball check valve and intake ball check valve.
6. Double acting: Pump shall provide equal delivery of material on up and down strokes.
7. Variable volume: Pump shall adjust speed to match system demands.
8. Mounting method: Pump shall be bung mounted and configured to draw from a bulk storage tank.

C. Accessories:

1. Overrun air shut-off valve: Graco No. 224-040, one each.
2. Combination filter, regulator, pressure gauge, lubricator and connection fittings: Graco No. 217-072, one each.
3. Bleed type shut-off valve (1/2 inch): Graco No. 110-225, one each.
4. Product line shut-off valve (3/4 inch): Graco No. 108-537, one each.
5. 72 inch hose and fitting kit: Graco No. 222-066, one each.
6. Low level cutoff: Graco No. 203-688, one each.
7. Thermal relief valve: Graco No. 240-429, one each.
8. Bung adapter: Graco No. 214-583, one each.
9. 1-1/2 inch riser tube, one each.

D. Utilities Available: Air, 100 PSI, 40 CFM.

E. Finish:

1. Air motor: Durable enamel in manufacturer's standard color.
2. Pump: Carbon steel with zinc plating.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
   a. Graco Inc.
      P.O. Box 1441
      Minneapolis, MN 55440
      Phone: (612) 623-6000, (800) 533-9655

Website: www.graco.com
b. Model: 205-626 with Accessories

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.
   a. Lincoln Industrial Corporation
      One Lincoln Way
      St. Louis, MO 63120
      Phone: (314) 679-4200, (800) 804-4135
      Website: www.lincolnindustrial.com
   b. Ingersoll-Rand, Fluid Products
      One Aro Center
      Bryan, OH 43506
      Phone: (419) 636-4242
      Fax: (419) 633-1674
      Website: www.arozone.com

2.3 PUMP, DIAPHRAGM, ENGINE COOLANT (EC)

A. Capacities and Dimensions:

1. Ratio: 1 to 1.
2. Flow rate: 15 GPM.
3. Air socket inlet: ¼ inch NPT(F).
4. Material outlet: ½ and ¾ inch NPT(F).
5. Material inlet: ¾ inch NPT(F)

B. Features and construction:

1. Pump: Acetal housing pump with stainless steel trim shall be self-priming with single inlet and single outlet.
2. Internal ball: Internal ball shall be constructed of Buna “N”.
3. Diaphragm and O-ring: The pump diaphragms and O-rings shall be Buna “N” type.
4. Design: Pump shall allow suspended solids up to 1/8 inch in diameter to pass without internal wear.
5. Dual inlet manifold: Dual inlet manifold shall enable the pump to pump two fluids simultaneously or to mix two fluids in the pump.
6. Standard equipment: Standard equipment shall include pump and all pertinent equipment for complete installation and operation including bung adapter, material hose, filter, regulator, pip nipples, pipe swivels, cap screws, nuts, and washers.
7. Mounting method: Pump shall be wall mounted and configured to draw from a bulk storage tank with siphon tub kit, low level cut off and control float valve and a 55 gallon polyurethane water storage drum with water level control float valve.

C. Accessories:

1. Wall bracket: Graco No. 224-835, on each.
2. Bung adapter: Graco No. 183-553, one each.
3. Grounding wire and clamp: Graco No. 222-011, one each.
4. Suction line assembly: Graco No. 221-094, one each.

5. Air gauge, filter, and regulator: Graco No. 110-149, one each.
6. Airline "bleed-type" shut-off valve: Graco No. 110-223, one each.
7. Product line shut-off valve: Graco No. 108-537, one each
8. 55 gallon polyurethane water storage drum with water level control float valve, one each.

D. Utilities Available: Air, 40 PSI, 28 CFM

E. Finish: Durable enamel in manufacturer's standard color.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
   a. Graco Inc.
      88-11th Avenue NE
      P.O. Box 1441
      Minneapolis, MN 55413
      Phone: (612) 623-6000, (800) 533-9655
      Fax: (612) 623-6777, (800) 533-9656
      Website: www.graco.com
   b. Model: Husky 515 243-669 with Accessories
2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.
   a. Lincoln Industrial Corporation
      One Lincoln Way
      St. Louis, MO 63120
      Phone: (314) 679-4200
      Fax: (314) 679-4359, (800) 804-5359
      Website: www.lincolnindustrial.com
   b. Ingersoll-Rand, Fluid Products
      One Aro Center
      P.O. Box 151
      Bryan, OH 43506
      Phone: (419) 636-4242, (800) 276-4658
      Fax: (419) 633-1674, (800) 266-7016
      Website: www.arozone.com

2.4 PUMP, AIR PISTON, CHASSIS GREASE (CG)

A. Capacities and Dimensions:

1. Pump:
2. Ratio: 50 to 1.
3. Cycles per gallon: 110 cycles.
4. Maximum flow rate: 11 pounds per minute.
5. Air motor diameter: 4-1/4 inches.
6. Air inlet: 1/2 inch, NPSM(F).
7. Material outlet: 3/8 inch, NPT(F).

8. Hoist: Extended height: 93.5 inches.

B. Features and Construction:

1. Air motor: Differential air motor powered by compressed air shall drive piston up and down inside cylinder to draw material in through pump intake and force it out pump outlet.
2. In-line design: Air motor, air motor valves, and lower pump shall be of the in-line design and air motor shall be balanced with no metal to metal seals.
3. Air valve: Pump shall have pneumatically actuated air valve.
4. Construction: Air cylinder shall have hard coat aluminum body with corrosive resistant steel inserts.
5. Priming piston: Pump shall have priming piston and priming tube.
6. Double acting: Pump shall provide equal delivery of material on up and down strokes.
7. Variable volume: Pump shall adjust speed to match system demands.
8. Adjustable throat packing: Pump shall have adjustable throat packing nut.
9. Elevator: Pump shall be provided with baseplate mounted, air operated elevator to support pump and inductor plate.
10. Inductor plate: Pump shall have inductor plate rigidly mounted to end of pump tube and rubber wiper shall be attached to inductor plate to clean drum.
11. Hose kit: Pump shall be provided with 3/8 by 72 inch material hose, 1/2 by 72 inch air hose, and air valve for pump. Air hose shall connect to elevator manifold. All interconnecting pump elevator hoses from manifold to air valve, elevator, and inductor plate shall be provided including hose from air valve to air pump.
12. Mounting method: Pump shall be mounted on elevator and configured to draw from 400-pound drum.

C. Accessories:

1. Runaway valve (mounted on air hose between manifold and air pump): Graco No. 224-040, one each.
2. Combination filter, regulator, pressure gauge, lubricator and connection fittings: Graco No. 217-072, one each.
3. Bleed type shut-off valve: Graco No. 110-225, one each.
4. Grease dispense line shut-off valve: Graco No. 202-869, one each.

D. Utilities Available: Air, 100 PSI, 30 CFM.

E. Finish:

1. Air motor and inductor plate: Baked white enamel.
2. Pump and elevator: Carbon steel with zinc plating.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
   a. Graco Inc.
      P.O. Box 1441
      Minneapolis, MN 55440

Phone: (612) 623-6000, (800) 533-9655
Website: www.graco.com

b. Model: 226-018 Stationary Topper-Inductor Package with Accessories.

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

a. Lincoln Industrial Corporation
One Lincoln Way
St. Louis, MO 63120
Phone: (314) 679-4200, (800) 804-4135
Website: www.lincolnindustrial.com

b. Ingersoll-Rand, Fluid Products
One Aro Center
Bryan, OH 43506
Phone: (419) 636-4242
Fax: (419) 633-1674
Website: www.arozone.com

2.5 REEL BANKS – GENERAL

A. Capacities and Dimensions:

1. Overall reel dimensions, nominal:
   a. Width: 8-1/2 inches.
   b. Height: 21-1/16 inches.
   c. Reel diameter: 20 inches.
2. Reel fluid inlet:
   a. Commodities: 1/2 inch NPSM male.
3. Hose:
   a. Commodities:
      1) Length: 50 feet.
      2) Inside diameter: 1/2 inch.
      3) Working pressure: 1,800 PSI.

B. Features and Construction:

1. Construction: Frames, discs, and drum shall be fabricated of heavy gauge steel.
2. Double pedestal arm: Reel frame shall have double pedestal arms that are welded and gusseted.
3. Hose guide arm: Reel hose guide arm shall be adjustable with nylon rollers on all four sides of roller assembly at hose opening.
4. Ball stop: Adjustment of hose extension length shall be permitted by ball stop.
5. Rewind mechanism: Reel spring shall be enclosed and fastened to reel drum with a reinforcing clip.
6. Bearings and ratchet latch: Reel shall have permanently lubricated bearings and extra large ratchet latch with audible hose position lock.
7. Hose covers and tubes: Chassis grease hose shall have Buna-N tube and Buna-N PVC cover. Air, water, and windshield washer solvent shall have neoprene tube with Buna-N PVC cover. All other commodity hoses shall have Buna-N nitrile tube with nitrile PVC cover.

8. Delivery kits: Each commodity hose shall be fitted with the dispensing control as listed.
   a. Automatic transmission fluid (ATF): Electronic in-line style English metered totalizing dispenser set to dispense in quarts to .01 increments.
   b. Engine coolant, mixed (EC): Electronic in-line style English metered totalizing dispenser set to dispense in pints to .01 increments.
   c. Engine oil (EO): Electronic in-line style English metered totalizing dispenser set to dispense in quarts to .01 increments.
   d. Gear oil (GO): Electronic in-line style English metered totalizing dispenser set to dispense in pints to .01 increments.

C. Accessories:

1. Inlet hose kit: Each commodity reel shall be fitted with the inlet hose kit as listed.
   a. Commodities: 1/2 inch ID by 24 inch, medium pressure hose and fittings, rated for 2,000 PSI, Graco No. 218-549, one each.
2. Identification labels: Each commodity reel shall have a 3/4 by 4-1/4 inch metal identification label indicating the commodity, attached adjacent to each hose guide arm roller assembly. Label kits including label and mounting hardware as listed for each commodity. Note: Label is listed before ( ).
   a. ATF (ATF): Graco No. 218-673.
   b. GEAR OIL (GO): Graco No. 218-677.
   c. ENGINE OIL (EO): Similar to Graco No. 218-670.
   d. ENGINE COOLANT (EC): Graco No. 218-678
   e. COMPRESSED AIR (CA):
3. Channel mounting bracket: Graco No. 204-741, as required.
4. Reel mounting channel: Graco No. 218-679, 218-680, and/or 218-681, as required.

D. Utilities Available: Contractor shall provide process piping from product pumps to point of connection for each reel specified herein.

E. Finish: Durable enamel in manufacturer's standard color.

F. Manufacturers Reference:

1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction.
   a. Graco Inc.
      P.O. Box 1441
      Minneapolis, MN 55440
      Phone: (612) 623-6000, (800) 533-9655
      Website: www.graco.com
   b. Model:
      1) 224-384 (ATF): 1/2” x 50’
      2) 224-382 (EC): 1/2” x 50’
      3) 224-382 (EO): 1/2” x 50’
      4) 224-380 (GO): 1/2” x 50’

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.
   a. Lincoln Industrial Corporation
      One Lincoln Way
      St. Louis, MO 63120
      Phone: (314) 679-4200, (800) 804-4135
      Website: www.lincolnindustrial.com
   b. Ingersoll-Rand, Fluid Products
      One Aro Center
      Bryan, OH 43506
      Phone: (419) 636-4242
      Fax: (419) 633-1674
      Website: www.arozone.com

2.6 REEL BANK (EO, ATF, CG, EC, CA, CA)

A. Reel bank shall consist of one each EO reel, one each ATF reel, one each CG reel, one each EC reel and two each CA reels as delineated in Part 2.04 of the specification section.

B. Provide space on mounting channel for the addition of future hose reel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.

B. Inspect delivered equipment for damage from shipping and/or exposure to weather. Compare delivered equipment with packing lists and specifications to assure receipt of all items.

3.2 INSTALLATION

A. Perform work under direct supervision of Foreman or Construction Superintendent with authority to coordinate installation of scheduled equipment with Architect.

1. Install equipment in accordance with plans, shop drawings and manufacturer's instructions:
2. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.
3. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.
4. Anchorage: Attach equipment securely to floor and/or walls, as directed by Architect, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.
5. Provide mounting channel for four additional reels at each reel bank.

6. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.3 TESTING

A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with specifications in the presence of the Architect using acceptance procedures provided by the manufacturer.

3.4 CLEANUP

A. Touch-up damage to painted finishes.

B. Wipe and clean equipment of any oil, grease, and solvents, and make ready for use.

C. Clean area around equipment installation and remove packing or installation debris from job site.

D. Notify Architect for acceptance inspection.

3.5 TRAINING

A. Direct the technical representative to provide specified hours of training to designated Owner's maintenance personnel in operation and maintenance of the following equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

1. 8525 PUMP, AIR PISTON (ATF), 2 hours.
2. 8534 PUMP, AIR PISTON (CG), 2 hours.
3. 8566 PUMP, AIR PISTON (EO), 2 hours.
4. 8720 REEL BANKS 4 hours.

B. Obtain, from technical representative, a list of Owner's personnel trained in equipment operations and maintenance.

END OF SECTION 221121

SECTION 221123 - PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:

1. Pumps and motors shall be furnished as one complete unit, including base, flexible connection, and mounting. Pump shall be non-overloading throughout whole length of performance curve. Casing shall be tapped for gauges, unless otherwise indicated. Furnish pump curve with submittal data.
2. Pumps having discharge connections larger than 3" and operating at more than 60 total dynamic head shall be provided with casing wearing rings.
3. Provide high points of pump casings with air vent globe valve; provide low points of casings with valved drains. Provide each removable casing part weighing over 50 lbs. with lifting eye or lugs.
4. Pressure classification of flange connections shall correspond to casing working pressures of 125 psig.
5. Bearings shall be of ball type, either permanently lubricated or provided with ample oil reservoirs, and sealed to prevent loss of oil and entrance of dirt.

B. Related Sections:

1. General Conditions, Division 01
2. Section 200000 – General Mechanical Requirements
3. Section 221116 – Domestic Water Pipe and Fittings

1.2 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pumps

B. Pump Curves

PART 2 - PRODUCTS

2.1 APPROVED PUMP MANUFACTURERS

A. Bell and Gossett

B. Armstrong

2.2 DOMESTIC WATER IN-LINE PUMPS (CIRCULATORS)

A. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump must be capable of being serviced without disturbing piping connections.

B. Pump body shall be of bronze, rated 125 psi working pressure, with gauge ports at nozzles, and with vent and drain ports, if pump(s) is circulating potable hot water, pump body shall be bronze.

C. Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.

D. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat, and carbon seal ring, suitable for continuous operation at 225°F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.

E. Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.

F. Motor shall meet NEMA specifications and shall be the size, voltage, and enclosure called for on the plans.

G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

H. Approved Manufacturers:

1. Armstrong
2. Bell & Gossett
3. Taco
4. Grundfos

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install with proper support on in-line pumps and vibration isolators under base mounted pumps.

END OF SECTION 221123

SECTION 221300 - SOIL, WASTE & 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. Perform excavating and backfilling required by work of this Section.

1.2 RELATED SECTIONS

A. General Conditions, Division 01

B. Section 200000 – General Mechanical Requirements

C. Section 220529 – Hangers and Supports

D. Section 221116 – Domestic Water Pipe and Fittings

E. Section 222020 – Excavation and Backfill for Mechanical Underground Utilities

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe

B. Above ground couplings

C. Below ground couplings

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:

b) AB&I
c) Charlotte
d) 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:
b) AB&I
c) Charlotte
d) 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:

1) Plastic piping: ANSI/ASTM D2665-94 (PVC).
2) Fitting: Comply with current UPC.

B. PVC Soil Waste and Vent Piping:

1. Each pipe of PVC pipe shall bear the manufacturers identification mark and shall be certified by the manufacturer to have met the requirements of the latest ASTM specifications.
2. Aboveground: All aboveground soil, waste and vent piping and fittings shall be type DWV and comply with ASTM D 2665, ASTM D 2949, ASTM F 891, ASTM F 1488 and CSA CAN/CSA-B181.2.
3. Belowground: All below ground soil, waste and vent piping and fittings shall be type DWV and comply with ASTM D 2665, ASTM D2949, ASTM F891 and CSA CAN/CSA-B181.2.
4. Below Ground PVC Waste and Vent Piping Beyond 5' Outside Building: Shall be type DWV and comply with ASTM D 2665, ASTM D 2949, ASTM D 3034, ASTM F 891, CSA B 182.2 and CSA CAN/CSA-B182.4.
5. Joints:
a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

b. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

c. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

C. ABS Soil Waste and Vent Piping:

1. Each pipe of ABS pipe shall bear the manufacturers identification mark and shall be certified by the manufacturer to have met the requirements of the latest ASTM specifications.
2. Aboveground: All aboveground soil waste and vent piping and fittings shall be type DWV and comply with ASTM D 2661, ASTM F 628, CSA B181.1.
3. Belowground: All belowground soil waste and vent piping and fittings shall be type DWV and comply with ASTM D 2661, ASTM F 628, CSA B181.1.
4. Belowground ABS Waste and Vent Piping Beyond 5' Outside Building: Shall be type DWV and comply with ASTM D 2661, ASTM D 2751 and ASTM F628.
5. Joints:
   a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.
   b. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.
   c. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

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 135 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 fewest 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.

3.2 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 221300

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 220529 – Hangers and Supports for Plumbing Equipment
4. Section 221116 – Domestic Water Pipe and Fittings

1.2 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Valves

B. Stops

C. Dryer

D. Outlets

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. 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.

2.2 FITTINGS

A. Black Pipe: Welded forged steel fittings of ASTM A 234-87, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures," or standard weight malleable iron screwed.

B. For copper, see Section 221116 – Domestic Water Pipe and Fittings.

2.3 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.

2.4 STOPS

A. Furnish Crane or Mueller stops as hereinbefore specified. Furnish union joints as required for removal of equipment.

2.5 OUTLETS

A. Furnish and install female quick disconnect couplers to suit Owner's equipment. Quality per U.S. MIL-C4109E

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 221500

SECTION 222000 - EXCAVATION AND BACKFILL FOR MECHANICAL 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 221116 – Domestic Water Pipe and Fittings

B. Section 221300 - Soil, Waste and Vent Piping System

1.3 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, "Uniform Building Code".
2. Local requirements for all utility work.
3. OSHA and WISHA regulations.
4. APWA Standard Specifications.

1.4 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 Design Consultant 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.

1.5 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:

D 422-63	Particle Size Analysis of Soils.
D 423-66	Liquid Limit of Soils.
D 424-59	Plastic Limit and Plasticity Index of Soils.
D 1557-78	Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inch (457 mm) Drop.
D 2167-66	Density of Soil In-Place by the Rubber Balloon Method.
D 2217-66	Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents.
D 2487-69	Classification of Soils for Engineering Purposes.
D 2922-81	Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
E 548-79	Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

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.

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 pipe, conduit or appurtenance structure.

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 C. 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.

1

Unified Soil Classification (USC) System (from ASTM D 2487)				
Major Divisions			**Group Symbol**	**Typical Names**
Course-Grained Soils More than 50% retained on the No. 4 sieve	**Gravels** 50% or more of course fraction retained on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the No. 200 sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

2 PART 3 - EXECUTION

3 3.1 EXCAVATION

4 A. If workers enter any trench or other excavation four or more feet in depth that does not meet the
5 open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The
6 Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the
7 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 BACKFILLIING at no additional cost to the Owner.

F. The Contractor shall provide any dewatering needed and is considered incidental to the Contract.

3.2 TRENCH EXCAVATION

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed unless shown otherwise on the drawings. Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

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 pipe and for bedding. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 inches or greater in any dimension, or as recommended by the pipe 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 pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe 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 pipe or to the lower curved portion of pipe arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Bell holes and depressions for joints shall be only of such length, depth and width as required for properly making the particular type joint. Provide bedding using pea gravel where noted on the drawings.

3.3 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, catch basins, inlets, or similar structures below 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 pipe, 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 3.07.

1. Trench Backfill: Trenches shall be backfilled to finish grade. The trench shall be backfilled to above the top of pipe prior to performing the required pressure tests (except that where piping requires insulation, the pipe shall have an initial test prior to insulating and then a final test as specified herein). The joints and couplings shall be left uncovered during the pressure test.
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 SPECIAL REQUIREMENTS

A. Special requirements for excavation, backfill, and bedding relating to the specific utilities are as follows:

1. Combination Fire/Water Lines: Trenches shall be a depth to provide a minimum cover of 3.5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Bedding shall use "special bedding" materials as specified in paragraph 2.07.

2. Domestic Water Lines: Trenches shall be of a depth to provide a minimum cover of 3.0 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Except that branch lines serving individual fixtures within building footprint shall have minimum of 1.0 foot cover. Bedding shall use "special bedding" materials as specified in paragraph 2.07.
3. Backflow Preventer Fire Vault: Provide special bedding as specified in this Specification Section.
4. Where piping passes under footings, provide concrete fill starting 12 inches above pipe for excavated length and width of footing above pipe for footing support. Concrete specification shall match same provided for footing.

3.7 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 other approved compaction equipment.

3.8 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 222000

SECTION 222100 - SLEEVES AND SEALS FOR PLUMBING 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

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.
2. Ducts: Silicone type sealant, designed for use with duct material involved as weatherproof sealant.

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 222100

SECTION 223226 – MANUAL BUS WASH SYSTEM

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. The general provisions of the Contract, including General and Supplementary Conditions apply to the work specified in this contract.

B. These specifications are performance based and it is the bus wash installers' responsibility to determine exact pipe routing, pipe sizes, elevations, equipment, etc. that will meet local jurisdiction and project drawing requirements.

C. Provide all material, labor, equipment, design, and services necessary to perform the installation and coordination of the bus wash system.

1.2 RELATED SECTIONS

A. General conditions, Division 1

B. Civil Sections

C. Mechanical

D. Electrical

1.3 QUALITY ASSURANCE

A. The system shall be produced by a manufacturer of established reputation with a minimum of five (5) years experience supplying specified equipment in similar applications.

B. Installation: Provide a qualified manufacturer's representative to supervise work related to equipment installation, check out and start-up. The general contractor shall meet with the manufacturer's equipment representative prior to installation.

C. Training: Provide technical representative to train Owner's maintenance personnel in operation and maintenance of specified equipment.

1.4 SUBMITTALS

A. Completed shop drawings coordinating the requirements of all trades including mechanical and electrical connections.

B. Product Data:
   1. Submit Product Data in strict accordance with requirements of these specifications.

2. Submittal engineering drawings must have the Floor Plan Views and the Isometric Views with bill of materials separately for the following:
   a. Equipment general layout
   b. Electrical layout
   c. Mechanical layout
   d. Any related in-ground electrical or mechanical installation
   e. Provide UL listing card or equivalent document of Nationally Recognized Testing Laboratories from the company building the electrical panel(s) and attach with the electrical drawings indicating that the electrical panels will be built to the required standards.
   f. Provide the Owner with the Sepias for all as-built drawings
3. Restrict submitted material to pertinent data. For instance, do not include manufacturer's complete catalog when pertinent information is contained on a single page.

C. Operation and Maintenance Manual
1. Assemble and provide copies of manual in 8.5 x 11 inch format. Fold out diagrams and illustrations are acceptable. Manuals to be reproducible by dry copy method.

D. Deviations From These Specifications:
1. No deviations from these specifications will be allowed unless approved by the owner in writing prior to bid closing. All equipment and equipment functions must be built and designed to these specifications.
2. Regardless of the owner's approval for any deviations and/or changes, the supplier is solely responsible for the performance of the supplied equipment as per these specifications.

E. Supplier's Qualifications:
1. The equipment specified herein is based on the system model (Wash Titan LYUS-TITAA) as supplied by InterClean Equipment, Inc. (800-468-3725) or engineer approved equal.
2. The wash system, high pressure cleaning systems, pumping stations and all electrical controls shall be designed and supplied by one supplier.
3. Supplier shall have been regularly engaged in the design and supply of the type of equipment specified herein, for a period of not less than five years. All similar items shall be the products of one manufacturer. The equipment offered shall be the latest standard product, modified as necessary to meet the requirements of this specification; of a type that has been commercially available and in satisfactory use for a minimum of 5 years.
4. All bidders shall submit with the bid package the following information for an approved equal status:
   a. A complete list of manual heavy duty vehicle wash system and water reclamation system installations made by the bidder. This list shall include all such manual vehicle wash installations made the bidder in the last five (5) years including the duration of the service and application. Should the reference list have more than 10 names, a list of last 10 installations shall suffice.
   b. Provide name of contact person at each location who is familiar with the operation and maintenance of the wash system.
   c. Based on the information supplied and discussions with contact persons named, the engineer will determine the acceptability of the proposed supplier and the equipment.

1.5 WARRANTY

A. Warranty work specified herein is for one (1) year from substantial completion against defects in materials and in labor and workmanship.
   1. Defects shall include, but not be limited to:
      a. Operation; Noisy, rough or substandard operation
      b. Parts; Loose, damaged and missing parts
      c. Finish; Abnormal deterioration

1.6 SCOPE OF WORK

A. To furnish a complete manual, heavy duty vehicle wash system utilizing 100% recycled water. This system shall include a high pressure, low volume, wand wash system. No low pressure, high volume hose reels shall be provided.

B. The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per these specifications.

1.7 WASH SYSTEM PERFORMANCE

A. Operation: The vehicle washer shall be actuated by a manual push button station located next to each hose reel station. All operations related to water recycling operations shall be automatic and require no operator control or input.

B. The supplier is solely responsible for the equipment performance. Should the equipment not perform, as per these specification requirements, the supplier shall modify, add and/or alter the equipment supplied at his own expense until the performance is satisfactory. The Owner shall approve all such changes. Should the performance criteria not be met after the changes, the supplier shall remove the system at no cost to the owner.

1.8 WATER RECLAMATION PERFORMANCE

A. The water reclamation system shall be capable of reclaiming water from the vehicle washer and process it by means of settling pits, in-line filters, centrifugal filter system and bio-remediation system. The system must be able to continuously supply adequate amount of water for high-pressure pump regardless of traffic volume through the washer.

B. Prior to final acceptance of the system by the owner, the supplier shall demonstrate the continuous operating capacity of the reclamation system in relation to the truck wash system by running (on manual override) both the high pressure wash system and the water reclamation system for a period of 60 minutes (without a pause). During the 60 minutes test no manual adjustments or overrides are allowed and no solenoid shall be allowed to fill the reclamation tank with fresh water should the sump pump capacity be not able to keep the recycled water tank full.

C. Regardless of technical specifications, the equipment supplier explicitly assumes the responsibility to design the water reclamation system for the intended purpose and has familiarized themselves with all performance requirements prior to bidding.

D. All equipment located outside the wash bay area including reclamation tank, high pressure pump, sump pump, aeration pump, booster pump, cyclonic separators and all float switches must be mounted on a single modular skid assembly. The total floor space for the reclamation skid shall not exceed 30 square feet.

E. The equipment module shall be tested for all plumbing connections (pressure tested), all electrical circuitry, pump rotations, and for all component functions at the factory prior to shipping.

F. The odors must be kept in total control without the use of any chemicals. The guarantee that the system is built to control odors must remain valid after the final acceptance for the period of three years. Algae build-up in wash water that will results in objectionable odors is not acceptable to the Owner.

G. The above ground tank or tanks must be of self-cleaning type and shall be designed not to accumulate any dirt build-up.

H. Bio-Remediation system shall be included in total system design. The bio-remediation system shall be designed to eliminate and/or reduce the total load of hydrocarbon loading within the recycled water body. The system shall include and consist of at least the following components:
1. Enzyme dispensing system
2. Accelerator dispensing system
3. Dissolved oxygen and aeration system

1.9 MECHANICAL INTERCONNECTING PIPING

A. The equipment module including recycle tank, high pressure pump, sump pump, booster pump, aeration and pit dirt removal pump is to be pre-plumbed and pressure tested prior to shipment to the site.

B. All field plumbing and mechanical work will be done by others (Mechanical Contractor), including:
1. Water and compressed air utilities up to and connecting to the equipment.
2. Interconnecting piping between various equipment components located in the equipment room.
3. Interconnecting piping between the equipment located in the equipment room and the equipment located in the wash bay.
4. Furnish and Installation of:
    a. Electric Wall Heater
    b. Backflow preventer (located in Building A Utility Room)

1.10 ELECTRICAL INTERCONNECTING WIRING

A. The equipment module including electrical panel, tank float switches, high-pressure pump, sump pump, booster pump, aeration and pit dirt removal pump is to be mounted on a single skid assembly (equipment module) and shall be pre-wired and tested prior to shipment to the site.

B. All field electrical work will be done by others (Electrical Contractor), including:
1. Electrical service up to and connecting to the equipment panel.

2. Interconnecting wiring between various equipment components located in the equipment room.
3. Interconnecting wiring between the equipment located in the equipment room and the equipment located in the wash bay.

1.11 WASH SYSTEM TECHNICAL SPECIFICATIONS

A. High Pressure Low Volume Pump
1. The high pressure low volume pump is of the diaphragm type as manufactured by Waner Engineering D35X and shall be capable of producing pressures up to 1200 PSI. The pump shall deliver a maximum flow of 24 GPM as determined by the nozzle sizes.
2. Brass Head, Buna-nxs diaphragms, 17-4 hardened stainless steel seats and valves, elgiloy valve springs, and celcon valve spring retainers. Pump operates at 700 rpm for 24 gpm at 1200 psi with a 25 hp motor.
3. Base, blue epoxy coated steel base to accommodate a 25 horse power TEFC 284T Frame Motor, 284T sliding motor base.
4. Brass body with hardened 17-4 SS plunger and seat.

B. Electric Control Panel and Components
1. The Industrial Control Panel shall be manufactured and evaluated in accordance with the Underwriters Laboratories, Inc. (UL) standard 508A (Industrial Control Panels). In addition, the panel shall be evaluated for high-capacity short circuit withstand and shall bear the appropriate UL marks including the short circuit withstand value mark as part of the official UL label.
2. The industrial Control Panel shall be designed for operation on a 460 Volt, 3 phase, 60 Hertz system, with a short circuit capacity of 25,000 amperes RMS Symmetrical, available at the incoming line terminals of the control panel.
3. The Industrial Control Panel shall be designed to meet the requirements of the National Electric Code (NEC) Articles 430 and 670, also the National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).
4. The hose reels shall have start/stop push button station location by each high pressure wash wand station.
5. Electric Panels that are not UL approved are not acceptable.
6. Each activator shall be pre-mounted and wired to a water tight junction box equipped with built-in drainage holes.

1.12 WATER RECLAMATION AND TREATMENT SYSTEM SPECIFICATIONS

A. Sump Pump:
1. Self priming type for transferring water from sump pit to the above ground recycled water tank through the filtration system. Minimum capacity shall be 300 gpm of cleaned water.
2. The capacity of sump pump shall allow for the pressure losses from two cyclone separators used in series and GPM after the pressure losses shall be bigger or equal to the high pressure wash water usage.
3. The sump pump shall be designed to handle solids that will be found in wash water.

B. Cyclone Separators:
1. Two (minimum) cyclone separators used in series, the cleaned water from the first cyclone shall pass through the second cyclone separator to ensure maximum solid removal performance. Two cyclone separators shall be provided in series with at least one of them being in-line.
2. Cyclone Centrifugal Separators shall provide second and third stage filtration.

C. Cyclone Solid Removal:
1. Downflows (purge water from cyclone separators containing solids) from cyclones separators shall be pumped back to the exit end of the trench pit with a solid handling pump. The solid removal pumping shall be activated when cyclone separators need to be purged. Solid removal from cyclone separators by gravity alone shall not be acceptable.

D. Aeration System:
1. Aeration system shall provide air into the trench pit to prevent algae and odor build-up. Aerated water shall be evenly distributed throughout the pit even when the wash system is not operational. The system shall be designed to have no odors from algae. No odor masking deodorants or other chemical used to kill odors shall be allowed.

E. Stainless Steel Pump Intake Filter:
1. Stainless Steel Intake Filter Screen to provide first stage filtration for sump pump intake. The pump intake filter shall be InterScreen or engineer approved equal and shall be sized 0.015" or smaller.
2. The intake filter shall be made of stainless steel and shall have slotted orifices; wire mesh filters are not acceptable. Intake filter shall prevent any dirt from clogging the recycled water spray nozzles under all circumstances.
3. Intake Filter Screen shall be equipped with high-pressure air back wash system that is automatically activated by the reduced flow into the pump intake.

F. Reclamation Tank:
1. Reclamation Tank shall be made of linear low-density polyethylene with a minimum holding capacity to allow recycling a minimum of 250 GPM continuous operational flow.
2. The tank shall have conical bottom with minimum of 35-degree slope equipped with a 6" bottom manhole, float switch connections and other required fittings. The tank shall be equipped with steel support structure with ½" thick polyethylene continuous support for the cone part of the tank.

G. Enzyme-Catalyzed Water Treatment System:
1. A biological water treatment system shall be included in total system design. This water treatment system, the Enzyme-Catalyzed Water Treatment System, shall be designed to eliminate and/or reduce the total petroleum hydrocarbon loading within the recycled water body. When used in conjunction with the specified recycling equipment, the systems shall remove both organic contaminants and inorganic particulate from the reclaimed water stream.
2. The Enzyme-Catalyzed Water Treatment System shall be equipped with an automatic product injection system for delivery of specialized biological products and enhancements. These biological products shall be specifically suited for wash water treatment applications, including degradation of petroleum hydrocarbon components commonly found in vehicle wash systems. This system will treat the reclaim wash water generated during the vehicle wash process. The bulk of the treatment process shall take

place in the wash water pit, where continuous biological treatment of organic wastes in the vehicle wash water shall occur.

3. The Enzyme-Catalyzed Treatment System shall deliver a constant supply of biological products, bio-enhancements, and oxygen to support degradation of organic constituents. The biological products and enhancements shall be injected directly into the circulation/aeration discharge pipeline of the recycling system, where they will then subsequently be discharged into the wash water pit. Oxygen shall be provided by the aeration pumping and mixing system.
4. The automatic product injection system shall consist of low-flow injector pumps that inject biological products on a continuous basis. The injector pumps shall be:
    a. Operating Temp -35 – 110° F
    b. Product Flow rate -0.5-1.5 liters per day, adjustable
    c. Product Delivery -Up to 10 feet of 3/8-inch diameter polyethylene tubing
    d. Two 3/8-inch NPT polyethylene check valves
    e. Two 3/8-inch compression fittings

H. Hose and High Pressure Lances:
1. Two required high pressure guns to include lance, gun, nozzle (10 gpm each), 50 feet high pressure hose, and wall hooks for hose.
2. Each high pressure gun station to include 24 VDC control station with pilot light for system activation.
3. High pressure hoses shall have quick disconnect fitting attached to the piping to allow for easy removal and storage of the hose and lance.
4. Freeze protection valves shall be supplied and installed in the hard piping just prior to the quick disconnect of the high pressure hoses.

PART 2 - INSTALLATION, START-UP, TRAINING AND SERVICE

2.1 GENERAL

A. Install equipment in accordance with manufacturers' supplied installation drawings.

B. Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.

C. The equipment manufacturer shall start-up the system. The owner shall have all operating personnel present during the start-up and equipment training.

D. The supplier shall arrange adequate amount of detergent for the performance testing.

E. The owner’s personnel shall be trained for a minimum of 5 hours in the system operation and maintenance.

F. The supplier shall provide the owner the names and the addresses of all local service and maintenance personnel to assist in future service.

G. Acceptable Manufacturers
   1. Interclean
   2. Or pre-approved equal

END OF SECTION 223226

`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.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. State

B. Lochinvar

C. Rheem/Ruud

D. Bradford White

2.2 COMMERCIAL HEATER

A. The heater(s) shall be as scheduled. The heater shall be for (vertical) 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 223300

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

D. Section 221117 – Crosslinked Polyethylene (PEX) Piping System

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.

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. Stainless Steel Sinks:

1. Just
2. Elkay

C. Stainless Steel Shower:

1. Bradley
2. Willoughby Industries
3. Acorn

D. Supply Stops:

1. Chicago Faucets “STB” Series, Loose Key
2. Engineers Brass Company (EBC) “LAH” Series, Loose Key
3. BrassCraft “KT” Series, Loose Key

E. Faucets:

1. Chicago Faucets
2. Zurn
3. Symmons
4. Toto
5. Speakman
6. Moen
7. Delta

F. Waste:

1. EBC
2. Just
3. Elkay

G. Traps:

1. EBC
2. Just
3. Elkay
4. Dearborn Brass

H. Flush Valves:

1. Sloan
2. Zurn

3. Geberit
4. Toto
5. Moen

I. Stainless Steel Lavatories and Water Closets:

1. Bradley
2. Willoughby Industries
3. Acorn

J. Drinking Fountains:

1. Halsey Taylor
2. Haws
3. Oasis
4. El Kay
5. Acorn

K. Fiberglass Showers and Combination Tub/Showers:

1. Fiberfab
2. Lasco

L. Shower Valves/Bath & Shower Valves:

1. Bradley
2. Symmons
3. Powers
4. Speakman
5. Moen

M. Service Sinks:

1. Florestone
2. Fiat

N. Emergency Eye Wash & Showers:

1. Haws
2. Guardian
3. Bradley
4. Speakman
5. Acorn

2.2 FIXTURES

A. See Schedule on Drawings.

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 #56010

B. Resilient Flooring:

1. Zurn ZN-1400-X
2. Smith #4143
3. Wade #W-6000-T
4. Josam #56010-12

C. Finished Wall:

1. Zurn Z-1468
2. Smith #4472
3. Wade #W8460R
4. Josam #58890

D. Exposed Drain Lines:

1. Zurn Z-1441
2. Smith #4402
3. Wade #W8560A
4. Josam #58510

E. General Purpose:

1. Zurn Z-1441
2. Smith #4402
3. Wade #W8550A
4. Josam #58500

2.5 CARRIERS

A. Urinal carriers in stud wall:

1. J.R. Smith: 0637
2. Zurn: Z-1222
3. Wade: W400

B. Lavatory carriers in stud wall:

1. J.R. Smith: 0700 (0700Z for 2x4 stud wall)
2. Zurn: Z-1231
3. Wade: W520

C. 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:

1. Zurn: Z-1310
2. Wade: W-8620 with union elbow
3. Smith: 5609
4. Josam: 71050
5. Woodford: 65
6. Jones Spec: 51010

B. Wall Box Hydrants: Freezeproof type with integral anti-siphon device:

1. Jay R. Smith: 5509QT
2. Zurn: Z-1300

2.7 HOSE BIBBS

A. Approved types with integral vacuum breaker, chrome plated face and loose key. J.R. Smith FIG 5618.

2.8 STAINLESS STEEL SINK

A. All stainless steel drop-in-bowl sinks shall be seamless 18 gauge type 304 and have corrosion resistant mounting channel, sprayed on sound deadening compound fully coating underside of sink, and polished surface. Verify amount of hole punches required for each sink prior to ordering.

2.9 HOT WATER DISPENSER

A. Hot water dispenser shall be U.L. listed, 750 watts, 6.5 amps, 115 volts, factory mounted 3 wire cord and 3 prong plug, adjustable thermostat with range of 140°F to 200°F. ½ gallon storage capacity with faucet having chrome plated finish. Refer to manufacturer's installation manual for proper installation. Provide shut-off valve in supply line to unit, install in back left or back right corner of sink.

B. Approved Manufacturers:

1. In-sink-erator (ISE)
2. Other manufacturers will be allowed by prior approval only. To request approval, the manufacturer must provide an equipment layout showing how the proposed equipment will fit in the space and meet all access requirements. This manufacturer must include in the cost of the proposed equipment, at bid time, the difference in piping, electrical, etc.

2.10 SENSOR FAUCET

A. The sensor faucet shall be battery powered, have an infrared convergence type proximity sensor battery compartment, access to controls and battery through spout. Provide with vandal resistant aerator as indicated on plans, cover plate to match hole pattern of lavatory, and supply hose(s). The spout and cover plate shall be chrome plated cast brass.

PART 3 - EXECUTION

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 precedent 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. WC: 14" to 16" to rim from floor.
      b. Urinal: 24" from floor to bottom lip.
      c. Lavatory: 29" from floor to top of apron.
      d. 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. Provide concealed arm supports for wall mounted china lavatories.

G. All exposed metal shall be chrome-plated brass.

H. Provide concealed heavy steel stanchion and supporting plate for lavatories and urinals.

I. 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.

J. Provide flush valve supply support on all WC and urinal carriers.

K. All fixture mounting heights shall be verified or determined on site prior to installation. Coordinate with architectural drawings.

L. Install (1) bellows type water hammer arrester (at each quick acting valve). Jay R. Smith Hydrotrol, Sioux Chief Manufacturing, Zurn Shoktrol or approved equal and 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

Fixtures Units	Water Hammer Arrester Size
1-11	JR Smith #5005 (4" High Shell)
12-32	JR Smith #5010 (5" High Shell)
33-60	JR Smith #5020 (6" High Shell)
61-113	JR Smith #5030 (7" High Shell)
114-154	JR Smith #5040 (8" High Shell)

M. Provide trap primer and connection to p-trap of showers, floor sinks, floor drains, and service sinks.

N. ADA showers shall be installed with entrance lip flush with finish floor.

O. On ADA water closets, provide flush valve handle or tank handle on side facing wheelchair turn around.

P. 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.

Q. 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.

R. 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.

S. Wall Hydrant: Install at 18" above finished grade, unless otherwise indicated.

T. Lavatory 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.

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:

Fixture	Standard
Flushometer-valve WC	1.6 gal. (6.0 liters) per flush
Urinals-sensor operated flushometer	0.125 gal. (0.5 liters) per flush
Showerheads	2.5 gal. (9.5 liters) per minute
Lavatory Faucets (metered)	2.5 gal. (9.5 liters) per minute
Lavatory Faucets (non metered)	0.5 gal. (1.89 liters) per minute
Kitchen Faucets	2.5 gal. (9.5 liters) per minute
Public Lavatory Faucets (other than self-closing)	0.5 gal. (1.89 liters) per minute
Replacement Aerators	2.5 gal. (9.5 liters) per minute

END OF SECTION 224000

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 7-05 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)
3. Seismic Restraint Manual – Guidelines for Mechanical Systems (SMACNA)
4. ASCE 7-05, 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

B. Section 200000 – General Mechanical Requirements

1.4 DESIGN CRITERIA

A. Occupancy Category of Structure (I-IV) per IBC or ASCE 7-05

B. Component Importance Factor (Ip) per ASCE 7-05

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 7-05

J. Response Modification Factor Rp per ASCE 7-05

1.5 SUBMITTAL REQUIREMENTS

A. Isolation Pads

B. Seismic Control:

1. Periodic Special Inspections: The mechanical contractor shall provide a list of components/systems requiring periodic special inspections per IBC.
2. 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.
3. 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 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. 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.

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 compressors, condensation pumps, 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 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.

C. Provide seismic bracing for hot water tanks.

D. Housekeeping pads shall be properly anchored to the floor per ASCE 7-05.

3.3 SEISMIC BRACING GENERAL REQUIREMENTS - PIPING

A. When determining horizontal load requirements, consider all pipes full of water and maximum equipment heights unless 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 NFPA-13.

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 7-05. 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.

END OF SECTION 230548

SECTION 230553 - MECHANICAL IDENTIFICATION FOR HVAC PIPING & 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.

PART 2 - PRODUCTS

2.1 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.

2.2 PLASTIC TAPE

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6".

2.3 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.

2.4 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.

2.5 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 items on equipment schedules.

C. Provide for all emergency shut-offs.

D. Provide for all pressure vessels, storage tanks, air separators, etc.

2.6 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 intermediately 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 intermediately 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).

Service	**Color**	**Stencil**
Refrigerant Liquid	Yellow	White
Sprinkler Work	Red	White
Condensate Piping	Green	White

B. Identification stenciling and flow arrows shall be following colors for proper contrast:

Arrows & ID Stenciling	**Color Shade of Pipe**
White	Red, Gray, Black and Green
Black	Yellows, Oranges and White

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, convenience and lawn watering hose bibbs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in Valve Schedule for each piping system.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operation device. Provide signs for the following general categories of equipment and operational devices. Provide signs on suspended ceiling tile below mechanical equipment located above ceiling.

1. Pumps and similar motor-driven units.
2. Fans, exhaust, and air handling units.
3. Tanks and pressure vessels.

3.6 FIRE AND FIRE/SMOKE DAMPER IDENTIFICATION

A. Furnish and install label reading "FIRE DAMPER" or "FIRE/SMOKE DAMPER" on each fire damper duct access door. Provide additional labels at locations where external duct insulation covers the access door. Install on outside of insulation.

3.7 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:

ITEM	**COLOR**
Heating System Equipment Component	Green
Fire Protection System Component	Red

END OF SECTION 230553

SECTION 230593 - AIR SYSTEM TESTING & 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 01 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.

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)

PART 3 - EXECUTION

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 controls 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.

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.
2. 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.
3. Rebalancing shall be done in presence of Architect and subject to his approval.
4. Spot balance and rebalance shall be performed at no additional cost to Owner.
5. System shall be completely balanced and all reports submitted to Architect prior to prefinal inspection.
6. 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. MTW Design Services

D. Airtest Company, Inc.

E. American Air Balance Company

F. Advanced Mechanical Services, Inc.

G. United Test and Balance

END OF SECTION 230593

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

C. Section 233113 - Steel Ductwork

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Wrap Insulation

PART 2 - PRODUCTS

2.1 DUCTWORK INSULATION

A. Manufacturers: Manville Corporation Owens Corning, Knauf 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 B/cu.ft.
   b. R-6.8: 1.5” of 6.0 B/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.
3. Manville Zeston 2000 jacketing, UV resistant polyvinyl chloride covering with joints secured and sealed with Manville Perma-Weld Adhesive.
4. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. (220 g/sq. m.), plain weave cotton treated with dilute fire retardant lagging adhesive.
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.

2.2 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):

DUCT TYPE AND LOCATION	**LINER**	**WRAP**
Within Conditioned Space:		
- Supply Air	R - 3.3[4]	R - 3.3
- Return Air	R - 3.3[4]	R - 3.3
- Relief Air	Not Required	R - 3.3[2]
- Transfer Air	R-3.3	Not Required
- Exhaust Air	Not Required	Not Required[2]
- Outside Air	Not Required	R - 7[1]
In cold attic, in cold ceiling space, in cold wall, in cold garage, in cold crawl space:		
- Supply Air	R – 6[3]	R – 6[3]
- Return Air	R – 6[3]	R – 6[3]
- Relief Air	Not Required	Not Required
- Transfer Air	Not Required	Not Required
- Exhaust Air	Not Required	Not Required
- Outside Air	Not Required	Not Required

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.

4 Use liner for the first 10' of duct, then use wrap insulation.

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. Relief Air: Air from the conditioned space to the outdoors or to a large semi-conditioned or non-conditioned space.

4. Transfer Air: Air from one conditioned space to another conditioned space.
5. Exhaust air: Air from a space moved by a fan to directly outside. Also, air downstream of a heat recovery device to directly outside.
6. 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 230713

SECTION 230900 - CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnishing and installing of automatic temperature control system as described in Contract Documents.
2. Furnish and install conductors and make connections to control devices and equipment. Furnish and install exposed raceway (conduit) in Mechanical Rooms, and areas where owner may store items. Conduit is not required where equipment to be controlled is above an attic walkway; however, special care shall be taken to bundle plenum rated wires and install as high as possible.
3. Calibrate, adjust and set controls for proper operation, operate systems and be prepared to prove operation of any part of control system. This work is to be completed before prefinal inspection.
4. Provide relays and equipment as required for HVAC shutdown of all air moving equipment on signal from fire alarm panel. See Section 200000.

B. Related Sections:

1. General Conditions, Division 1, and Section 200000 apply to this Section.
2. Division 26 - Power wiring to equipment.

1.2 SYSTEM DESCRIPTION

A. Design Criteria:

1. Install line and low voltage electrical wiring in accordance with Division 26 of these Specifications.
2. System controls shall be single manufacturer's products.

1.3 SUBMITTALS

A. Shop Drawings: Provide three copies of shop drawing submittal data for review. See Section 013400 for definitions and procedures.

B. Operation & Maintenance Data: Upon completion of work of this Section and prior to final inspection, provide two copies of "as-built" ATC diagrams, schematics, Catalog cuts, Maintenance instructions, and written operating sequence for each furnace/fan system to be included in Operation & Maintenance Manual specified in Section 200000.

PART 2 - PRODUCTS

2.1 ROOM THERMOSTATS

A. Programmable low voltage type provided with automatic change over feature for both heating and cooling stages, seven-day program with one start and stop per day with three-hour override, and provisions for damper operators. Thermostat shall be capable of at least 5°F deadband between heating and cooling setpoints.

B. Approved Models - (No Substitutes):

1. (Without Sensors) - Honeywell Y7300A1038 with plastic clear keyed locking guard TG501A1002 with solid plastic base.

2.2 CONTROL MODULES

A. Approved Models:

1. Zones Not Using Economizer - Honeywell W7300A1001
2. Zones Using Economizer - Honeywell W7301A1000

2.3 SAFETY CONTROLS

A. Manual reset fire protection thermostat with 125 deg F high limit setting mounted in return air stream.

B. Approved Models: Honeywell L4029E1227.

2.4 THERMOSTAT GUARDS

A. Thermostat shall have Shaw Perkins cam key locking, heavy-duty perforated metal guard painted as directed by Architect. Provide two keys.

B. Guards for horizontally mounted thermostats shall be Shaw Perkins TGH-161 with cam key locking cover.

2.5 SWITCHING SUB-BASE

A. "Fan selector switch" with ON-AUTO modes for each fan system.

B. Approved Model: Honeywell Q7300D1003

2.6 RELAY

A. Approved Model - 24 volt coil 2PDT Honeywell R8222D1014

2.7 DAMPER ACTUATORS

A. Equipped for Class I wiring.

B. Have built in spring return.

C. Shall not consume power during UNOCCUPIED cycle.

D. Shall not use chemical or expandable media.

E. Electric type.

F. Approved Models:

1. Zones Not Using Economizer - Honeywell M836A1042
2. Zones Using Economizer - Honeywell M945A1017 with cover transformer

2.8 SINGLE STAGE THERMOSTAT (Conventional)

A. Heating and cooling type with two or three wire wall plate for heating-only, cooling-only, or heating, cooling systems with remote switching heat/cool anticipator. Subbase in systems requiring system and fan switching at the thermostat location. Separate temperature setting and thermometer scale on thermostat face. Dustproof, SPDT mercury switch, thermostat guard (Lexan).

2.9 CONDUCTORS

A. Color coded and #16 AWG Type TFN or THHN.

2.10 MIXED AIR LO-LIMIT SENSOR

A. Approved Model: Honeywell - C7046A1004.

2.11 MODULAR MOTOR INTERFACE:

A. Approved Model: Honeywell - Q7301A1008

2.12 BONNET SWITCH

A. Install bonnet switch in discharge duct of duct heater to control fan ON-OFF. Install 4 inches maximum from heater. Clip off lever after setting to automatic position.

B. Approved Model: Honeywell L4068E1054

2.13 REMOTE SENSOR

A. Approved Model: Honeywell T7047C 1025

2.14 REMOTE SWITCH

A. 2PDT Subminiature rated at 5 amp, 120 volt.

B. Approved Manufacturer & Model: Sprague QSP-111701.

2.15 DAMPERS

A. Control Dampers: Provide low leakage control dampers where not furnished with packaged units. Damper leakage rate shall not exceed 7 cfm/sq ft at 1" wg. Blade seals shall be extruded vinyl; jamb seals, flexible stainless steel compression type. Dampers shall have blade seals and stops, Ruskin CD-36 or approved American Warming and Ventilation.

B. Damper and Valve Actuators: All actuators are to be supplied and installed by the Control Contractor. Provide in sufficient size, quantity and type matched to application. Proportional or 3 point floating as required, suitable for analog or pulse width modulation control or with solid state positioner. Electric end switches to stop automatically at end of travel and shall include a permanently lubricated gear train. Provide spring return closing upon loss of power on all outside air dampers for freeze protection. Damper actuators shall be mounted directly on the damper shafts.

1. Whenever feasible, damper location and arrangement shall be coordinated with the sheet metal contractor such that interconnecting linkage with a single economizer actuator can be utilized. Where this is not possible, multiple actuators may be used and shall be of the analog or proportional type to assure positive position control. Where multiple actuators are necessary, a three point floating actuator may be used as the master actuator; however, the slave unit shall be positioned using a feedback potentiometer in the master feeding a proportional slave actuator. Multiple three point floating actuators connected in parallel are not acceptable.
2. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper or valve throughout its operating range. Actuators shall be heavy duty reversible type with driving motor and gear train or hydraulic, completely submerged in oil and sealed in die cast case.
3. Proportional actuators shall have a built in electro- mechanical system to provide for positive repeatability of position regardless of change in output load. All outside air damper actuators shall be spring return type.

2.16 SAFETY CONTROLS

A. Ionization smoke detector mounted in air stream. Detector to operate on 120 volts AC.

B. Install on systems greater than 2000 CFM.

C. Approved Manufacturers and Models: Duct mounted smoke detector by, "BRK Electronics."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Run all wiring in conduit.

B. Safety Controls:

1. Mount fire protection thermostat in return air duct of each heating and/or cooling system and interlock to keep heating and cooling from operating if return air temperature rises above 125°F. If it is physically impossible to mount firestat in return air duct, mount in mixed air plenum as close to return air duct as possible.
2. Interlock gas valves with cooling compressors and supply air fan.
3. Gas valves shall obtain their electrical control power from same circuit as supply fan motor.
4. Check high limit thermostats furnished with heating equipment for correct operation. Gas valves shall close when duct temperature exceeds high limit setting. Perform this work immediately after wiring burner controls.
5. Bonnet thermostatic switches furnished with heating equipment shall be wired to dissipate all heat in combustion chambers.
6. Fresh air dampers shall close on fan shut-down, power failure open fan motor disconnect switch and when thermostat is in UNOCCUPIED mode.
7. Gas burner safety controls furnished with furnace units shall be incorporated in control circuits for all modes of operation.
8. Control furnace systems with two or more furnaces serving common zone as one unit with twining kit. Motors shall start and stop together and gas valves operate together.

C. Mount Room Thermostats 4'6" from floor to bottom of thermostat.

D. Mount damper actuators and actuator linkages external of air flow.

END OF SECTION 230900

SECTION 231000 - FUEL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. This section includes construction related to the design and installation of a pre-packaged fuel system equipment. Included are design requirements, installation and testing of aboveground fuel storage tank, turbine pump, fuel dispenser, card reader equipment, service station equipment, card reader booth, tank leak detection equipment, conduit and wiring including connections and testing. Items, including fuel tank, are furnished and installed by Contractor.

B. In addition to the requirements of this section, site work of this section shall comply with requirements of Division 02000, SITE CONSTRUCTION; concrete work of this section shall comply with requirements of Division 03000, CONCRETE; and structural canopy work shall comply with requirements of Division 05000, METALS.

1.2 RELATED SECTIONS

A. 023000 Earthwork

B. 027510 Cement Concrete Pavement

C. 033000 Cast-In-Place Concrete

D. 036000 Grout and Underlayments

E. 051200 Structural Steel

F. 200000 General Mechanical Requirements

G. 220553 Mechanical Identification

H. 222000 Excavation and Backfill for Mechanical Underground Utilities

1.3 REFERENCES

A. NFPA 10 - Portable Fire Extinguishers.

B. NFPA 30 – Flammable and Combustible Liquids.

C. NFPA 30a – Motor Fuel Dispensing Facilities and Repair Garages.

D. NFPA 70 - National Electrical Code.

E. International Fire Code (IFC), current version

F. UL 2085 – 2-Hour Fire Rated Above Ground Tanks

G. NECA - Standard of Installation.

H. Washington State Administrative Code (WAC 51-44-5200 and WAC 51-44-7900)

I. National Electrical Code (NEC), current version

1.4 AREA CLASSIFICATION SCHEDULE

A. Fuel dispensers and island: ANSI/NFPA 70; Class I, Divisions 1 and 2, group D.

B. Building Classification: ANSI/NFPA 70, Gasoline Dispensing and Service Stations.

1.5 QUALITY ASSURANCE

A. Fuel System Installer Qualifications:

1. Provide proof of license, registration and certificates required to install and service fuel systems in State of Washington.
2. Provide certification for installing and testing as approved contractor by system manufacturer. Contractor shall provide evidence of certification to State prior to installation.
3. Provide minimum two years documented experience installing gasoline fuel systems.

B. Fuel system installer shall provide shop drawings to coordinate the location and routing of all pipe, equipment, tanks, signs, and device with all other trades working on-site. Shop drawing shall be submitted to Engineer/Architect prior to work commencing.

1.6 REGULATORY REQUIREMENTS

A. Comply with current edition of National Electrical Code, National Electric Safety Code, IFC, NFPA 20, NFPA 72, NFPA 110, NFPA 10, local codes, ordinances and requirements of utility companies furnishing services to installation.

B. Comply with NEMA, UL, ANSI, ICEA and other industry standards.

C. Comply with Factory Mutual Global Loss Prevention Data Sheets 7-88 (storage tanks for flammable liquids and 1-11 (Fire following earthquakes).

1.7 SUBMITTALS

A. Submit design documentation and product data of all equipment.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit inspection certificates in O&M Manual. Include certificate of final inspection and acceptance from authority having jurisdiction.

B. Submit manufacturer's operation and maintenance data.

C. Provide data for:

1. Mechanical equipment and controls.
2. Electrical equipment and controls.

D. Directory, listing names, addresses, telephone numbers of: Contractors and sub-contractors.

E. Operation and maintenance instructions. Give names, addresses, and telephone numbers of subcontractors and suppliers.

F. List:

1. Appropriate design criteria.
2. List of equipment.
3. Parts list.
4. Operating instructions.
5. Maintenance instructions, equipment.
6. Maintenance instructions, finishes.
7. Shop drawings and product data.

G. Warranties.

H. Fire extinguishers: Include test, refill or recharge schedules, procedures, and re-certification requirements including requirements applicable to Work.

PART 2 - PRODUCTS

2.1 EXTERIOR SIGNS

A. Provide and install IFC decals, signs and labels as required by local Fire Marshal and per code. (I.E.; ”NO SMOKING-STOP YOUR MOTOR WHILE REFUELING” and “NO DISPENSING INTO UNAPPROVED CONTAINERS”)

B. Stock Painted Signs: Aluminum sign base sheet metal, white field, red letters, rounded corners, stock bold lettering.

C. “EMERGENCY FUEL SHUTOFF” required at emergency switch location. A emergency sign shall read “In case of fire, spill or release”. Stock or custom aluminum sign. 1- 1/2-inch lettering.

1. Use emergency pump shutoff
2. Report the accident! Fire Department telephone No. , Facility Address

D. Provide operating instructions sign on every dispenser; include the location of the emergency controls on the sign.

2.2 FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

A. Fire Extinguishers: Multi-purpose Dry Chemical Type: Heavy-duty steel tank, with pressure gage, exterior use. 20:A; 120 B: C. Red enamel finish.

B. Cabinets: Formed heavy steel, weatherproof, rust proof, primed and factory-finished in red color; surface-mounted type, size to accommodate accessories. Form body of cabinet with tight inside corners and seams. Pre-drill holes for anchorage. Form perimeter trims and door stiles by welding, filling, and grinding smooth.

C. Cabinet Interior: white or red enamel.

D. Door: Factory red baked enamel finished steel. Install handle operation decal on door. Hinge doors for 180 degree opening with continuous piano hinge. Provide locking hasp.

E. Glass: Break-a-way plastic panel at handle only.

F. Acceptable Manufacturers:

1. J. L. Industries, Bloomington, MN.
2. Larsen's Manufacturing Company, Minneapolis, MN. Model 2712 SM.
3. Kidde Manufacturing Company.
4. AMEREX No. 423 Extinguisher.

2.3 FUEL TANK

A. Aboveground Storage Tank Double-Wall: Containment Solutions (or approved equal tank meeting UL-2085) with openings as required for proper installation removal and maintenance of equipment for a complete, functional, code-compliant system in accordance with these specifications. Tank shall feature Cylindrical construction, (1) 24” watertight manway with (4) 4” FNPT fittings per compartment (5) 4” shell Wall Fitting per compartment, 2” Interstitial Monitoring Port. Tanks shall be 10,000 gallon capacity, split 6,000 gallon gasoline/4,000 diesel.

2.4 FILL SYSTEM

A. The tank shall be equipped with a grade-level fill system. The fill system shall be 4”.

B. Fill equipment shall include:
1. Minimum 5 Gallon Fill Box with drain valve, Morrison 715
2. Overfill Prevention Valve: Morrison 9095 A, or approved equal
3. Aluminum Drop Tube: Morrison 419, 4”, or approved equal
4. Fill Cap & Adapter: PT30A with 30VL cap, or approved equal
5. Vapor Recovery Cap and Adapter: OPW 1611AV w/ 1711T Cap (Gasoline Tank Only)

2.5 VENTS

A. The tank system shall utilize the following vent devices:

1. Diesel Atmospheric Vent: Protectoseal 6670 series Flame Arresting Vent Cap, or approved equal
2. Gasoline Atmospheric Vent: Husky model 5885 Pressure/Vacuum Vent, or approved equal
3. Atmospheric Vents to terminate a minimum of 12’ above grade.

2.6 TANK MONITORING SYSTEM:

A. Provide tank monitoring and leak detection system for above ground storage tank and fuel dispensing system. Contractor is responsible for providing (and coordinating) complete wall mounted tank monitoring system, installed by authorized personnel ready for use, meeting State, City and/or County code requirements that are required for complete system.

B. Monitoring Panel Standard features shall include:

1. RS-232 Communication Interface to computer for remote monitoring.
2. Automatic continuous leak sensing of tank interstitial spaces and sumps.
3. Audible alarm and display of indicated leak locations.
4. In-tank warnings and alarms for leak, overfill, low product, sudden loss, high water, delivery needed, test failure, tank test not performed.
5. Discriminating Interstitial, piping sump and dispenser sump alarms for fuel or water.
6. (4) Output relays for overfill alarm and audible and visual warning devices.
7. Ability to monitor a minimum of (8) storage tank and (24) Leak Sensors.
8. Monitor to be OPW Site Sentinel iSite panel for remote monitoring.

C. Tank Level Probes: Tank probes shall utilize magnetostrictive technology and be capable of temperature compensation, in-tank leak detection and fuel and water level detection. Level probes shall incorporate fault detection and be manufactured by the console manufacturer.

D. Sensors: Leak sensors shall be product distinguishing and capable of sensing the presence of ½” of liquid. Sensors shall incorporate fault detection and be 3rd party certified, and be manufactured by the console manufacturer.

E. Overfill Alarm: Overfill alarm shall provide audible and visual indication of high tank level. Alarm to be NEMA 4 outdoor rated, UL listed as part of the tank monitoring system, and incorporate a manual silence switch. Overfill alarm shall be manufactured by the console manufacturer.

F. Install system and setup per factory requirements to insure full factory warranty. Contractor is responsible for providing (and coordinating) complete wall mounted system and ready for use. Wiring type shall be per manufacturer’s installation manual and installed in strict accordance with manufacturer’s written instructions.

G. Start-up and Training: Contractor shall provide start-up and training services by a factory certified technician. Training to be a minimum of (4) hours and include manuals and documentation for no less than (6) Pierce County personnel.

2.7 FUEL ISLAND TERMINAL WITH INTEGRATED FUEL MANAGEMENT SYSTEM

A. Provide OPW C/OPT fuel system control including island terminal with OPW FSC3000 integrated fuel system controller.

B. Fuel Island Terminals, (FIT), shall include Mag-stripe card reader, 2 by 16 character backlit display, thermostatically-controlled heater, pocket lights, reader dust cover and pedestal.

C. Provide Petrovend 20-4161, 2 hose pump control kit, quantity as required for the application.

D. Provide Petrovend 20-4168 pocket weather shield.

E. Provide Petrovend 20-1478 PC/CRT cable.

F. Install system and setup per factory requirements to insure full factory warranty. Contractor is responsible for providing (and coordinating) complete wall mounted system and ready for use. Wiring type shall be per manufacturer's installation manual and installed in strict accordance with manufacturer's written instructions.

G. Dispensing system shall have the capability to preprogram each dispensing card to limit the quantity of dispensed fuel without a manual reset per IFC.

H. Start-up and Training: Contractor shall provide start-up and training services by a factory certified technician. Training to be a minimum of (4) hours and include manuals and documentation for no less than (4) Jefferson County personnel. Contractor shall coordinate connection with OPW isite.

I. Owner to provide Phoenix Software, Contractor to install.

2.8 POWER CONDITIONER:

A. Power conditioner shall be hardwire type.

B. Output capacity shall be 1000 VA. Voltage regulation shall be plus or minus 3 percent for input variation of plus10 to minus 20 percent.

C. Input voltage shall be compatible to Pierce County's building electrical service. Output voltage shall be compatible with fuel system's electrical requirements.

D. Provide with 10-year warranty.

E. Sola MCR #63-23-210-8, as manufactured by Sola/Hevi-Duty, PO Box 268, Goldsboro, NC 27533 (800) 377-4384.

F. Mount near the OPW isite.

G. Connect card reader, card reader controller, OPW isite, and modem to power conditioner. See electrical diagram.

2.9 FUEL DISPENSER

A. Single hose, compact fuel dispenser, UL rated, with flow rate up to 22 gpm. Gallon display with mechanical totalizer, power reset, two (2) stage solenoid, strainer, external filter and adapter, 10:1 pulse output. Wayne S1 Series, or approved equal.

B. Dispenser accessories shall include hoses (20'), hose retractors, nozzles, swivels, breakaways, whip hoses, and other accessories, as needed for a complete system.

C. Gasoline to be ¾" "conventional" fueling accessories.

D. Diesel to be 1" "conventional" fueling accessories.

E. Provide (6) spare fuel filters for each fuel type.

2.10 PRODUCT PUMPING

A. Turbine Pump –submersible pump to include the following:

1. Relay control box for remote installation
2. Discharge piping with flex connector
3. Turbine secondary containment sump (steel construction).
4. Solenoid Anti-Syphon Valve

B. Provide boots or seals required for complete sealed installation of piping, conduit or sensors to be installed with sump.

2.11 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Flexible Metal Conduit & Fittings: Dry Interior Locations: Galvanized flexible steel. Fittings, malleable iron or steel. Thomas and Betts "squeeze type, Crouse-Hinds, 0-Z Gedney, or approved substitution.

B. Exterior and interior Wet and Damp Locations: Liquid Tight, PVC weatherproof cover over flexible steel conduit. Fittings, Thomas and Betts "Super-Tite, Crouse Hinds, 0-Z Gedney, or approved substitution.

2.12 SUPPORTING DEVICES

A. Conduit Supports: Conduit Clamps, Straps, and Supports: Steel or malleable iron.

B. Support Channel: HDG Galvanized or electro-galvanizing and zinc chromate paint, Kindorf, Unistrut Superstrut or approved.

C. Hardware: EG Corrosion resistant. Electro-plated zinc and zinc dichromate coating. Toggle bolts or hollow wall fasteners Expansion anchors or preset inserts. Self-drilling anchors or expansion anchor. Sheet metal screws or wood screws. Hexagon head bolts with spring lock washers and nuts.

2.13 WIRE

A. Building Wire: Thermoplastic-insulated Building Wire: NEMA WC 5 and UL Standard 83/1063. Solid copper conductor, 600-volt insulation, THHN/THWN/MTW. ROME Cable Corp.

B. Control Wire: From card reader to card reader controller use RS-485 twisted pair wire, 600 volt rating, 18 AWG (or greater), oil and gas resistant.

2.14 BOXES

A. Outlet Boxes:

1. Cast Feraloy, deep type, rain tight gasketed cover, threaded hubs. NEMA 3R.

B. Junction Boxes & Gutters:

1. Cast Metal Boxes for Hazardous Location Installations:
2. Surface-mounted junction box, UL listed, for Class I, Group D, Division 2.
3. Metal Boxes and gutters outside of hazardous location rain tight gasketed, galvanized and painted. NEMA 3R.
4. Hazardous Location Junction Box

C. Cast Metal Box for Hazardous Location Installations

D. Lid rated for ASHTO “H-20” traffic load

E. Lid to be labeled for service contained within:

1. “Controls”
2. “Power”

2.15 EMERGENCY DISCONNECT SWITCHES

A. Emergency stop to disconnect all conductors including neutral connections.

B. Outdoor Rated red mushroom head push-pull emergency stop in NEMA 4X stainless steel junction box.

C. Relay and terminal strip(s) as needed for load side distribution.

2.16 ELECTRICAL IDENTIFICATION

A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor is responsible for providing (and coordinating) complete tank and remote filling system, installed by authorized personnel ready for use.

B. Thoroughly clean parts and fittings prior to installation.

C. Furnish necessary bolts or anchors required to secure equipment in place.

3.2 FIRE EXTINGUISHER INSTALLATION

A. Secure rigidly in place in accord with manufacturer's instructions. Location as directed by Project Administrator.

3.3 FUEL TANK INSTALLATION

A. Off-load tank on site with crane. Contractor is responsible for proper handling and installation of tank and related equipment and to insure that good workmanship, practices, and construction procedures are followed during handling and installation of tank, regardless of inclusion or omission of applicable suggestion in these instructions.

B. Testing: Notify Project Administrator at least 24 hours in advance of tests.

C. Maintain closures on tank until set in place.

D. Remove tank closures only when ready to make permanent attachments.

E. Clean and prepare tank openings.

F. Schedule licensed supervisor to be on site at times tank service activities are being carried out at tank installation or testing project. Complete and sign structural warranty, notarize and submit original to Project Administrator.

G. Work with tank manufacturer, shipper and project administrator to schedule delivery to permit prompt unloading. Before unloading, inspect tank for damage.

H. Take responsibility for unknown situations or conditions not covered in manufacturer’s instructions. Employ manufacturer’s specialists for consultation. Presence of manufacturer or observer at installation site does not relieve Contractor of responsibility for proper installation of tank, including proper clearances to sides and bottom of excavation.

I. Direct questions regarding installation procedures or tank repairs to Project Administrator.

J. Install tank according to these instructions and NFPA 30, 30a, and 31.

K. Consult local codes.

3.4 TESTING OF SYSTEM

A. Follow manufacturer's testing requirements. Contact State Fire Marshall in advance should there be any discrepancy with these requirements. Notify State Fire Marshall at least 72 hours in advance of testing.

B. Contractor is responsible for labor, material, and equipment necessary to conduct required tests.

C. Acceptable test "Soaps": "Soaping" tank and fittings during test is to be done using small garden-type hand-pressurized spray unit. Test soap shall be high foaming "soap" that bubbles easily in contact with air leak in tank or piping but will not bubble due to dispensing from pressure applicator. Acceptable soaps are: "Seam Test Concentrate", "Amway Loc High Soap", "#7006 South Bend Leak Detector".

D. Pressure Application System: Consists of two pressure gauges (0 to 10 psig maximum), both in good condition and tested and calibrated within three month period prior to tank test (copy of test and calibration date to be furnished to State upon request). Provide one gauge with fitting that allows connection of installation of air pressure hose to enable pressurization of tank.

E. Conduct following tests for tank acceptance:

1. Visually inspect entire exterior surface of tank for signs of damage.
2. Inspect tank interior for signs of damage.
3. If bubbles are present at fitting plugs or manway cover, tighten plugs or bolts and retest.

F. Pre-installation Test:

1. Tighten tank fittings.
2. Install pressure application system to tank by installing pressure gauge in vent/monitor fitting in secondary tank and second pressure gauge with air pressure hose fitting to manway.
3. Pressurize primary tank to minimum 4 psi, maximum 5 psi,
4. Monitor pressure gauges minimum 1/2 hour.
5. Apply soapy water solution to fittings and manways.
6. Check for leaks as indicated by bubbles.
7. If bubbles are present at fitting plugs or manway cover, tighten plugs or bolts and retest.

G. Post-installation Tank Pressure Test:

1. Use extreme care around and near pressurized tank.
2. Test tank to 4-psig, minimum (5-psig maximum) after installation.
3. Risers, Bushing, Plugs, and Pipe Connections: Install and tighten prior to application of test.
4. State Fire Marshall shall witness and record results of this test.
5. Install pressure relief system set at 5-psig at vent pipe connection or in vent piping (if installed) downstream of flex connector on tank with vent valve open.
6. Perform pressure system test as described above.

H. Piping Test:

1. Before being covered, enclosed or placed in use, hydrostatically test product and vapor piping to 150 percent of maximum anticipated pressure of system, or pneumatically test to 110 per cent of maximum anticipated pressure of system but not less than 5 psig of highest point in system, per IFC.
2. Perform and verify leak detection system shut down test by Fire Marshal during final inspection and approval of installation per IFC.

3.5 SERVICE STATION EQUIPMENT INSTALLATION

A. Tank Level Sensor System: Mount console and printer securely, level and plumb, where directed. Provide electrical service per manufacturer's instructions.

B. Card Reader System: Install Petro Vend System 2 where shown on plans by factory authorized installer. Wire complete and demonstrate operation.

C. Tank Monitor Leak and Level Sensors: Install and calibrate. Install conduit, wire, seal offs, and junction box.

D. Turbine Pump Sensor: Install and calibrate. Install conduit, wire, seal offs, and junction box.

3.6 PETROLEUM PRODUCT AND VENT PIPING

A. Fittings:

1. Screwed, malleable iron, Class 300, black ASTM 197. No Substitutes. Galvanized at vent piping above grade.

B. Preparation:

1. Ream ferrous pipe ends. Remove burrs. Remove scale and dirt, on inside and outside, before assembly. Prepare piping connections to equipment as detailed.

C. Installation:

1. Route piping in orderly manner, shortest route and maintain gradient.
2. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
3. Establish elevations of buried piping to ensure not less than 18 inches of cover.
4. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
5. For ferrous pipe installations, install black pipe and fittings for gasoline service. Use galvanized vent riser piping.
6. Street ells and threaded nipples shall not be used. Place pipelines in straight runs, using pipe fittings as required.
7. Bury pipelines 18 inches minimum below finished yard grade.

8. Grade horizontal vent and product lines uniformly upward from sumps at 1/8-inch per lineal foot minimum, without traps, thus permitting liquid to drain into sumps, (Mandatory).
9. Securely attach vertical lines.
10. Terminate vents minimum 12'- 0" above ground.
11. Tightly wrap with corrosion protection tape the following:
    a. Ferrous product piping.
    b. Exposed threads.
    c. Exposed unions.
    d. Swing joints.
    e. Risers, and vent lines below grade in contact with soil.
12. Apply two layers of 3-inch wide corrosion protection tape (3M coal-tar epoxy tape or CALPICO 10 mil).
13. Each layer shall be spiral wrapped with 1/2-inch overlap.
14. At connections between galvanized and fiberglass pipe, tape shall extend 2-inch onto fiberglass pipe.
15. Wrap stainless steel bands with double layer of 3M coal-tar epoxy tape or CALPICO 10 mil at flexible connectors and bulkhead fittings.
16. Threads shall be clean, full length, coated with petroleum resistant thread lubricant (RECTOR SEAL #5, JOMAR, or equal), then tightened to refusal.
17. Steel pipe and fittings will be used only where specifically called for in details.
18. Contractor shall strictly adhere to manufacturer's recommended procedures for installation of fiberglass reinforced piping, using recommended adhesives.
19. Install and test Environ Products piping and secondary piping in strict accordance with Environ Products Installation Manual. Dial gauge shall be used for air test on primary and secondary piping.
20. Install flat bulkhead fittings as manufactured by Environ Products at penetrations of dispenser and Transition sumps.
21. Flush and clean product and vent lines before making final connections to turbine.

D. Paint:

1. Paint vent pipe riser, supports and welded areas with zinc-rich primer and 2-coats exterior enamel. Color black.
2. Repair and repaint factory-coated surfaces damaged during construction to match existing surface finish and color.

E. Testing:

1. Notify Project Administrator 48 hours before delivery of petroleum products for testing equipment or for ballasting tanks. Immediately after delivery, Contractor and Project Administrator shall together accurately gauge petroleum product with gauge stick and make record. Upon completion and acceptance of construction work by Project Administrator, Contractor shall repeat previously described gauging procedure and record for comparison with first gauges.
2. Contractor is responsible for labor, material, and equipment to conduct pressure tests (air or hydrostatic) of product, and vent piping. After obtaining approval of Fire Marshal, and lines are flushed clean, backfill trenches to subgrade.

3. Adjust fuel dispenser meters as near as possible to zero error. Calibrate meters out of tolerance by more than plus or minus 3-1/2 cubic inches in 5-gallon measure. Tests will be made according to methods prescribed by Department of Weights and Measure. Test to be witnessed by State Fire Marshall.
4. After tests are completed and if reduction in quantity of petroleum products since first gauging exceeds combined total of 10 gallons per tank, total gallon reduction shall be charged to Contractor at regular State Fire Marshall price for each petroleum product involved. More than 30 gallons is considered to be excessive for testing, line flushing, and line filling at each site.

3.7 DISCONNECT SWITCHES

A. Emergency Shut Off Switch: 1-pole switch, NEMA 3R, FD Series, cast box. (Paint Red). Connect to contactor coil.

B. Emergency shut-off must have separate reset, which must be located at least 15’ away in line of sight, or around a corner.

3.8 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Size conduit for conductor type installed or for Type XHHW conductors, whichever is larger; 3/4-inch minimum size. Arrange conduit to maintain headroom and present neat appearance. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping. Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

B. Fuel Island Terminal has restricted base access to route required conduits. Arrange conduits with care to ensure proper alignment, placement and arrangement to within enclosure.

3.9 CONDUIT INSTALLATION

A. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture. Use PVC tape, sleeves or liquid to apply 2-mil minimum thickness coating at joints and fittings in runs of PVC coated conduit. Lap tape, sleeves or liquid 1-inch minimum over factory coating. Use similar means to repair scars and damaged areas of factory coating. Provide suitable pull string in empty conduit, except sleeves and nipples. Location of electrical conduits shall be approved by DOT inspector prior to installation. Locate conduits to minimize visual impact.

3.10 CONDUIT INSTALLATION SCHEDULE

A. Underground Installations: Plastic-coated rigid steel conduit, rigid steel conduit double wrapped with 10-mil Scotchwrap 5 or CAPICO tape, schedule 40 plastic conduit more than 5'-0" from building foundation wall.

B. Exposed Outdoor Locations: Rigid galvanized steel conduit.

C. Exposed or Concealed Dry Interior Locations: Electrical metallic tubing.

D. Underground to above grade: Plastic-coated rigid steel conduit or rigid steel conduit double wrapped with 10 mil Scotchwrap 5, or CALPICO tape, with factory or bent 90's.

E. Fuel System, Monitoring System, Card Reader System and Future Control and Power Conduits: Provide plastic coated rigid steel conduit or rigid steel conduit double wrapped with 10 mil Scotchwrap 5 or CALIPCO tape for underground conduit. Interior dry locations rigid steel shall be used for UL Listing.

F. Flexible Metal Conduit (Liquid Tight): Provide connections to card reader. Shall not be used as substitute for metal conduit.

3.11 WIRING

A. General: Use no wire smaller than 12 AWG for power and lighting circuits. Splice only in junction or outlet boxes. Neatly train and lace wiring inside boxes, equipment, and panel boards.

B. Installation: Completely and thoroughly swab raceway system before installing conductors.

C. Pull all conductors into raceway at same time.

D. Connections & Terminations: Thoroughly clean wires before installing lugs and connectors. Use solderless pressure connectors with insulating covers for copper wire splices and taps.

3.12 BOX INSTALLATION

A. Provide knockout closures for unused openings. Support boxes independently of conduit. Provide cast outlet boxes in exterior locations exposed to weather and wet locations. Verify number of openings required in each box.

3.13 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as required for splices, taps, wire pulling, equipment connections, and code compliance. Locate and install boxes to allow access. Locate and install to present neat appearance.

3.14 SUPPORTING DEVICES INSTALLATION

A. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit. Do not use powder-actuated anchors. Do not drill structural steel members Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

3.15 EXTERIOR SIGNS

A. Preparation: Clean all surfaces free from dust, oil, grease, concrete, and paint.

B. Installation: Aluminum Signs: Tap-ins, masonry surfaces; stainless or brass screws, wood surfaces; aluminum pop rivets, sheet metal surfaces; self adhesive on glass, painted or plastic surfaces.

C. Schedule of Signs:

1. "FIRE EXTINGUISHER:" One required each fire extinguisher location. Stock or custom aluminum sign. Verify if vertical or horizontal sign required.
2. "EMERGENCY FUEL SHUT OFF". One required each emergency switch location. Stock or custom aluminum sign. 1-3/4-inch lettering.
3. Pump Numbers: Furnished by pump supplier for installation by Contractor. Obtain number sequence prior to installing from Project Administrator.
4. Emergency Procedures Sign: One for site.

3.16 NAMEPLATE INSTALLATION

A. Degrease and clean surfaces to receive nameplates. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Embossed tape will not be permitted for application.

3.17 FIRE ALARM/PUMP INTERLOCK

A. All fuel pumps shall shut down upon activation of fire alarm.

3.18 AUTOMATIC EMERGENCY SHUTDOWN

A. Provide automatic shut down of pumps in the event an earthquake per FM Global Property Loss Prevention Data Sheet 1-11.

3.19 WARRANTY ACTIVATION

A. Complete all appropriate warranty paperwork and submit to manufacturer(s) for validation of warranty. Specific items include Tank, Tank Monitor System, Cardlock System, Underground Piping, Oil Vending Machine.

3.20 START-UP AND OWNER TRAINING

A. Petro-Vend systems require start-up and programming. Start-up to be performed by manufacturer's authorized representative. Failure to do so will void warranty. Contractor to coordinate and pay for cost of start-up services.

3.21 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 - General Commissioning Requirements and Section 230800 - Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 231000

SECTION 232000 - EXCAVATION AND BACKFILL FOR HVAC 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 211123 – Private Fire Service Mains

B. Section 211313 - Wet Pipe Automatic Fire Sprinkler Systems

C. Section 211316 - Dry Pipe Automatic Fire Sprinkler Systems

D. Section 221116 - Pipe and Fittings

E. Section 221300 - Soil, Waste and Vent Piping System

1.3 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, "Uniform Building Code".
2. Local requirements for all utility work.
3. OSHA and WISHA regulations.
4. APWA Standard Specifications.

1.4 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 Design Consultant 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.

1.5 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:

D 422-63	Particle Size Analysis of Soils.
D 423-66	Liquid Limit of Soils.
D 424-59	Plastic Limit and Plasticity Index of Soils.
D 1557-78	Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inch (457 mm) Drop.
D 2167-66	Density of Soil In-Place by the Rubber Balloon Method.
D 2217-66	Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents.
D 2487-69	Classification of Soils for Engineering Purposes.
D 2922-81	Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
E 548-79	Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

1.6 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 - MATERIALS

2.1 APPROVED MANUFACTURES

Not Applicable

2.2 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.

2.3 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.).

2.4 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility pipe, conduit or appurtenance structure.

2.5 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.

2.6 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 C. Minimum compaction requirements shall be as specified in PART 3.

2.7 DRAINAGE GRAVEL

A. Shall be 3/4 inch washed gravel with no more than 2% passing 1/2 inch sieve opening.

2.8 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8 inch washed pea gravel.

1

Unified Soil Classification (USC) System (from ASTM D 2487)				
Major Divisions			**Group Symbol**	**Typical Names**
Coarse-Grained Soils More than 50% retained on the No. 200 sieve	**Gravels** 50% or more of course fraction retained on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the No. 200 sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

2 PART 3 - EXECUTION

3 3.1 EXCAVATION

4 A. If workers enter any trench or other excavation four or more feet in depth that does not meet the
5 open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The
6 Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the
7 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 BACKFILLIING at no additional cost to the Owner.

F. The Contractor shall provide any dewatering needed and is considered incidental to the Contract.

3.2 TRENCH EXCAVATION

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed unless shown otherwise on the drawings. Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

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 pipe and for bedding. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 inches or greater in any dimension, or as recommended by the pipe 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 pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe 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 pipe or to the lower curved portion of pipe arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Bell holes and depressions for joints shall be only of such length, depth and width as required for properly making the particular type joint. Provide bedding using pea gravel where noted on the drawings.

3.3 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, catch basins, inlets, or similar structures below 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 pipe, 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 3.07.

1. Trench Backfill: Trenches shall be backfilled to finish grade. The trench shall be backfilled to above the top of pipe prior to performing the required pressure tests (except that where piping requires insulation, the pipe shall have an initial test prior to insulating and then a final test as specified herein). The joints and couplings shall be left uncovered during the pressure test.
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 SPECIAL REQUIREMENTS

A. Special requirements for excavation, backfill, and bedding relating to the specific utilities are as follows:

1. Combination Fire/Water Lines: Trenches shall be a depth to provide a minimum cover of 3.5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Bedding shall use "special bedding" materials as specified in paragraph 2.07.

2. Domestic Water Lines: Trenches shall be of a depth to provide a minimum cover of 3.0 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Except that branch lines serving individual fixtures within building footprint shall have minimum of 1.0 foot cover. Bedding shall use "special bedding" materials as specified in paragraph 2.07.
3. Backflow Preventer Fire Vault: Provide special bedding as specified in this Specification Section.
4. Chilled Water Lines: Provide special bedding as specified in this Specification Section.
5. Where piping passes under footings, provide concrete fill starting 12 inches above pipe for excavated length and width of footing above pipe for footing support. Concrete specification shall match same provided for footing.

3.7 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 other approved compaction equipment.

3.8 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 232000

SECTION 232300 - REFRIGERANT PIPING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Includes, but not limited to, the furnishing and installation of piping for refrigeration systems. The general arrangement and location of piping is shown on the plans. The pipe sizing and exact arrangements shall be designed by this contractor. This contractor shall provide all labor, materials, equipment, refrigeration specialties, testing, evacuation, oil and refrigerant charging as required for a complete and operational system. The design and installation shall conform to the equipment manufacturer's recommendations and installation instructions and all local mechanical and environmental codes.

1.2 RELATED SECTIONS

A. General Conditions, Division 1

B. Section 200000 – General Mechanical Requirements

C. Section 221116 – Domestic Water Pipe and Fittings

D. Section 222000 – Excavation and Backfill For Mechanical Underground Utilities

E. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

F. Section 230719 – HVAC Piping Insulation

1.3 QUALITY ASSURANCE

A. Refrigerant piping shall be installed by a refrigeration contractor licensed in the State of Washington, having a minimum of five (5) years experience in refrigeration piping installation, and certification of technical training specifically in refrigeration from an industry recognized training program. Proof of license, experience and training shall be submitted as part of the Mechanical Submittals, see Section 200000. All technicians working on-site shall be certificated in the use and handling of refrigerants in accordance with federal EPA regulation 40 CFR Part 82, sub-paragraph F.

1.4 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe

B. Fittings

C. Brazing Material

D. Accumulators (Separate from Equipment)

E. Expansion Valves (Separate from Equipment)

F. Isolated Valves

G. Filters/Driers

H. Shop Drawings and Calculations

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Meet the requirements of ASTM B 280-86, "Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service", ACR hard drawn straight lengths.

B. Use of pre-charged soft copper line sets is prohibited, except for ductless split system units.

2.2 REFRIGERANT FITTINGS

A. General: 100% Wrot copper with long radius elbows.

B. Approved Manufacturers: Mueller Streamline, Nibco.

2.3 BRAZING MATERIAL

A. Brazing rods with a minimum of 5% silver content shall be utilized. Rods containing Cadmium will not be permitted.

2.4 ACCUMULATORS

A. Accumulators are typically furnished as an integral component of the refrigeration equipment however the capacity of the provided accumulator shall be verified in each installation. Should additional accumulators be required to support larger refrigerant charges due to long piping runs, they shall be sized, furnished and installed by this contractor. Include all calculations in submittal to Engineer.

2.5 EXPANSION VALVES

A. Expansion valves are typically furnished as an integral component of the refrigeration equipment. However, should the selection of equipment require field installation of the expansion valve, it shall be provided by this contractor. Expansion valves shall be selected as recommended by the manufacturer for the individual coil, tonnage, refrigerant and system pressures. Size valves to provide full rated coil capacity and indicated on the equipment schedules. Adjust final superheat temperature settings to those recommended by equipment manufacturer.

2.6 ISOLATION VALVES

A. Line size, ball type isolation valves shall be provided on both vapor and liquid lines of all systems. Provide one vapor and 2 liquid line valves (for filter/drier isolation) at the outdoor unit.

B. Valves shall be suitable for use with HCFC and HFC refrigerants, forged brass body, seal cap and wrot copper fitting extensions. Temperature rating shall be -40°F to +325°F minimum.

C. Coordinate optimum location of valves with filter/dryer unit (a valve on each side of the filter) to facilitate replacement with minimal loss of refrigerant. At minimum, provide one set of schrader valves located on the indoor coil side of the valves to facilitate evacuation and charging of the piping.

2.7 FILTER/DRIERS

A. All systems shall be provided with field installed, bi-directional, liquid line filter drier units. This filter shall be provided regardless of whether the unit is provided with one, sized to provide rated tonnage as indicated on the equipment schedule plus 50% while maintaining a 2 PSIG or less pressure drop. Provide filters with SAE flare type fitting for ease in replacement.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND CALCULATIONS

A. Provide shop drawings of each system in the project. Drawings are to be at 1/8th inch per foot minimum, and in sufficient detail to count fittings and devices with all vertical and horizontal runs fully dimensioned. Show sizes of all piping and type of fittings. Provide large scale details of indoor and outdoor equipment connections with all devices located, chases through the building components, refrigerant traps, and underground piping runs.

B. Provide calculations that support the shop drawings with an individual pipe sizing calculation for each piping system. These calculations are to be performed by the equipment manufacturer's technical support personnel and submitted to the Engineer. These calculations shall provide total system capacity loss due to piping, system vapor velocities and critical system operating temperatures.

C. All piping systems shall be sized as required to prevent no more than 5% system capacity loss due to piping.

D. Each piping system is to be individually sized accounting for that particular unit's capacity, piping lengths, fittings and devices. Oil return is a major consideration and refrigerant vapor velocity must be sufficient to entrain oil. Minimum velocity must be 800 fpm in horizontal runs and 1500 fpm in vertical suction risers.

3.2 PIPING INSTALLATION

A. All vapor lines shall be sloped downward towards the compressor at a rate of one (1) inch per 10 lineal feet to facilitate oil return.

B. Provide oil traps at vertical risers where required to return oil to compressor and to prevent liquid migration back to the compressor in the off cycle.

C. Refrigeration system connections shall be copper-to-copper type properly cleaned and brazed. Use flux only where required for brazing brass components. Soft solder connections are prohibited. Only silver solder containing a minimum of 5% silver shall be utilized

D. Circulate dry nitrogen as a shield gas through piping while being brazed to eliminate formation of copper oxide during brazing operation.

E. All piping shall be secured using unistrut type channel with "Hydrosorb" type clamps. All clamps shall be specifically designed for use with refrigeration piping and shall contain internal plastic grommett for vibration and thermal isolation. The use of general purpose clamps, conduit straps or plumbers tape is strictly prohibited. Carefully plan routing and grouping of all piping to ensure a neat and professional installation.

F. Where necessary to offset piping around obstructions, utilize 45° elbows in lieu of 90° elbows to minimize pressure losses.

G. Where piping is installed underground, provide an utilidor or conduit type system in which all piping shall be routed and protected against physical damage and moisture. Refer to drawings for additional installation details.

H. A complete review of all installation recommendations produced by the equipment manufacturer is recommended prior to the installation of ACR piping. Conformance to all manufacturers' recommendations will be enforced.

I. All leak testing shall be performed and verified prior to covering any concealed or buried piping. See Field Leak Tests.

3.3 FIELD LEAK TESTS

A. All leak tests shall be witnessed and confirmed by the Engineer or Owner's representative. The purpose of all leak testing is to confirm the integrity of field installed piping. If equipment is provided with a factory provided refrigerant charge, the equipment may be isolated and excluded from the test. If shipped with only a "holding charge" or no charge, the isolation valves shall be opened, and the equipment shall be included in the pressure testing.

B. Following completion of the refrigeration piping systems, the following tests shall be performed.

C. Connect test gauge with minimum of "2% accuracy to the piping system to be tested and pressurize piping system with dry nitrogen gas to 1.25 x design service pressure (minimum of 250 psi) or as recommended by the equipment manufacturer. Do not introduce any refrigerant into the system prior to pressure testing. The test gauge shall remain connected throughout the test period. Record actual test gauge pressure, date, time and ambient temperature. System shall remain under test for a period of one week. At the conclusion of the test period, record pressure, date, time and ambient temperature. If the test gauge is within 1% (2.5 PSIG) of the original test pressure as witnessed by the Engineer, (plus adjustment fluctuations in ambient temperatures) the system will be "Passed" and approved for evacuation and charging procedures.

3.4 OIL/REFRIGERANT CHARGING

A. Prior to commencing oil and refrigerant charging procedures, this Contractor shall refer to and closely follow the manufacturers' specific procedures for charging the system. As a minimum, the following procedures shall be followed:

B. Calculate oil charge using manufacturer's recommended method and add oil to compressor crankcase as necessary for size of piping system. Affix permanent, weatherproof label to unit indicating date, type of oil, and amount added, signed by the technician performing the task.

C. Draw a vacuum on each entire system with vacuum pump to 200 microns using vacuum gauge calibrated in microns. Break vacuum with refrigerant shipped with unit and re-establish a 200 micron vacuum (double evacuation). Calculate recommended charge and add the appropriate refrigerant charge by weight using a digital scale. Check and adjust charge as necessary to obtain manufacturer's specified operating pressures and superheat during start-up procedure.

3.5 SYSTEM START-UP

A. Perform a system start-up and check-out procedure as recommended by the equipment manufacturer, and as indicated on the enclosed system Start-up and Check-out Log. This start-up and check-out shall be performed in the presence of the Engineer or Owner's representative.

B. Provide one week’s written notice to the Engineer prior to start of equipment start-up and check-out.

C. Submit the following completed documentation including copies of the completed compressor warranty registration forms to the Engineer upon completion of system start-up.

3.6 START-UP LOG

(See attached.)

START-UP LOG

Date: _____ Project Title: _____

Contractor: _____ Tech. Name: _____

Refrigerant License #: _____

EQUIPMENT:

	Indoor	Outdoor	Accessories
Unit #:	_____	_____	_____
Make:	_____	_____	_____
Model:	_____	_____	_____
Serial#:	_____	_____	_____
Location:	_____	_____	_____

REFRIGERANT CHARGE: Type:_____ Amount:

OIL CHARGE: Type:_____ Amount:

TEMPERATURES:

Indoor: _____ Outdoor:

Return Air: _____ Supply Air:

COMPRESSOR(S):

	#1		#2	
	Cooling		Cooling	
Discharge Pressure:	_____		_____	
Suction Pressure:	_____		_____	
	Actual	Rated	Actual	Rated
Amps:	_____	_____	_____	_____

Volts(at disconnect) L1 - L2 ___ L2 - L3 ___ L1 - L3

INDOOR MOTOR:

Direct Drive _____ Belt Drive _____ Belt Size

Amps-Actual _____ Amps-Rated _____ Volts

Rotation Verified? Yes ( ) No ( )

OUTDOOR MOTOR:

Amps-Actual _____ Amps-Rated _____ Volts

HEAT:

Electric: KW _____ Volts _____

None: _____ (check if no heat)

THERMOSTAT OPERATION:

Type _____ Fan On During Occupied? Yes ( ) No ( )

Setpoints Occupied Cool _____ Unoccupied Cool

FILTERS: Type: _____ Size: _____ Quantity:

COMMENTS: _____

_____

_____

_____

TECHNICIAN SIGNATURE: _____

END OF SECTION 232300

SECTION 233100 - 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. Volume dampers

D. Motorized dampers

E. Duct Sealers

F. Turning vanes

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Motorized dampers

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. Gauges: Steel sheet and wire are U.S. Standard Gauge; aluminum sheet is Brown and Sharpe Gauge.

PART 2 - PRODUCTS

2.1 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.

2.2 DUCT JOINTS

A. General: Duct with sides or diameter up to and including 36 inches shall be as scheduled below.

Max. Side Inches	Required Minimum Metal Gauges Steel, U.S. Standard Gauge	Type of Transverse Joint Connections	Bracing Required
Under 13"	26	S-drive, pocket or bar slips on 7 - 10" centers	None
13" to 24"	24	S-drive, pocket or bar slips on 7-10" centers	None
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.

2.3 ROUND DUCT

A. 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. Gauge Selection Table:

Duct Diameter in Inches	Maximum 2" w.g. Static Positive		Maximum 2" w.g. Static Negative	
	Spiral Seam Gauge	Longitudinal Seam Gauge	Spiral Seam Gauge	Longitudinal Seam Gauge
3 thru 8	28	28	28	24
9 thru 14	28	26	26	24
15 thru 26	26	24	24	22
27 thru 36	24	22	22	20
37 thru 50	22	20	20	18
51 thru 60	20	18	18	16
61 thru 84	18	16	16	14

C. Provide insulation where required by the Insulation Schedule in Section 230713 - Equipment/Ductwork Insulation.

2.4 SPIRAL DUCT

A. The outer pressure sheet shall be manufactured from galvanized steel meeting ASTM A-527-67 in the following minimum gauges:

Nominal Size Range	Solid Spiral Wound Duct Outer Pressure Shell	Solid Welded Fitting Outer Pressure Shell
3"-12"	26 Ga.	20 Ga.
13"-24"	24 Ga.	20 Ga.
25"-34"	22 Ga.	20 Ga.
35"-48"	20 Ga.	18 Ga.
50"-58"	18 Ga.	16 Ga.

2.5 STAINLESS STEEL DUCT

A. Stainless steel duct and fittings shall be Type 304 stainless steel. The duct shall be constructed with the following gauges:

Duct Diameter Inches	U.S. Standard Gauge	Thickness Inches
Up to 11''	22*	0.0313
12"-15"	20*	0.0375
16" and greater	18	0.0500

* Note: All welded duct shall be minimum 18 gauge.

1. Provide stainless steel duct where indicated on the plans and in the following areas:
   a. Fume Hood:
      1) The exhaust duct to fume hoods shall be stainless steel duct. If duct is under a positive pressure (i.e. hood with inline fan), duct shall be welded.
      2) If welded duct is required, all joints shall be welded. Cross joints shall be slip type with 1" – inside lap in the direction of airflow.
      3) Support duct runs on minimum 8-foot centers. Supports shall be ban type as shown in SMACNA HVAC Duct Construction Standards. See Section 220529 – Hangers and Supports for Plumbing Equipment, for allowable hanger loads and type.
      4) Fittings: Shall be constructed of material at least 2-gauges heavier than required for straight duct. Elbows shall have a minimum centerline radius of two duct diameters. Construct elbows 6" diameter or less of at least five sections; all other ducts hall have seven or more sections. Transitions shall be tapered to provide minimum 2" change in diameter in five inches of length (11.3 degrees). All branches shall enter the main at the large end of the transition of an angle not to exceed 45 degrees.

2.6 DUCT LINER

A. Densities and R-value:

1. R-3.3: 1.0 inch of 1.5 to 3.0 lb/cu. Ft. duct liner.
2. R-5.3: 1.5 inches of 1.5 to 3.0 lb/cu. Ft. duct liner.
3. R-7: 2.0 inches of 1.5 to 3.0 lb/cu. Ft. duct liner

B. Duct Liner:

1. 'K' ('ksi') Value: ASTM C518, 0.25 at 75°F (0.036 at 24°C).
2. Noise Reduction Coefficient: 0.65 or higher based on "Type A mounting".
3. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min (25.4 m/sec).
4. Adhesive: UL listed waterproof type.
5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
6. Approved Manufacturers:
   a. Manville Linacoustic (Mat Faced)
   b. Permacote (meeting ASTM C1071)

C. Spiral Duct Liner:

1. For ductwork requiring 1-inch (25 mm) Spiracoustic Plus System Lining:
   a. The installed 1-inch lining shall have a Thermal Resistance (R-Value) of 4.3 (.76) at 75°F (24°C) mean temperature, and Noise Reduction Coefficients (NRC) per ASTM C 423, Type "A" mounting.

b. Metal duct with inside diameters from 8 inches to 18 inches (203 to 457 mm) shall be lined with 1-inch Preformed Round Liner.
   1) Approved Manufacturers:
      a) Permacote Spiracoustic Liner
c. Metal duct with inside diameters from 18 inches to 32 inches (457 to 813 mm) shall be lined with 1-inch Round Liner Board.
   1) Approved Manufacturers
      a) Spiracoustic Plus “SD” Liner
d. Metal duct with inside diameters greater than or equal to 34 inches (364 mm) shall be lined with 1-inch Round Liner Board.
   1) Approved Manufacturers
      a) Spiracoustic Plus “LD” Liner

2.7 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

2.8 FLEXIBLE EQUIPMENT CONNECTIONS

A. Provide flexible equipment connections between ductwork and equipment. See Section 233300 - HVAC Specialties.

2.9 VOLUME DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Fabricate splitter dampers of same material and gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for larger sizes, secured with continuous hinge or rod, operated with minimum 1/4-inch (6 mm) diameter rod.

C. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inch (240 x 760 mm).

D. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch (300 x 825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Except in round ductwork 12 inches (300 mm) in diameter and smaller, provide end bearings.

F. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where width exceeds 30 inches (750 mm), provide regulator at both ends.

2.10 MOTORIZED DAMPERS

A. General:

1. Coordinate actuator type with Controls Contractor.
2. Make provision for damper actuators and actuator linkages to be mounted external of airflow.
3. 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. End seals shall be flexible metal compression type.
3. Opposed blade type

C. Performance:

1. Maximum leakage rate shall be 4 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

2.11 DUCT HANGERS

A. See Section 230529 - Hangers and Supports for HVAC Piping & Equipment.

2.12 DUCT SEALER

A. All duct systems shall be effectively sealed and leak tested with the total allowable leakage from the high and medium pressure ducts not to exceed 1% of the total system design airflow rate. Total allowable leakage from the low pressure ducts shall not exceed 5% of the total system design airflow rate. These requirements are in compliance with ASHRAE Standard #90A, and SMACNA High, Medium, and Low Pressure Duct Construction Standards (Seal Class A, B, C, D). All 1-inch and 1/2-inch pressure duct shall be sealed for Class 'C'.

1. The description for the work to include the sealing of all seams, joints, fastener penetrations and connections.
2. The sealant used shall be Elastomeric tape, which shall consist of a pressure sensitive layer of Modified Butyl Rubber Duct Sealer laminated to a backing material which will conform to surface variations and irregular areas and will not harden, crack, or peel. The sealant shall provide an instant, positive bond which shall seal on contact, be waterproof, and shall conform with N.F.P.A. Class 1 requirements.

2.13 TURNING VANES

A. Turning vanes may be either Contractor or factory fabricated. Factory fabricated vanes shall be Barber Colman "Airturns" or approved.

B. Vanes and runners shall be fabricated of minimum 24 gauge galvanized.

C. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards. For duct widths less than 19 inches, vanes may be single wall construction; for widths greater than 19 inches, vanes shall be double wall "airfoil" type.

D. Turning vanes shall be equally spaced, parallel to each other, and securely attached to runners.

E. For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

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. All exposed ducts shall be spiral.
17. Provide duct transitions to equipment openings.

B. Duct Liner:

1. Adhere insulation to sheet metal with full coverage of a UL listed adhesive.
2. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.
3. All exposed edges of the fibrous type liner must be factory or field coated. For systems operating at 4000 fpm or higher, a metal nosing must be installed in all liner leading edges.
4. Repair fibrous type liner surface penetrations with UL listed adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
6. Provide duct liner for all return air ducts unless specifically excluded in Section 230713.
7. Provide acoustic duct liner for duct indicated on plan and Section 230713.
8. Provide liner for all supply duct unless specifically excluded from Section 230713.
9. Provide ductliner for first 10’ in and out of all exhaust fans (excluding dishwasher, kitchen fume, and particulate fans).

C. Turning Vanes:

1. Install turning vanes in all square duct turns, and at locations shown on drawings.
2. Securely attach turning vane runners to ductwork.

D. Flexible Connections: See Section 233300 - HVAC Specialties.

E. 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.
5. Install motorized dampers.
6. Motorized dampers shall be installed in all outside air intakes, exhaust outlets, and relief outlets per WSEC and as shown on drawings.

F. Grilles, Registers, and Diffusers: Install and anchor securely.

G. 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.

H. Painting of Ductwork: Paint ductwork visible through registers, grilles, and diffusers flat black.

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 operating at 3” water column or greater AND for low pressure ductwork (i.e. operating at less than 3” water column) for up to 300 feet of duct as selected by the Engineer.
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. All ductwork (i.e. low, medium, and high pressure) shall be tested in accordance with the requirements outlined in the SMACNA HVAC Air Duct Leakage Manual and Chapter 14 of the WSEC under “High Pressure Duct Leak Test”.
5. Duct leakage, in excess of SMACNA HVAC Air Duct Leakage Manual and Chapter 14 of the WSEC, shall be repaired and have the test re-performed until the leakage rate is within acceptable levels.

NOTE: It is recommended that the first 100'-300' of ductwork installed be tested to ensure the quality of the workmanship at an early state.

END OF SECTION 233100

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.
3. Filters and filter housing.
4. Flexible connections.
5. Fire and fire/smoke dampers.
6. Field applied grease duct enclosure

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. Filters

C. Filter housing

D. Air filter gauge

E. Flexible ductwork

F. Flexible equipment connections

G. Fire and/or smoke dampers

H. Hoods

1.4 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Backdraft dampers

B. Filters (Summary list including equipment tag and size and quantity of filter per unit.)

C. Fire and/or smoke dampers

D. 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 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

2.2 FILTERS

A. 2" MERV 8:

1. General: 30% efficient filters as specified herein shall be medium efficiency, pleated panel type, disposable filters; Farr 30/30 or approved and shall have an average efficiency of 25-30% atmospheric and 90-92% arrestance by ASHRAE Standard 52-76 unless instructed otherwise.
2. Filter Housings: Shall be sized to fit furnished unit or duct to be installed in and provide minimum filter sizes to obtain a maximum filter velocity of 300 fpm.
3. Resistance: Initial resistance of a 24"x24"x2" filter handling 2000 CFM shall not exceed 0.31" w.g.
4. Duct Holding Capacity: Shall be no less than 60 grams per square foot of face area at 1.0" w.g.
5. Size: Filters shall be 2" deep (unless indicated otherwise), with number and sizes indicated, or as required to give minimum nominal face area as scheduled on drawings.
6. Provide a filter pull strap for all multiple filter sets longer than 24 inches.
7. Approved Manufacturers:
   a. Farr Co.
   b. Airguard
   c. Purolator
   d. Eco-Air

2.3 FILTER HOUSINGS - DUCT MOUNTED

A. Filter housings shall be factory or Contractor fabricated of not less than 20 gauge galvanized steel.

B. Housing shall have access doors on two sides, constructed of minimum 20 gauge galvanized steel and shall be hinged type with minimum of two heavy-duty latches (Ventlock or equal) and have neoprene sponge gasketing.

C. Holding frames shall be constructed of minimum 20 gauge galvanized steel, with U-type bearing channels, polyurethane gasketing on surfaces adjacent to filters.

2.4 TEMPORARY AIR INLET FILTERS

A. Type: Glass fiber or synthetic material blanket type filter media. Inlets and outlets shall be MERV 8 and unit shall be same as final.

B. Capacity: Shall have an average arrestance no less than 64%; dust holding capacity of 172 grams.

C. Size: Minimum 1" thick cut to size as required to cover inlets.

2.5 FLEXIBLE DUCTWORK

A. Formable, flexible, circular duct shall have a fiberglass scrim (or equivalent) and retain its cross-section, shape, rigidity, and shall not restrict air flow after bending.

B. Normal 1-1/2 inches thick, 3/4 lb/cu ft density fiberglass insulation with airtight, see-through polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.

C. Assembly including insulation and vapor barrier, shall meet Class 1 requirements of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.

D. Approved Manufacturers:

1. Wiremold
2. Flexible Air Movers Inc.
3. J.P. Lamborn
4. General Flex Corp.
5. Young & Co. Mfg 165
6. Thermaflex 'GKM'
7. Cleavaflex

2.6 FLEXIBLE EQUIPMENT CONNECTIONS

A. General: 30 oz. closely woven UL approved glass fabric, double coated with neoprene. Fire retardant, waterproof, airtight, resistant to acids and grease, and withstand constant temperatures of 250°F.

B. Approved Manufacturers:

1. Ventglas by Ventfabrics
2. DuroDyne MFN

2.7 COMBINATION FIRE/SMOKE DAMPERS

A. Furnish and install at location shown on plans combination fire/smoke dampers meeting or exceeding the following specifications:

1. Use 1 ½ hour dampers for wall or floor construction of less than 2 hours. Use 3 hour dampers for wall or floor construction of 2 hours or greater.
2. Frame shall be a minimum of 16 gauge galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement. The blades shall be single skin 16 gauge minimum galvanized with three longitudinal grooves for reinforcement. Bearing shall be stainless steel sleeve turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber mechanically locked in blade edge (adhesive or clip fastened seals are not acceptable). Jamb seals shall be stainless steel flexible metal compression type.
3. Each combination fire/smoke damper shall be rated for 1.5 hours under UL Standard 555 and shall further be classified by UL as a leakage rated damper for use in smoke control systems under UL 555S and bear the UL labels for both UL 555 and UL 555S. Damper manufacturer shall have tested a range of damper sizes covering all dampers covered by the specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL 555S shall be leakage Class II (10 cfm/sq.ft. at 1" W.G.)
4. Fire/smoke dampers may be round or square depending on the duct to which it is attached. Contractor must provide square-to-round adapters as required.
5. As part of the UL Qualification, dampers shall demonstrate a capacity to operate (open and close) under HVAC system operating conditions, with pressure of at least 4" W.G. in the closed position and 2000 fpm air velocity in the open position.
6. In addition to the leakage rating already specified herein, the dampers and their actuators shall be qualified under UL 555S to a minimum elevated temperature of 250°F. Appropriate 120 volt electric actuators shall be installed by the damper manufacturer at the time of damper fabrication. Damper and actuator shall be installed as a single entity which meets all applicable UL 555 and UL 555S qualifications for both dampers and actuators. Dampers must be open and close within 15 seconds of appropriate signal and dampers must close upon lack of power.
7. Manufacturer shall provide factory assembled sleeve of 17" minimum length (Contractor to verify requirement). Factory supplied caulked sleeve shall be minimum 20 gauge for dampers through 84" wide and 18 gauge above 84" wide if breakaway connections are provided, 16 gauge sleeves are required if other connection methods are provided. Damper and actuator assembly shall be factory cycled 10 times before shipment to assure operation.
8. Temperature Control Contractor shall provide all necessary switches and relays etc. to interface damper with smoke control system and building control system as described elsewhere in these specifications.
9. Fire/smoke dampers in tunnel corridor construction must bear UL 555 and UL 555S labels and meet all of the above criteria and have installation instructions showing UL approval for tunnel corridor construction.
10. Fire/smoke dampers shall be rated for no higher than Class II leakage and with an elevated temperature rating of not less than 250°F, and shall bear both UL 555 and UL 555S labels.
11. In systems requiring a smoke control system, provide remote sensing of damper position and damper override of damper closure to permit controlled operation in a dynamic smoke management system. Device shall be Ruskin Model TS 150 Fire Stat or approved.

12. Approved Manufacturers:
    a. Ruskin
    b. Greenheck
    c. Air Balance
    d. National Controlled Air
    e. Prefco

2.8 EXHAUST HOOD (TYPE II HEAT)

A. General: 18-gauge stainless steel hood deep. Furnish with two (2) vapor proof incandescent fixtures, and stainless steel baffle in lieu of filters.

B. Approved Manufacturers:

1. X-L Equipment
2. Kees
3. Air Masters
4. Gaylord
5. K-Tech
6. Vent Master

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Backdraft Dampers: Provide access doors to backdraft dampers.

B. Filters and Filter Housing:

1. Contractor to install temporary filters to provide temporary sealing of all duct systems during the construction period to prevent the entry of dirt, dust and debris into the duct systems. These systems that are operated during the construction period shall have temporary filters installed over all inlets and filters installed in the air handling equipment. Filters installed in equipment shall be same type as final filters required for the units. Temporary air inlet type filters shall be taped over all inlets to completely filter all air drawn into the systems.
2. Contractor to provide and install four (4) complete sets of all filters as scheduled below:
    a. At equipment start-up.
    b. Prior to balancing system.
    c. Three (3) months after building occupancy.

d. During the one year warranty to be scheduled with Owner.

3. Construct and install filter housings to prevent passage of unfiltered air. Provide sheet metal blanks, felt, rubber, and/or neoprene seals as necessary.
4. Provide air filter gauge on units over 2000 cfm. Connect sensing tips to gauge with copper or aluminum tubing. Locate gauge in easily read position, provide brightly colored tape marker to indicate clean filters pressure drop and change-out pressure drop (use clean pressure drop plus 0.15" unless instructed otherwise).
5. Furnish Owner with schedule of filter sizes for each air handler, heat pump, furnace, and fan coil unit.

C. Flexible Equipment Connections:

1. Provide insulated flexible equipment connections between ducts and vibrating equipment. Fans which are internally isolated with spring isolators do not require flexible connections, unless indicated on the plans.
2. Install flexible connections with sufficient slack to permit 2 inches of horizontal or vertical movement of ducts or equipment at connection point without stretching the flexible material.
3. Where installed exposed to weather, provide a galvanized "hat" channel protecting top and vertical stretches of flexible connector from sunlight and weather.

D. Flexible Ductwork:

1. Install duct in fully extended condition free of sags and kinks, using ten foot maximum lengths.
2. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with 1/2 inch wide metal cinch bands and sheet metal screws. Tape exterior of flex to duct ahead of damper.

E. Fire and Fire/Smoke Dampers:

1. Fire damper installation shall conform to details shown in the UL installation instructions for the particular damper.
2. Each fire damper or fire/smoke damper shall have an access panel located not more than 6 inches from the fire damper served. Access panel shall not be less than 10" x 10" or equivalent size in smaller ducts.
3. Ceiling radiation dampers must be installed in a UL rated ceiling assembly as explicitly described in the UL Fire Resistance Directory.
4. All dampers must be installed strictly in accordance with the UL installation instructions that must accompany the dampers and be available on site for the appropriate building inspector to view.

F. Install duct smoke detectors in air handling units over 2000 CFM.

G. Hoods:

1. Anchor hood units securely to structure.
2. Hood manufacturer shall obtain a signed statement from the Contractor verifying ceiling height at hood location prior to fabrication.

END OF SECTION 233300

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 01 apply to this Section.

B. Section 200000 - General Mechanical Conditions.

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).

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

A. General:

1. Direct drive, forward curve, upflow discharge utility fan.
2. 16 gauge minimum steel housing.
3. Wheels to be dynamically balanced with quiet operation.
4. Suitably ground motors and mount on rubber-in shear vibration isolators.
5. Provide quiet type non-chattering backdraft damper.
6. Approved Manufacturers:
    a. Air Control Products
    b. Greenheck
    c. Peerless
    d. Penn Barry
    e. Twin City Fans

2.2 IN-LINE FANS

A. General:

1. Motors on V-belt units shall be supported on the exterior of the fan casing with bearings encased within the fan tube.
2. All models shall incorporate a panel to permit access to interior.
3. Centrex wheels shall be backwardly inclined, non-overloading and made of aluminum.
4. Inlets shall be deep spun for non-turbulent entrance condition.
5. Approved Manufacturers:
    a. Cook
    b. Greenheck
    c. Pace
    d. Penn Barry
    e. Twin City Fans

2.3 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

2.4 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.
7. Provide “Architectural deluxe” metal grille.

B. Approved Manufacturers:

1. Penn Barry
2. Cook
3. Greenheck
4. Twin City Fans

2.5 SPEED CONTROL

A. Use manufacturer’s recommended speed control, which varies speed from 50 to 100% of full speed.

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.

E. Install motorized damper no closer than 12” from fan.

END OF SECTION 233423

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. Grilles, registers, and diffusers

B. Louvers

C. Wall caps

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS (GRD)

A. Shall be as scheduled on drawings.

B. Provide the various grilles, registers and diffusers shown on the plans and of the various types herein before specified. All terminals with prime-coat finish shall be installed before the walls and ceiling is painted, in order that they may be finish painted by the General Contractor. Those with factory finish or aluminum construction shall be installed after the walls and ceilings are painted. All air terminals located in shower, toilet rooms, locker and dressing rooms shall be of aluminum construction w/baked off-white finish. All other Air Terminals shall be of a standard steel construction; wall-mounted terminals shall be prime coat finish; ceiling diffusers, exhaust and return air terminals shall have factory-applied baked enamel finish, color as selected by Architect.

C. Approved Manufacturers: (subject to submittal approval):

1. Anemostat
2. J & J
3. Kees
4. Krueger
5. Price
6. Titus
7. Tuttle & Bailey

2.2 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

2.3 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.

2.4 ROOF HOOD

A. For dryers and residential type hoods, use Pennbarry SL20 or equal unless otherwise called out on the plans.

2.5 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 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. Provide louvers with motorized dampers on all ductless, through wall relief penetrations unless otherwise noted on the drawings.

END OF SECTION 233700

SECTION 238143 - SPLIT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes, but not limited to, furnishing and installing material as described in Contract Documents.

B. Related Sections:

1. General Conditions and Division 1
2. Section 200000 - Mechanical General Requirements
3. Section 220719 - Piping Insulation
4. Section 230529 - Hangers and Supports for HVAC Piping & Equipment
5. Section 230719 – HVAC Piping Insulations
6. Section 232300 - Refrigerant Piping System
7. Section 233300 - HVAC Specialties

1.2 QUALITY ASSURANCE

A. Qualifications: Units shall be ARI certified and bear the certification symbol.

1. Condensing units shall be started up, checked out, and adjusted by Condensing Unit Manufacturer’s authorized factory trained service mechanic.
2. Mechanic shall use check-out sheet provided by Manufacturer, complete and sign all items on sheet, and submit to Architect.

B. Requirements of Regulatory Agencies: Each unit shall be UL labeled.

1.3 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Indoor/Outdoor units.

1.4 WARRANTY

A. This Contractor shall warrant the systems to be free from defects in material, equipment, and workmanship under normal use and service and any time within one (1) year from date of final acceptance, with repair or replacement without cost to the Owner, any material, equipment, or workmanship found to be defective. The date of final acceptance shall be recorded on a warranty certificate for each unit. The certificate is to be included in Operation & Maintenance Manual. See Section 20 00 00.

B. All systems and control equipment shall be inspected and serviced or adjusted as required for optimum and satisfactory performance a minimum of four (4) times during the next twelve (12) months after the date of final acceptance. The first inspection shall be made approximately thirty (30) days after final acceptance and the final inspection shall be made during the eleventh month thereafter.

C. At the end of the first year the Contractor shall present a service contract to the Owner which would cover filter replacement for an additional four (4) years.

1.5 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment

B. ARI 270 – Sound Rating of Outdoor Unitary Equipment

1.6 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Outdoor Units

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Carrier

B. Lennox

C. Trane

2.2 MANUFACTURED UNITS

A. Indoor Units:

B. Cabinets:

1. Constructed of 18 gauge or heavier steel with protective enamel on zinc coated finish or galvanized steel, adequately braced and reinforced, and of sectionalized construction.
   a. Panels shall be side removable for easy access to interior of unit.
   b. With interior mounted motors, hinged access doors with ventlock style handle.
   c. Cabinet panels shall be internally insulated with 1" thick, 1-1/2 lb density, vinyl coated glass fiber insulation.
2. Drain Pan: Provide double sloped drain pan with condensate drain connection. Extend drain pan under coil headers and refrigerant distributors.
3. Fans:
   a. Provide with a forward curved centrifugal type designed for Class I operation.
   b. Base fan ratings on test conducted in accordance with AMCA Code #210.
   c. Construct fan housings with streamline inlet and side sheets.

d. Fans shall be statically and dynamically balanced and tested as an assembly at design RPM to meet design specifications. Maximum rated fan RPM shall be below first critical fan shaft speed.
e. Flexible connection to unit cabinet.
f. Fans serving units 5 tons or larger shall be internally isolated with 2" open spring isolations.
g. Units without internal isolation must be externally isolated.

4. Fan Shaft: Solid high carbon steel.
5. Bearings:
   a. Self-aligning, grease lubricated, ball type, and shall perform to L50 200,000 hour average life.
   b. Provide lubrication fittings. Permanently lubricated bearings are not acceptable.
   c. Provide clear extended lubrication lines to accessible side of unit.
6. Sheaves and Belts for Belt Driven Units:
   a. Rate V-belt drives at 150% of motor rating.
   b. Motor sheaves shall be of adjustable pitch type giving 30% speed variation.
7. Motors:
   a. As scheduled in Contract Documents and mounted internal to unit with fan, motor, and drive assembly internally isolated. If unit is belt driven, mount motor on adjustable slide base to allow belt tightening.
   b. Locate motor on side of unit most accessible.
8. Refrigerant Coils:
   a. Coils shall be mounted in the unit casing to be accessible for service and can be removed from the unit through the side. Capacities, pressure drops, and selection procedure shall be certified in accordance with ARI Standard 410 or as indicated on schedule.
   b. All coils shall be enclosed in an insulated coil section. Coil headers and U-bends shall not be exposed. Suction and distributor headers shall be made of copper tubing and penetrate coil cover panel to allow for sweat connection of refrigerant lines.
   c. Coils shall be proof tested to 425 psig and leak tested to 300 psig, air pressure under water. Coils shall be dried after testing and filled with a 10 psig holding charge of nitrogen.
   d. Coils shall have an equalizing type vertical distributor to ensure that each coil circuit receives the same amount of refrigerant liquid.
   e. Each refrigeration circuit is to be controlled by a factory-installed expansion valve.
9. Filter Boxes: See Section 23 33 00 - HVAC Specialties.
10. Expansion Valves:
    a. Stainless steel diaphragm and same refrigerant in thermostatic elements as in system. Externally or internally equalized as required by evaporator/ condensing system.
    b. Size valves to provide full rated capacity of cooling coil served.
    c. Furnished by evaporator coil/condensing unit supplier and coordinated to provide bleed holes for system pressure equalization, if required.
    d. Electronic or thermal expansion valves shall be used to control refrigerant expansion. The expansion valves shall be adjusted to the manufacturer's superheat and sub-cooling levels. No capillary tube expansion type devices will be allowed.

C. Outdoor Units:

1. Condenser units having side inlets shall have coil guards.

2. Fans:
   a. Each fan shall have a safety guard.
   b. Fans shall be direct driven propeller upflow type.
   c. Fan motors shall be resiliently mounted and suitable for outside use. Provide with permanent lubricated ball bearing.
   d. Fans shall be constructed of aluminum.
3. Controls:
   a. Factory wired and located in separate enclosure as the main condensing unit.
   b. Safety devices shall consist of high and low pressure cutouts, and condenser fan motor overload devices.
4. Casing:
   a. Fully weatherproof for outdoor installation. Finish shall be weather resistant.
   b. Panels shall be removable for servicing.
   c. Provide openings for power and refrigerant connections.
   d. Constructed of 18 gauge or heavier steel with protective enamel on zinc coated finish or galvanized steel, adequately braced and reinforced, and of sectionalized construction.
5. Condensing Unit:
   a. All condensing units shall use the same refrigerant.
   b. Only one liquid line, one suction line, and one power connection shall be made to each compressor.
   c. Provide charging valves.
   d. Must have a EER, SEER, COP and IPLV, as defined by ARI, which complies with the most current Washington State Energy Code.
   e. Install each condensing unit on neoprene isolation pads located at each corner and having a minimum size of 4"x4"x3/4" high.
   f. Insulate refrigerant lines according to Section 23 07 19 HVAC Piping Insulation.
6. Condenser coil shall have aluminum plate fins mechanically bonded to seamless copper or aluminum tubes.
7. Fan motor shall be single or two speed, thermostatically controlled and designed with permanent protection.
8. Compressor shall be of hermetic design with the following features.
   a. Externally mounted brass service valves with charging connections.
   b. Crankcase heater.
   c. Resilient rubber mounts.
   d. Compressor motor overload protection.
   e. Single speed

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install units in locations shown on plans and in accordance with manufacturer's instructions.

B. Piping: Insulate refrigerant piping according to Section 22 07 19. Provide condensate piping to unit. Condensate line shall drain to the nearest drainage point or where indicated on plans.

C. Unit Protection: Units shall be protected during construction to prevent debris from depositing on the unit per Section 20 00 00.

D. Horizontal Units:
1. Pitch units towards condensate drain outlet to facilitate condensate drainage.
2. Support hung units with hangers, rods, and manufacturer furnished clips and vibration isolators.

E. Vertical Units: Install units on isolator pad to minimize vibration transfer to structure. Large vertical units shall be installed on external rubber type vibration isolators.

F. Set condensing units on a 3” high (minimum) concrete slab.

3.2 START-UP

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, duct connections, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.

B. Testing and Adjustment: Operate unit in various modes of operation to test for proper operation, including fan rotation, proper damper travel (where applicable), proper cooling/heating, correct interface to other controls (time clock, fans, etc.). Make necessary adjustments per manufacturer's directions.

C. Final Check: When testing and adjustment is complete, a final check of each unit shall be done by the manufacturer's authorized service representative to verify proper unit operation.

D. Start-Up Log: Provide a start-up log per Section 23 23 00 - Refrigerant Piping System.

END OF SECTION 238143

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.

PART 2 - PRODUCTS

2.1 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

2.2 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

PART 3 - EXECUTION (Not Used)

END OF SECTION 238239

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 01 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 RELATED WORK

A. Temporary Power and Lighting

B. Mechanical Control Wiring

C. Cutting and Patching

D. Trenching, backfill, and asphalt work

1.5 STANDARDS AND REGULATIONS

A. The work shall comply with the latest edition of the applicable Standards and Codes of the following:

ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
---	State Electrical Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
U.L.	Underwriters Laboratories Inc.
IPCEA	Insulated Power Cable Engineers Associated
CBM	Certified Ballasts Manufacturers
---	Federal, State and Local Building Codes
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 with 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.

1.6 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.

1.7 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.

1.8 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.

1.9 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 Section 016000 for detailed requirements.

1.10 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.

1.11 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 01 specifications.

1.12 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, baseboard heaters, 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 mylar to the Engineer for transmittal through the Engineer to the Owner.

E. See Section 270000 for additional requirements of low voltage systems.

1.13 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.

B. See Section 270000 for additional requirements of low voltage systems.

1.14 INSTRUCTIONS AND MANUALS

A. Operation and maintenance data shall be submitted in accordance with Section 017800.

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. Lamps and Ballasts - referenced to each fixture type
3. Panelboards, Switchgear, and Transformers
4. Motor Controls
5. Fire Alarm System
6. Access Control System
7. Intercom
8. Television System
9. Audio/Visual Presentation Systems
10. Sound Systems
11. Low Voltage Lighting Control Systems
12. TVSS

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.

1.15 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.

1.16 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 suppliers representatives when so specified.

B. Scheduled Instruction periods shall be:

1.	Low Voltage Lighting Control Systems	1/2 day
2.	Intercom	1/2 day
3.	Sound Systems	1/2 day
4.	Television System	1/2 day
5.	Fire Alarm System	1/2 day
6.	Access Control System	1/2 day
7.	Generator Systems	1/2 day
8.	Daylighting Control Systems	1/2 day

C. Costs for time involved by Contractor shall be included in the bid.

1.17 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. Electrical Inspector Fire Department	COMPLETION OF WORK 260000 – 1.17
3.	Warranty to Owner (with copy for Engineer	SUPPLEMENTARY GENERAL CONDITIONS 260000- 1.13
4.	Marked Set, Electronic Media Set on CD in AutoCAD R-2013 Format, and Mylar Set of " As-Built" Electrical Drawings	GENERAL AS-BUILT DRAWINGS 260000– 1.12
5.	Motor Current Readings	GENERAL, TESTS 260519 – 3.03(D)
6.	Phase Current Readings	GENERAL, TESTS 260519 – 3.03 (E)
7.	OHMIC Test Readings	GENERAL, TESTS 260519 – 3.03 (B)
8.	Panelboard and Special equipment Shop Drawings and Final Approved List of Materials Installed	MATERIALS, GENERAL 260000– 2.03
9.	Certified of Feeders Torque Results	WIRES AND CABLES 260519
10.	* Receipt from person to whom delivered the following spare glasses, plastic diffusers, lamps, and ballast fuses.	LIGHTING FIXTURES 265000
11.	* Receipt from person to whom delivered the following: Spare Elements for Fire Detectors, Fuses for Switches, Spare Keys for Panelboards, receptacles switches, plugs, etc.	LOW VOLTAGE – 270000 FIRE ALARM – 283100 FUSES – 262813 PANELBOARDS – 262416 SWITCHES & RECEPTACLES – 262726

12.	Wiring diagrams, Maintenance Manuals, Operation Instructions, and Brochures (5 sets minimum)	GENERAL, INSTRUCTIONS & MANUALS – 260000– 1.14

* Secure delivery instructions from Architect for delivery to Owner.

1.18 SHOP DRAWING SUBMITTALS

A. The Contractor shall submit to the Architect as described in Section 016000.

B. 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. Transformers (Dry Type)
4. TVSS
5. Disconnect Switches
6. Fuses and spare fuse cabinet
7. Electrical System Protective Device Study
8. Lighting Fixtures (Complete)
9. Lighting Fixture Lamps and Ballasts referenced to fixture types
10. Low Voltage Lighting Control Systems
11. Wiring Devices
12. Back Boxes
13. Coverplates
14. Raceways and Connectors
15. Fire Wall Penetration Seals
16. Cable Tray
17. Copper Wire
18. *Fire Alarm System
19. *Access Control System
20. *Telecommunication System
21. *Intercommunication
22. *Sound Systems
23. *Audio/Visual Presentation Systems
24. Automatic Transfer Switches
25. **All Specialty Systems not listed above**

*See Section 270000 for further requirements.

C. 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.

D. 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.

E. Electrical Drawings for the project have been developed by the Engineer using AutoCAD™ Revision 2012 software. These drawing files will be made available to the Contractor for development of shop drawings and/or "As-Builts" for a fee of $20.00 per sheet.

1.19 SCHEDULE OF VALUES

A. Provide Schedule of Values per Division 01 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. Intercom
17. Television System
18. Fire Alarm System
19. Systems Equipment – Labor
20. Cable Tray
21. Cable Tray – Labor
22. Commissioning
23. 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 01, 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 01, 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. Medium Voltage Feeder Tags: Refer to Section 260573.
7. 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. Switches located on "strike" side of 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. 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 and in inaccessible ceiling space.

B. All branch circuit, signal and communication 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 refinished 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 connections 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 260000

SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all wire, cable, and terminations complete.

PART 2 - PRODUCTS

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: Solder-less type only. Pre-insulated "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 Architect. 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 Architect 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 Architect/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:

Equipment Maximum Voltage Rating	Minimum Test Resistance
1,000-Volts or less	2 Megohms

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 TAPING

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 260519

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.

B. An isolated grounding system shall be provided for all isolated ground receptacles as allowed by Code (2011 NEC 250-146, paragraph D).

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.

2.3 ISOLATED GROUND BARS

A. Provide in all panels containing isolated ground circuits.

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 260526

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.

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 2.02A 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, Telecommunications	18 Inches, Set Vertically to Centerline
Other	As Noted or as Directed by Architect

* *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.

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 insure accurate location of electrical fixtures (outlets and devices) as verified with the Architect. 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 Architect.

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
Fire Alarm	Red
Telephone	Dark Blue
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 260532

SECTION 260533 - RACEWAY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide Raceway System complete.

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. Indenter, drive-on and pressure cast or die cast type set screw are not acceptable.

2.4 FLEXIBLE METAL CONDUIT

A. Dry Locations:

1. General: Galvanized flexible steel for dry locations.
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 "Super-Tite" or equal.

2.5 SURFACE METAL RACEWAY

A. Formed steel or aluminum type. Standard factory finish. Where color choice is available, consult Architect/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 Architect/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 elbows. For all other Raceway, use factory ells for bends of 1-1/4" and larger diameter.

F. Raceway shall not penetrate sheet metal ducts unless permission is granted by Architect/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 HANGARS 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; 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.

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 inch (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
Fire Alarm	Red
Telephone	Dark Blue
Television	Rust
Low Voltage Switching	Black

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 260533

SECTION 260539 - FLOOR OUTLET DEVICES – FLUSH

PART 1 - GENERAL

1.1 SCOPE

A. The floor box provides the interface between power and communication cabling in an on grade or above grade concrete floor where power and/or communication services are required.

1.2 CLASSIFICATION AND USE

A. Floor boxes, covers, above floor fittings and accessories shall be of same manufacturer and be designed, manufactured, tested and installed to comply with UL514A, UL514C and NCE/NFPA 370-17(b), covers are suitable for tile, terrazzo, wood, and carpet covered floors.

1.3 SUBMITTALS

A. Product Data: provide catalog cuts of specified floor boxes and accessories upon request.

B. The manufacture's catalog numbers specified represent the minimum standard required. If product alternate manufactures are selected from the approved manufacture list, they must be equal to or exceed the standards and quality criteria set forth by listed Hubbell Inc. catalog numbers. Alternative manufactures must submit catalog cuts and samples for approval 10 days prior to bid date.

C. In general, all floor boxes shall be of size and type indicated on drawings herein specified. All floor boxes shall be located as directed by architect or on drawing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Following are acceptable:

1. Hubbell Inc. Wiring Device-Kellems or approved equal.

2. Legrand-Wiremold or prior-approved equal.

2.2 MATERIALS

A. Stamped Steel – for installation above grade.

1. Concealed Large Capacity Floor Box – Carpet or Tile Floor Applications.

a. The large capacity floor boxes shall allow for the activation of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. For concrete pours 3¼" and greater, the floor box shall be stamped steel with a galvanized finish. The depth of the box shall not exceed 3¼", with total dimensions of 12½" square. The box shall have vertical and angular adjustments of 1¼" before and 5/8" after the pour. Conduit connections shall be made through six ¾" and six 1"-1¼" combination style concentric knockouts. Total cubic inch capacity is to be 328.2. Six individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Six #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The large capacity floor box shall be Hubbell type LCFBSSA. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of six individual wiring chambers. When installed, these plates will enclose four wiring chambers with 38.2 cu. in. and two wiring chambers with 25.4 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Plates to be furnished shall be Hubbell type LCFBP14, LCFBP8, LCFBP26 and LCFBP720.

B. Cast Iron – for installation above, on, or below grade

1. Concealed Large Capacity Floor Box – Carpet or Tile Floor Applications. The large capacity floor boxes shall allow for the activation of power of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. For concrete pour 3½" and greater, the floor box shall be cast iron with a powder paint finish. The depth of the box shall not exceed 3½", with total dimensions of 13" square. The box shall have vertical and angular adjustments of 1¼" before and 5/8" after the pour. Conduit connections shall be made through six ¾" and six 1¼" threaded conduit hubs. Total cubic inch capacity is to be 322.6. Six individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Six #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The detailed above large capacity floor box shall be Hubbell type LCFBCA. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of six individual wiring chambers. When installed, these plates will enclose four wiring chambers with 36.8 cu. in. and two wiring chambers with 25.4 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Plates to be furnished shall be Hubbell type LCFBP14, LCFBP8, LCFBP26 and LCFBP720.

2.3 OVERSIZED FLOOR BOXES FOR SPECIALTY APPLICATIONS

A. Legrand model# EFB6S Floor Boxes: Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x

107mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through area shall be a minimum of 6-15/16 in^2 [176mm^2]. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

B. Legrand model# EFB6S-OG Floor Boxes: Manufactured from stamped steel approved for use in above grade and on-grade floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes, through the use of the EFB6S-2HUB and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4"

x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

C. Legrand model# EFB6S-FC Floor Boxes: Manufactured from stamped steel approved for use in 2-hour fire-rated concrete floors. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with a 21-3/4" L x 17-1/4" W x 6-1/2" H [552mm x 438mm x 165mm] sheet metal concrete pan to ensure that 3-1/4 inches [83mm] of concrete surrounds the box. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with four (4) intumescent services feed stems with a 1-1/4-inch [32mm] pass-through channel that allows the pathway to close off during a fire. Boxes shall be fully adjustable, accommodating a maximum 2-1/2-inch [64mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

2.4 MATERIALS – COVERS

A. Covers for Concealed Large Capacity Stamped Steel: Cover/flange assemblies re-enforced with metal cover plate shall be mounted to the box previously mentioned. Cover shall be made of die-cast aluminum. Flanges and cable doors shall be made of thermoplastic (ABS) or die-cast aluminum. The die-cast aluminum covers shall be brushed aluminum. All covers shall be UL listed for either tile floors or carpet floors. A die-cast aluminum cover shall also be available with no flange and a solid surface (no-insert required) for tile floor applications. This cover shall be hinged to allow for access to connections inside the box. When the box is in use, cable(s) will exit through two cable doors located on opposite ends of the cover. When the box is not in use, the cover will lay flush with the floor. This cover is 180 degrees reversible and will accept a carpet insert. (Except "T" series)

1. For LCFB series floor boxes
   a. **Die-cast aluminum** large capacity floor box cover flange assemblies shall be Hubbell type LCFBCALC (brushed aluminum).
   b. **Die-cast aluminum flangeless covers for tile** floor applications shall be Hubbell type LCFBCALT (aluminum). Covers shall feature ScrubShield gasketing technology and pass 2003 UL 514A scrub-water exclusion test requirements for carpet and tile floor applications.

PART 3 - EXECUTION

3.1 GENERAL

A. Cast metal watertight floor boxes shall be used in slabs, on grade level or below.

B. Steel concrete tight floor boxes shall be used in slabs above grade level.

C. After positioning the box, conduit is installed in accordance with local codes.

D. Box shall be secured and pre-pour adjustments made.

E. Grease shall be applied to outside of cement cover and exposed portion of adjustable collar.

F. Cover shall be duct taped prior to pour.

G. Locate boxes after pour and cement cover shall be removed.

H. Wires shall be pulled and receptacles installed per local and national codes.

I. Provide all service plates required to complete installation to include required plates for receptacles, low voltage devices and blank plates.

J. Coordinate and pay carpet installer to install matching carpet in floor box cover where installed in carpeted areas.

END OF SECTION 260539

SECTION 260943 – DAYLIGHT HARVESTING ROOM CONTROLLER

PART 1 - GENERAL

1.1 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.

B. Electrical Contractor shall provide all support, labor and material to accommodate commissioning, per Section 260800.

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 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 1equipment 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 Room Controller as manufactured by Cooper Controls. 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.

1.4 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 necessarily limited to, the low voltage relay panels, power wiring, and switch inputs.

1. Riser Diagram/System Diagram
2. Switch Input Wiring

1.5 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:
   1. Room Controller QuicKit (RCQK) – Pre-defined solutions to meet typical applications. The RCQK includes defined equipment shown below.
   2. Room Controllers – Pre-configured, three relay controllers with 0-10 volt control for ballasts (if applicable) with integral UL924 emergency relay (if applicable), that RCQK smart devices connect to over the RCQK communications network.
   3. Occupancy Sensors – Auto adjusting, MicroSet technology NEMA WD7 compliant occupancy sensors.

B. Wallstations – Smart device that is pre-configured, pre-engraved digital pushbutton wallstations, dimmers, and scene switches.

C. Daylight Photosensor – Smart device that is a multi-zone open loop daylight sensor with two-way active infrared (IR) communications. Which can provide switching or dimming control for daylight harvesting.

D. RCQK communication network – Pre-defined lengths of QuickConnect cable (RJ45) for power and data to smart devices.

1.6 LIGHTING CONTROL APPLICATIONS

A. Minimum lighting control performance required, unless local Energy Code is more stringent.
   1. Occupancy/vacancy requirements – Provide an occupancy/vacancy sensors with Manual On/ Automatic Off or Automatic On/ Automatic Off functionality in all spaces. Manual On vacancy sensors should be used for any enclosed space with a Manual On switch that does not require hands free operation. Spaces with multiple occupants or where line of sight might be obscured ceiling or corner mount sensors and Manual wallstations would be required. Automatic On of lighting via occupancy sensor cannot exceed 30% of lighting. Systems that do that allow the user to select Occupancy or Vacancy mode shall not be acceptable.
   2. Bi-Level switching – Provide multi-level switching and/or variable dimming for maximum energy savings. (Qualifies for EPACT tax deductions of $0.60 per foot)
   3. Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by a multi-level photocontrol device without the need for programming. Adjustments to the daylight zones must be provided by a simple to use, intuitive remote handheld device.
   4. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level.
   5. Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.
   6. Provide the ability for the dimmers and the relays to function separately. Systems where the 0-10V dimmers and relays are tied together reduce design capabilities and shall not be acceptable.

7. Provide the ability to provide occupancy status to a Building Automation System. Occupancy status shall happen automatically and be provided to the BAS without the need of programming any device in the Room Controller System. Systems that require programming for BAS occupancy status shall not be acceptable.
8. Shall be capable of automatically responding to a Demand Response Signal and adjusting the lighting level, without the need of programming or software. Systems that require software or commissioning to provide Demand Response integration shall not be acceptable. (Required for California Title 24 2013)

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Wall or Ceiling Mounted Occupancy Performance Requirements:
1. Sensing mechanism:
a. Dual technology:
1) Utilize multiple segmented lenses, with internal grooves to eliminate dust and residue build-up.
2) Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
3) Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.

B. Power Failure Memory:
1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.

C. Designed and tested to withstand discharges of 15,000 volts per IEC 801-2 without impairment of performance.

D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

E. Sensor shall have time delays from 10 to 30 min.

F. When specified, sensors shall automatically adjust time delay and sensitivity settings.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

I. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.2 CEILING MOUNTED SENSORS

A. Product: OAC-DT-2000, OAC-DT-1000, OAC-P-1500.

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
   1. OCC-RJ45 Room Controller accessory is used to allow any standard Occupancy/ Vacancy Sensor to utilize Click & Go cable connections.
   2. Two RJ45 connection ports for connection to Room Controller.
   3. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.

E. Device calibration and features:
   1. Sensitivity – 0-100% in 10% increments.
   2. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
   3. Test mode – Fifteen second time delay.
   4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   5. Walk-through mode.
   6. Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.
   7. Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area, shall not be acceptable.
   8. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
   9. All load parameters including Automatic On/Manual On, blink warning and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:
   1. PIR Detection
   2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

J. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

K. Sensors shall be RoHS compliant.

2.3 WALL/CORNER MOUNTED SENSORS

A. Product: OAWC-P-120W, OAWC-P-009L-H, OAWC-DT-120W

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
1. OCC-RJ45 Room Controller accessory is used to allow any standard occupancy/ vacancy sensor to utilize Click & Go cable connections.
2. Two RJ45 connection ports for connection to Room Controller.
3. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.

E. Device calibration and features:
1. Sensitivity – 0-100% in 10% increments.
2. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
3. Test Mode – Fifteen second time delay.
4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
5. Walk-Through Mode.
6. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
7. All load parameters including Automatic-On/Manual-ON, blink warning, and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:
1. PIR Detection
2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

J. Where specified, sensor packaging shall be 100% recycled made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable.

K. Sensors shall be RoHS compliant.

2.4 ROOM CONTROLLER DIGITAL WALLSTATIONS

A. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:
   1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons ENGRV-*BTNL-*, ENGRV-*BTNS-*. Button replacement may be completed without removing the switch from the wall.
   2. Intuitive button labeling to match application and load controls.

B. Two RJ-45 ports for connection to the Room Controller local network.

C. Multiple digital wall stations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.

D. Room Controller digital wallstations are delivered with pre-defined functions including, raise, lower, A/V mode, Quiet Time, manual and scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

2.5 ROOM CONTROLLER SLIDER STATION

A. Low voltage slider station is available in white, ivory, grey and black; compatible with wall plates with decorator opening. Slider stations shall include the following features:
   1. Automatic raise/lower control of dimming loads.
   2. Intuitive user control of dimmable lighting.

B. One RJ-45 port for connection to the Room Controller local network.

C. Cooper Controls catalog numbers: RC-SS1-W, RC-SS1-G, RC-SS1-B, RC-SS1-V.

2.6 HANDHELD REMOTE CONTROLS

A. Battery-operated handheld 10 button configuration for remote daylight sensor configuration. Remote controls shall include the following features:
   1. Two-way infrared (IR) transceiver for line of sight communication with the Room Controller daylight sensors within up to 30 feet.
   2. Red communication LED on the daylight sensor confirms button press.
   3. Inactivity timeout to save battery life.

B. Three intuitive daylight sensor range push buttons.

C. Intuitive daylight zone adjustment raise/lower pushbuttons.

D. Cooper Controls catalog numbers: HHPRG-RC.

2.7 ROOM CONTROLLERS

A. Room Controllers are fully functional out-of-the-box to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will include line voltage wiring space and will not require additional electrical junction boxes. The control units will include the following features:

B. Fully functional room configuration to the most energy-efficient sequence of operation based upon the connected devices in the room.

C. Simple replacement – Using the automatic configuration capabilities, a Room Controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

D. Quick installation features including:
   1. Included line voltage space to simplify wiring and eliminate the need for separate junction boxes.
   2. Included emergency voltage space to simplify wiring of emergency luminaire connections.
   3. Breakouts for direct conduit connection.
   4. Line and low voltage sections include conduit connection points. Systems that require special accessories for direct conduit connections may not comply with local building codes and shall not be acceptable.
   5. Quick low voltage connections using standard RJ-45 QuickConnect cable.
   6. Dual voltage (120/277 VAC, 60 Hz).
   7. Zero cross circuitry for each load.
   8. Three relay configuration.
   9. Efficient 150 mA switching power supply.
   10. Six RJ-45 Click & Go local network ports.
   11. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.

E. On/Off/Dimming Room Controllers shall include:
   1. Real time current metering (optional).
   2. Three relay, two 0-10V dimming zone configuration RC3D2.
   3. Three relay, three 0-10V dimming zone configuration RC3D.
   4. Three relay, three 0-10V dimming zone configuration for patient rooms RC3DEHC.
      a. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.
      b. Up to three 0-10V analog outputs per relay for control of compatible ballasts and LED drivers.

F. Cooper Controls catalog numbers: RC3, RC3D2, RC3D, RC3DE, RC3DEHC.

2.8 DAYLIGHT PHOTOSENSORS

A. Daylight photosensors work with Room Controllers to provide automatic daylight dimming capabilities for any load type connected to a room controller. Open loop daylight sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Daylight sensors shall be interchangeable without the need for rewiring. Daylight sensors shall be capable of daisy chaining with occupancy sensors in each room.

B. Digital daylight sensors include the following features:
1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve.
2. The daylight sensor has three light level ranges: Low (3-300 lux), High (30-3000 lux), Direct Sun (300-30000 lux).
3. For dimming daylight harvesting, the daylight sensor shall provide the capability of controlling multiple (up to three) daylight zones immediately upon connection without programming.
4. Optional digital wallstations to allow occupants to reduce lighting level to increase energy savings and lower lighting levels for a selected period of time or cycle of occupancy.
5. Infrared (IR) transceiver for daylight sensor range and daylight zone gain adjustments via handheld remote programmer.
6. Red configuration LED that blinks to indicate data transmission.
7. One RJ-45 port for connection to Room Controller local network.
8. An adjustable head and an optional mounting bracket to accommodate multiple mounting methods and building materials. The daylight sensor may be mounted on a ceiling tile, skylight well, suspended lighting fixture or backbox.

C. Open loop digital daylight sensor includes the following additional features:
1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes dimming set-points upon power up without any programming. Optional calibration using the wireless IR handheld programmer.
3. Cooper Controls Catalog Number: DS-FMOIR.

2.9 ROOM CONTROLLER LOCAL NETWORK

A. The Room Controller local network is a physical connection and communication protocol designed to optimally control a space within a building. Room Controller devices connect to the local network using CAT 5e cables with RJ-45 QuickConnect cables which provide both data and power to room devices. Features of the Room Controller local network include:
1. Click & Go default functionality of occupancy sensors, wallstations, slider station, daylight sensors, receptacle controls, BMS status output and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

2.10 EMERGENCY LIGHTING

A. Room Controller with emergency relay – The Room Controller is a UL 924 listed device that monitors normal power circuit to the Room Controller. The Room Controller has a dedicated UL 924 output which includes emergency power line in and emergency power load out connections. The UL 924 relay will track with output 1 (Yellow) during normal power operations. Upon loss of normal power the UL 924 output will force the emergency lighting On and full bright (if dimming) until normal power is restored. Features include:
1. 120/277VAC, 50/60 hz, 3 amp ballast rating.
2. Ladderless testing: Push the “All Off” button on any wallstation four times (e-mer-gen-cy), will turn off normal lighting and force UL 924 emergency output On and full bright.
3. Auxiliary input for remote Alert Mode (All On, and full bright).
4. Cooper Catalog Number: RC3DE.

B. Cooper Emergency Power Control – A UL 924 listed device installs down line of an output that monitors a switched or dimmed circuit providing normal lighting to an area. The unit provides normal ON/OFF or 0-10V dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
   1. 120/277 volts, 50/60 Hz, 20 amp ballast rating.
   2. Push to test button.
   3. Cooper Catalog Numbers: CEPC-1 (switching), CEPC-DF-S-120 or CEPC-DF-S-277 (dimming).

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.

D. All low voltage smart devices shall connect using QuickConnect wire provided by Cooper Controls. When using wire for connections other than the QuickConnect low voltage wire (pre-defined lengths of RJ45 cable), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements.

E. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

F. Provide written or computer-generated documentation on the commissioning 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.).

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 FACTORY COMMISSIONING (OPTIONAL)

B. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

C. The electrical contractor shall provide both the manufacturer and the electrical engineer with twenty one working days written notice of the system startup and adjustment date.

D. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4 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.

3.5 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.

3.6 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 01 9113 – General Commissioning Requirements and Section 26 0800 – Commissioning of Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all service entrance and main distribution switchgear with equipment as shown and described, with continuous full load ampacities as indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square-D

B. General Electric

C. Cutler-Hammer

2.2 ENCLOSURES

A. Shall be freestanding, steel with steel angle or channel framework of adequate strength and rigidity necessary to resist all conditions of use to which it may be subjected and to support all equipment, devices and appurtenances contained therein. Front plates shall be installed in sections so that all parts of the board are front accessible without disturbing other parts. A removable lifting angle shall be provided at the top and bottom of each shipping section(s).

B. Minimum 12 gauge steel, except front panels and doors may be minimum 14 gauge.

C. Shall be front access only unless noted otherwise.

D. Provide on 3-inch housekeeping concrete pad with minimum 3-inch lip on front and sides.

E. Finish shall be factory applied; standard gray color for all exterior and interior painted surfaces. Other colors may be considered.

F. Outdoor installation shall be NEMA 3R.

2.3 SWITCHBOARD DIMENSIONS

A. Overall height of switchboards shall not exceed 90 inches (not including base channels). Length and depth shall not exceed dimensions as scaled or noted in contract documents. Manufacturers whose equipment dimensions exceed those indicated shall notify the Engineer in writing 10 days prior to bid date. These Manufacturers may not bid as "Not Conforming To Contract Documents". Contractor shall base bid only on equipment which fully compiles with contract documents. Cost of building modifications or switchboard relocations, if permitted, or other additional work required to fit larger size switchboard(s) than shown on drawings shall be borne totally by the Contractor.

2.4 SWITCHBOARD BUSBARS

A. Aluminum or copper at manufacturer's option, factory fabricated; carried to terminals for connection to service cables or busway. Brace switchboard components for symmetrical fault current shown plus a symmetrical offset (50,000 amp bracing minimum). Aluminum bus shall be tin plated over its full length.

B. Busbar Joints:

1. Busbar to busbar shall be bolted, lapped and silver or tin plated, having low contact resistance and low temperature rise. For aluminum bus bolt using Grade 5 bolts with Belleville washers.
2. Overcurrent devices shall be bolted to busbars using Grade 5 bolts and Belleville washers. Exception: Square-D I-line and 30-200A fused switches

C. Conductor connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Where aluminum conductors are utilized for feeders the connectors shall conform with Section 260519.

D. System of Bussing: Three phase, 4 wire, full size neutral unless otherwise noted.

E. Ground Bus: Full length ground bus bonded to frame conforming to U.L. 891 for minimum size except larger as required by the code for grounding neutral conductor.

2.5 SWITCHBOARD COMPONENTS

A. Switchboards shall include (but not limited to) the following components:

1. Shall be full-fault current rated, series rating of devices is not allowed.
2. Switches and fuses or breakers as shown. If fuses are used, provide all necessary fuses and spares per Section 262813.
3. Space for future switches or breakers as shown including complete bussing and required hardware for mounting devices. Space for metering and instrumentation components, and current limiters (when required).
4. Miscellaneous appurtenances as required for a complete installation.
5. Cleats for securing all conductors.

B. When Serving as Service Entrance Equipment:

1. Shall conform to UL 869 and have a Service Entrance Type UL label
2. Shall be full-fault current rated, series rating of devices is not allowed. See drawings.
3. Where utility company metering equipment is shown, provide current transformer space, meter base(s), metering conductors and miscellaneous appurtenances as required by serving utility.
4. Shall contain surge arrestors on all phases for voltage surge protection on secondary (under 600V) electrical wiring systems. Similar to Square-D, J9200.

C. Digital Line Meter/Monitor (Spec Writer) this may add size to the switchboard, please verify)

1. Provide a digital line Meter / Monitor device equal to Cutler-Hammer type IQ DP-4000 Series having the features and functions specified below. The Meter / Monitor device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the MM4 shall auto range between units, kilounits and megaunits. The Meter / Monitor device shall provide the adjustable protection functions indicated and the capability to communicate data via twisted pair network. The MM4 shall be UL listed, CUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

METERED VALUES	ALARM FUNCTIONS (ACCURACY % FULL SCALE)
AC Phase Amperes +/- (0.3%)	Voltage Phase Loss
AC Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% – 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
varhours +/- (0.6%)	(105 to 140% – 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% – 5% steps)
Watt Demand with	Time Delay for Overvoltage,
10-, 15-, 20-, 25-, 30-,	Undervoltage, and Phase
45-, 60-minute interval)	Unbalance (0 to 20 seconds –
%THD (through 31st harmonic)	1-sec. steps)
Voltage – minimum/maximum	
Current – minimum/maximum	
Power – minimum/maximum	
Power Factor – minimum/maximum	
Frequency – minimum/maximum	
Peak % THD	
Peak Demand	

2. Input ranges of the Meter / Monitor device shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. Provide external current transformers sized for incoming service. Potential transformers shall be self included and fused up to 600 volts. Above 600 volts, provide fused external potential transformers.
3. Control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit or separate remote power source (96 to 264V AC or 100 to 350V DC) where shown on the drawings.

4. Provide the following features:
   a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.
   b. Load shed feature, which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.
   c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240V AC or 30V DC resistive. In addition, provide a separate Form C (NO/NC) contact to provide a programmable kilowatt-hour pulse output. The pulse shall be KYZ type.
   d. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible two-wire local area network to a central personal computer for storage and/or printout. The network shall also be capable of transmitting data in RS-232c format via a translator module.

D. Ground Fault Protection: Provide the following ground fault protection equipment on breakers (switches) rated 1000 amps or more, and as indicated.

1. A current transformer (also called a sensor or current monitor) installed and connected to indicate the sum of all phase and neutral currents. (Zero sequence method). A current transformer on the grounding conductor is not acceptable.
2. A current transformer (also called a ground break relay) operated by the current transformer. Trip point shall be adjustable (calibrated scale indication) from 20% to 60% of the breaker or switch rating (or 1200 amps whichever is lower). The sensor shall also include an adjustable time delay (calibrated scale indication) from .1 second to .4 second (approximately).
3. A monitor or test panel whose functions shall furnish a means to test the ground fault system; monitor to control voltage; indicate when the sensor has tripped the breaker (switch); and reset the system.
4. A trip device on the breaker or switch operated by the ground fault sensor.

E. Ground current meter and current transformer similar to Square-D #EA1GG/GF1 with current transformer on the neutral bonding jumper.

2.6 NAMEPLATES

A. Nameplates shall be installed on all switchboards. Each individual switch shall be identified with a nameplate adjacent to the switch, describing the load connected.

B. Provide a service entrance label nameplate on the main switchboard which includes the following:

1. Architect
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

C. Lettering size shall be suitable for the size of plate and information contained. Nameplates shall be engraved plastic (3/8-inch high minimum letters). Attach with stainless steel screws.

D. Nameplate color shall be: Emergency System - white on red, normal System - white on black.

E. Provide a riser diagram drawing using non-fading ink and mylar installed under glass and attached to the exterior of the main switchboard showing feeder runs, panels, transformers and raceway sizes.

2.7 SINGLE PHASING SENSORS

A. Provide single phasing sensors to trip the main switches in the event of a single phase failure.

2.8 CLEATS

A. Provide for securing all feeder cables within the switchboard.

PART 3 - EXECUTION

3.1 MOUNTING

A. Shall be bolted to floor using 1/2" x 8" (minimum) black mild steel foundation anchor J-bolts and anchored similarly to building structure to prevent overturning in the event of earthquake. Provide 3" thick structural concrete "housekeeping pad". J-Bolts in the floor shall be set in the structural floor and extend through the housekeeping pad with sufficient threads to attach the switchboard.

3.2 WIRING

A. Shall conform to applicable Sections of these specifications.

B. Shall be secured to switchboard enclosure with cleats. Maximum spacing shall not exceed 24 inches.

3.3 SPACE

A. Verify space available with equipment sizes and code required working clearances prior to submittals of shop drawings

3.4 GROUNDING

A. Provide pursuant to Section 260526.

3.5 UTILITY REQUIREMENTS

A. When service switchboard includes utility company metering equipment, provide all devices and wiring to meet serving utility requirements.

3.6 TESTS

A. Torquing requirements and installation of all terminations 1,000 amps and above shall be certified by an independent testing agency.

3.7 PULSE OUTPUT FOR REMOTE METERING, SINGLE PHASE, UNDER/OVER VOLTAGE OUTPUT

A. Provide programming of the digital meter assembly and provide all necessary components to supply a calibrated pulse output signal and a single phase, under/over voltage signal to interface with the EMCS system. Programming shall be provided by a factory authorized representative. Coordinate with the EMCS Contractor as required for complete operation.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all panelboard equipment, complete; dead front type.

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 bussing 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. Architect
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

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 262416

SECTION 262419 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 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 2.05, 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. See Section 283100. 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 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 260000 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.

END OF SECTION 262419

SECTION 262726 - SWITCHES AND RECEPTACLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all wiring devices and plates.

B. No push-in terminals allowed.

C. All devices color shall be ivory, unless otherwise noted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Pass & Seymour

C. Leviton

D. Cooper

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. Momentary Contact Line Voltage Switches: Single pole, double throw, 3-wire, normally open. Rating same as above.

D. Fluorescent Dimmer: Fluorescent dimmer switch shall be rated at 1200VA (900 Watts maximum loading), 120V or 277V, 60 hertz. Dimmer switch shall have a vertical slide with positive “off” button. Suitable for single-pole and 3-way. Dimmer shall have a radio/TV interference filter. Dimmer shall be matched with electronic dimming ballast. See specification section 265000. Leviton ‘Renoir’ series.

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 Type 302 stainless steel.

2.3 RECEPTACLES

A. "Industrial Specification Grade", Duplex NEMA 5-20R configuration (20-Amp, 120-Volt) unless shown otherwise. Must have "rivetless ground" contact manufactured as an integral component of the external ground screw terminal. Meets Fed Spec. WC-596 Hubbell HBL5362, Cooper 5362, P&S 5362A, and Leviton 5362.

B. Ground-Fault Circuit-Interrupter Duplex Receptacles: NEMA 5-20R. Hubbell GF20ILA, and Cooper VGF20, for 20 Amp, 125-Volt AC. Provide GFI receptacles where required by code.

C. Duplex NEMA 5-20R configuration, isolated ground, orange color. Leviton 5362 IG, and Cooper IG5362.

D. Weather Resistant (WR) / Ground Fault Circuit-Interrupter (GFCI) Outdoor Duplex Receptacles: NEMA 5-20R. Hubbell GFTR201 or equal, for 20 Amp, 125-Volt AC.

E. Special Purpose Receptacles: For special purpose receptacles, see drawings for voltage, amperage, and phase. Provide with matching plug delivered to the Owner.

2.4 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 Type 302 stainless steel. 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.

2.5 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.

2.6 LOW VOLTAGE CONTROL (When Shown)

A. General Electric or approved equal.

Relays	G.E. Type RR-7
Switches	G.E. Type RTS-5
Transformers	G.E. Type RT1 and RT2
Rectifiers	G.E. Type RA16
Plates	as noted herein

B. Wire shall be copper conductor as made for that purpose by Supplier of low voltage relays and switches.

2.7 SPARE DEVICES

A. Provide the following spare devices:

Device	Quantity
Single-pole switch	3
Duplex receptacle	5
Dedicated duplex receptacle	3
Isolated ground receptacle	4
GFI receptacle	3
20A, single-phase equipment connection	5
20A, three-phase equipment connection	3

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.

2.8 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.

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 stainless steel for each new wiring device and for each telephone and signal equipment outlet, except where equipment mounted thereon covers the outlet box completely.

B. Provide new covers on existing outlet boxes being reused.

3.4 DIMMER SWITCHES

A. Provide a separate neutral for each phase.

B. Fluorescent dimmer switches require a 4 square backbox per switch.

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 isolated ground and ground-fault circuit-interrupter type receptacles.

3.6 HANDICAPPED ACCESS

A. Comply with requirements of Washington State Handicapped Access Code.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 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.

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 262813

SECTION 262816 - DISCONNECTS AND FUSED SWITCHES

PART 1 - GENERAL

1.1 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.

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 262813.

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 2.05.

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.

END OF SECTION 262816

SECTION 263623 - AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all automatic transfer switches. Meet UL Standard 1008.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Asco

B. Zenith

2.2 TYPE

A. Transfer and retransfer to normal load shall be automatic. Automatic transfer switches shall be electrically operated, mechanically held and supplied with positive mechanical interlocking. The main contracts shall be equipped with a safe manual override capability, UL 1008 listed meeting tables 21.1, 23.1, 23.2.

2.3 RATING

A. Shall have voltage, amperage and ampere withstand ratings as indicated on the drawings.

B. Transfer switches used to transfer from normal to emergency power shall be approved for emergency service, full ampere rated (no derating) with make rating at 20 times and break rating at 6 times full load current rating. Provide 4 pole device for switching of neutral in addition to phase conductors when generator neutral is grounded at the generator, or as indicated on the plans.

2.4 ACCESSORIES

A. The following accessories shall be provided as a minimum in addition to those normally required for proper operation.

1. Full three phase voltage failure and phase reversal sensing. Adjusting drop out and pick up. Set at 85% drop out, 92% pick up.
2. Signals: Two pilot lights for indicating transfer position. White - normal, yellow - emergency at transfer switch. Auxiliary contacts for remote pilot lights.
3. Test Switch: For simulating power failure.

4. Transfer: Adjustable ride through feature of approximately 0-10 seconds for start of engine generator and transfer on monetary loss of normal source. Set at 1 second. Includes two auxiliary contacts, one N.O. and one N.C. for use for engine start signal.
5. Retransfer: Adjustable time delay (with emergency failure by-pass) of 0 to 30 minutes for retransfer to normal. Set at 15 minutes.
6. "Time Delay Neutral": Provide time delay with transfer switch in neutral position and load disconnected from either source, adjustable from 2 to 50 seconds, to prevent transfer between sources when sources are significantly out of phase. Set per Engineers instructions.

2.5 ENCLOSURE

A. Each transfer switch shall be enclosed in an enclosure suitable for the environment in which it is located, with front opening lockable door.

2.6 SHOP DRAWINGS

A. Prepare and submit detailed shop drawings for review prior to manufacture. Include the following information (written or highlighted): wiring diagrams, dimensions, front view, catalog information indicating complete electrical and mechanical characteristics and compliance with all specification items of Section 263623.

PART 3 - EXECUTION

3.1 MOUNTING

A. Wall mounted or free standing assembly as per plans.

3.2 OPERATION TEST

A. Provide testing of transfer system coordinated with generator set(s) and start control panel to insure proper operation of transfer devices under actual operating conditions.

3.3 SEQUENCE

A. Any automatic transfer switch sensing loss of power shall start the emergency generator set and the set shall continue to run until after all transfer switches have returned to normal power (engine cool-down timer part of emergency generator set).

3.4 OPERATIONS AND MAINTENANCE MANUALS

A. Provide pursuant to Specification Section 260000. Manuals shall in addition contain the following information:

1. Recommended test intervals.
2. Recommended service intervals.
3. Test and service record forms showing proper intervals for tests.
4. Recommended maintenance.
5. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and parts.

3.5 INSTRUCTION

A. The Contractor shall (after one week (minimum) written notification to Architect) conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner in conjunction with instruction period for Generator System Equipment, Section 26321313. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M Manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.

3.6 COMMISSIONING

A. Select equipment and systems referenced in this section are to be commissioned per Section 019113 - General Commissioning Requirements and Section 260800 - Commissioning of Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 263623

SECTION 263627 - SERVICE ENTRANCE RATED TRANSFER SWITCH

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Specification covers the supply of a complete operational service entrance rated automatic transfer switch rated as shown on the drawings.

1.2 GENERAL REQUIREMENTS

A. General:

1. The unit shall be manufactured in accordance with this specification and applicable UL, CSA, IEC, NEMA, and ANSI standards.
2. The unit shall be manufactured in a facility, which is registered to an ISO 9001:2000 quality system.
3. Supplier shall be responsible for ensuring the compatibility of all components of the unit.
4. The unit shall be free of defects in material and workmanship.
5. The unit shall be supplied with a 5 year warranty from the manufacturer at no additional cost.

B. Acceptable manufacturers:

1. Acceptable model will be a Thompson Technology Inc. TS880 series automatic transfer switch or approved equal.

1.3 RELATED INDUSTRY STANDARDS

A. UL 1008 Automatic Transfer Switches for Use in Emergency Systems

B. CSA C22.2 No.178-1978 Automatic Transfer Switches

C. NEMA No. ICS 10 Industrial Control and Systems AC Transfer Switch Equipment

D. IEC 947-6-1 Automatic Transfer Switching Equipment

1.4 SHOP DRAWING SUBMITTALS

A. The following documentation shall be made available for submission to the project engineer for review/approval purposes on the automatic transfer switch:

1. Physical Layout Drawing
   a. Outline dimensions, cable entry/exit locations, interior/exterior component layouts, connection data
2. Electrical Schematic
   a. Internal wiring, customer connection terminals, optional components, controller settings
3. Product Data Sheets

a. Equipment Ratings

1.5 ENVIRONMENTAL CONDITIONS

A. The unit shall be installed with ambient temperatures between -15°and +50°Celsius, relative humidity from 0-95% non-condensing.

1.6 RATINGS & CONSTRUCTION

A. Automatic Transfer Switch:

1. The transfer switch shall comprise of 4 switching poles.
2. The automatic transfer switch shall be rated for Service Entrance applications and shall contain a standard rated over current device for the utility power switching device as indicated on the drawings. The generator power switching device shall be rated for 100% continuous load without de-rating. The current rating shall be based on all classes of load including resistive and motor loads. Fault withstand current rating of the complete assembly shall be a minimum of 40 amps RMS. The interrupting and closing rating shall be equal to or exceed the required withstand rating. This rating shall be obtained with standard upstream over current protection devices.
3. The automatic transfer switch must be listed or certified to the following safety standards:
   a. UL 1008 Automatic Transfer Switches For Use in Emergency Systems
   b. CSA C22.2 No.178-1978 Automatic Transfer Switches
4. Enclosure: The completed assembly shall be mounted in a NEMA 3R enclosure suitable for outdoor application with controls mounted on an interior door. Exterior door shall provide additional protection against outside environment and vandalism.
5. Finish: All steel parts shall be cleaned, sealed and painted with one coat rust resistant primer and two coats of ASA #61 gray enamel or polyester powder coat finish inside and out.
6. Ground Lugs/Bus: Adequate size and quantity of ground lugs shall be provided and shall conform to NEC/CEC guidelines. Where a ground bus is provided, it shall be a full length copper ground bus bonded to the frame with adequate size and quantity of ground lugs and shall conform to NEC/CEC guidelines.
7. Busbars: Where load bus bars are utilized, they shall be tin plated round-edge high conductivity copper and be sized for 100% continuous load rating of the transfer switch, in accordance with NEMA, CSA and UL guidelines. The short circuit withstand rating of the completed bus assembly shall be not less than the short circuit fault current of the system.
8. Cable Connections: Provision shall be made to terminate all incoming and outgoing power cables and grounding conductors. Connections shall be via screw type cable lugs.
9. The automatic transfer switch shall be constructed to accommodate top (Alternate: bottom) entry of incoming generator power cables, incoming utility power cables and top (Alternate: bottom) exit of outgoing load cables.
10. The Power Switching units shall be fix-mounted, utilize fully enclosed contacts and their withstand and closing rating shall be equal to or exceed the required withstand rating of the complete mechanism.
11. All materials and parts used in the unit shall be new, of current manufacture, of best industrial grade, and free from defects and imperfections.
12. The transfer switch mechanism shall provide a simple means of manual operation using only components, which are permanently affixed, in the operating position.

13. The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load.
14. All internal control devices used in the automatic transfer switch shall be cable of being de-energized and isolated from the system by use of an accessible isolation plug for servicing procedures as required.
15. The automatic transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable.
16. All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. The service entrance rated automatic transfer switch shall automatically transfer the load to the generator supply in the event of a utility supply failure and return the load to the utility supply upon restoration. The transfer switch shall incorporate an isolating mechanism and over current protection on the utility supply to allow operation as the main service disconnect in accordance with NEC requirements. The transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator supplies from being interconnected.

2.2 AUTOMATIC SEQUENCE OF OPERATION

A. Special Load Shedding Control (Not Required for Egress Lighting Transfer Switches):

1. In the event of a utility power failure the transfer switch will signal the HVAC system to turn off / shed load by closing the load shedding contact. After transfer to generator power should the load be lower than an adjustable kW setpoint the load shedding contact will open which will re-start the HVAC system. Should the load of the system increase above another adjustable kW setpoint the load shedding contact will close which will shut down the HVAC system. This feature will be accomplished utilizing the following included components - Utility power available (UPA) contact, load shedding contact, kW meter c/w 2 adjustable setpoints, 3 current transformers, and two potential transformers for measurement of kW.

B. When the voltage on any phase of the utility supply is below preset levels of rated voltage for a preset time delay, a contact shall close to initiate starting of the generator set.

C. The load shall transfer to the generator supply when the generator voltage and frequency have reached acceptable preset levels and the warmup time delay has expired.

D. When the utility supply is restored to above preset levels of rated voltage on all phases, load transfer from generator to utility supply shall be initiated following expiry of the utility return timer.

E. Once the transfer mechanism operates and opens the generator power switching device, the transfer mechanism shall stop in the neutral position (i.e. with both power switching devices open) for the duration of the neutral delay timer setting to allow load voltage to decay prior to re-connecting the utility supply.

F. The load shall be re-connected to the utility supply once the neutral delay timer expires and the transfer mechanism continues operation and closes the utility power switching device.

G. The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail prior to expiry of the utility transfer delay.

H. The generator set shall continue to operate following a load transfer for a cooldown delay period, and then a contact shall open to stop the generator set.

I. An “on load” test mode may be initiated which shall cause a simulated utility failure condition and transfer the load to the generator set. The transfer sequence shall be the same as for a utility power failure except a neutral delay sequence shall occur when transferring from utility to the generator source.

J. The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail during a “on load” test mode.

2.3 STANDARD CONTROL FEATURES

A. Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.

B. A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.

C. The transfer switch controller shall be microprocessor based and shall contain all voltage and frequency sensing, timing functions, and metering.

D. The transfer switch controller software program shall include a three (3) level security password system for access to all programming functions. Specific password levels shall be provided for “read only”, “read/write” and “master”. All programming setpoints for voltage, frequency and time delays shall be software programmable from the front panel mounted keypad, and all parameters shall be displayed in alpha numeric format.

E. The transfer switch controller shall include an operator interface liquid crystal display (LCD) which is door mounted. The LCD shall have an automatic scrolling display feature for all main system information. The following information shall be displayed:

1. System Time
2. Transfer switch position
3. Utility supply metering – 3 phase voltage and frequency
4. Generator supply metering – 3 phase voltage and frequency
5. Timer countdown display
6. Test mode operation indication

7. Data Logging of Events

F. Digital metering provided by the transfer switch controller shall have an accuracy of +-0.5% for all voltage and frequency readings. Frequency shall be displayed to at least one decimal. Three phase line to line voltages shall be displayed for both generator and utility supplies.

G. The transfer controller shall provide data logging and shall store the data in non-volatile EEPROM memory. The following events shall be recorded:

1. Total Number of Transfers
2. Total Number of Transfers due to source failureNumber of Hours Controller is energizedNumber of Hours Load is on UtilityNumber of Hours Load is on GeneratorThree phase under voltage sensing shall be provided for the utility supply. The under voltage sensor shall be user adjustable from 70-100% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting and shall be adjustable. The under voltage sensor shall include a transient time delay feature set at 1 second.

I. Three phase over voltage sensing shall be provided for both utility and generator supplies. The voltage sensing function shall be programmable as follows:

1. Over voltage pickup 100–130% of nominal, factory set at 110%.
2. Over voltage dropout 100–130% of nominal, factory set at 108%.
3. Over voltage time delay 0–10 seconds, factory set at 5 seconds.

J. Three phase under voltage sensing shall be provided for the generator supply. The under voltage sensor shall be user adjustable from 70 -100% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting and shall be user adjustable. The under voltage sensor shall include a transient time delay feature set at 5 seconds.

K. Voltage phase balance sensing shall be provided for the generator and utility supplies. The voltage phase balance sensor shall be user adjustable from 0 - 15% of nominal and shall be factory set at 5% nominal voltage. Activation of an abnormal utility phase balance condition shall cause the generator to start and to transfer on load. The voltage phase balance sensor shall include a transient time delay feature set at 5 seconds.

L. Frequency sensing shall be provided for the utility supply to permit load transfer to the utility supply if within nominal limits. The utility frequency sensing function shall be programmable as follows:

1. Under frequency 40.0–60.0Hz, factory set at 57.0Hz
2. Under frequency time delay 0–10 seconds, factory set at 5 seconds.
3. Over frequency 50.0–70.0Hz, factory set at 63.0Hz
4. Over frequency time delay 0–10 seconds, factory set at 5 seconds.

M. Frequency sensing shall be provided for the generator supply to permit load transfer to the generator supply if within nominal limits. The generator frequency sensing function shall be programmable as follows:

1. Under frequency 40.0–60.0Hz, factory set at 57.0Hz
2. Under frequency time delay 0–10 seconds, factory set at 5 seconds.
3. Over frequency 50.0–70.0Hz, factory set at 63.0Hz
4. Over frequency time delay 0–10 seconds, factory set at 5 seconds.

N. An engine start contact shall be provided which shall close to initiate starting of the engine. The engine start contact shall be rated 5A, 120/240VAC, 5A, 28Vdc resistive.

O. The following time delay functions shall be provided:

1. Engine Start: A time delay on engine start shall be provided to delay the engine start signal after failure of the utility source. The time delay shall be user adjustable 0 - 60 seconds, factory set at three (3) seconds.
2. Engine Warmup: A time delay for engine warmup shall be provided which permits transfer to the generator supply after generator voltage and frequency exceed acceptable limits. The time delay shall be user adjustable 0 - 60 minutes, factory set at 2 seconds.
3. Utility Return: A time delay for return to utility shall be provided which permits transfer to the utility supply only after stable voltage conditions exist for the specified time period. The time delay shall be user adjustable 0 - 60 minutes, factory set at 2 minutes.
4. Engine Cooldown: A time delay for engine cooldown shall be provided which delays the engine stop signal after load has retransferred to the utility source until the time delay period expires. The time delay shall be user adjustable 0 - 60 minutes, factory set at 2 minutes.
5. Neutral Delay: A time delay for neutral position shall be provided to minimize the effect of out-of-phase transfer due to connected motor load. The time delay shall be user adjustable 0 - 120 seconds, factory set at three (3) seconds.

P. The transfer controller shall provide a timer bypass function to automatically bypass unwanted delays during testing or maintenance procedures. The timers shall automatically reset on the next operation sequence to their original setting. The following time delays shall have a user initiated bypass feature:

1. Engine Warmup Delay
2. Utility Return Timer
3. Engine Cooldown Timer
4. Neutral Delay Timer

Q. The re-transfer to utility sequence of operation shall be user selectable for Automatic, or Manual re-transfer operation. When Manual re-transfer mode is selected, the user can initiate when the re-transfer to utility power shall occur.

R. Provision for operator-initiated system test modes shall be provided. Test modes shall be programmable for “off load” testing (load does not transfer to generator) or “on load” testing (load does transfer to generator).

S. All test modes shall have provisions to enable a programmable security access with password protection if required. A master level password shall be required to change user access passwords.

T. Automatic timed test modes shall be provided to allow for tests to be manually initiated and automatically terminated. Timed test modes shall be user adjustable (0-240 minutes). The load shall automatically re-transfer back to the utility supply should the generator fail on load.

U. An automatic exercise time function shall be provided for generator testing. A7/14/21/28 day, programmable time clock shall be provided. The timer shall be fully programmable for; day, week, time of day, duration of the test and type of test mode (i.e. On-Load or Off-Load). The exercise timer shall utilize the transfer controller's internal time clock for referencing all timing functions. The time clock shall have a ten (10) minute power reserve feature to retain correct time settings during short duration utility power failures. The transfer switch shall automatically re-transfer back to the utility supply if the generator set fails during an exercise period.

V. Control logic shall be provided for immediate transfer to the utility supply (if within acceptable limits) should the generator set fail during any activated test mode.

W. Control logic shall be provided for sensing a transfer switch failure condition, and if the alarm condition is activated, the transfer controller shall automatically force a transfer to the alternate source if available.

X. Programmable control logic shall be provided to select desired point at which a "commit to transfer" to the generator supply shall be given to prevent nuisance starts on fluctuating utility supply. The "commit to transfer" point shall be user selected as follows: following expiry of the engine start delay period or following expiry of the warmup delay period.

Y. Pilot lights shall be provided to indicate load on utility status (green) and load on generator status (red). Pilot lights to be long life LED type.

Z. The transfer switch controller shall provide a lamp test function to test all LED lights.

AA. A programmable contact shall be provided for customer use. The contact shall be a Form C contact rated 5A, 120/240VAC resistive and shall have the following user programmable functions:

1. Utility available (within voltage, frequency & phase balance limits)
2. Generator source available (within voltage, frequency & phase balance limits)
3. ATS Control not in auto
4. Second engine start contact
5. Utility and Generator sources available
6. Transfer Fail
7. Load on Generator
8. Load on Utility
9. Load Shed

BB. Utility Supply Auxiliary Contact (AUX-U):

1. Three (3) auxiliary contacts shall be provided which operate when the utility source is on load. The auxiliary contacts shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

CC. Generator Supply Auxiliary Contact (AUX-G):

1. Three (3) auxiliary contacts shall be provided which operate when the generator is on load. The auxiliary contacts shall be supplied with a rating of 10A, 120/240VAC, 5A, 28Vdc resistive, Form C.

2.4 OPTIONAL CONTROL FEATURES

A. Utility Available Light (UAL):

1. A pilot light shall be provided to indicate the availability of the utility supply condition. Pilot light is to be green, LED type.

B. Generator Available Light (GAL):

1. A pilot light shall be provided to indicate the availability of the generator supply condition. Pilot light is to be green, LED type.

C. Enclosure Strip Heater c/w Thermostat (TS-H2):

1. An enclosure strip heater shall be supplied inside the Transfer Switch enclosure and shall be controlled by an adjustable thermostat. Power for the strip heater is to be connected to the transfer switch load bus via suitably sized power transfer.

PART 3 - EXECUTION

3.1 MOUNTING

A. Wall mounted, inistrut mounted assembled as required.

3.2 FACTORY TESTING

A. The automatic transfer switch shall be factory tested prior to delivery to the purchaser. The following tests shall be conducted by qualified factory personnel:

1. Visual Inspection: Electrical and mechanical inspections to verify installed components are of correct ratings; meet the requirements of the project specifications and to ensure regulatory and quality requirements are met.
2. Mechanical Tests: As a minimum, the following mechanical tests shall be performed on the transfer switch:
    a. Power conductor torque verification
    b. Verification of mechanical interlock
    c. Manual ATS mechanism operation/adjustment
    d. All mechanical fasteners/wire connections tight
3. Electrical Tests: As a minimum, the following electrical tests shall be performed on the transfer switch:
    a. Adjustment/setting all timers & voltage sensors
    b. Verification of electrical interlock
    c. Function test-normal operation- three (3) complete cycles
    d. Mechanism adjustment
    e. Dielectric test

4. Final Inspection: As a minimum, the following final inspection tasks shall be performed on the transfer switch:
   a. Calibration label/equipment labels installed and correct
   b. All safety/warning labels attached
   c. All wiring straight, neatly bundled and adequately protected.
   d. All options supplied as specified
   e. Enclosure is clean, no paint imperfections
   f. Final documentation is enclosed (Drawing, O&M Manual)
5. The transfer switch manufacturer shall provide upon request of the project engineer, four (4) copies of certified Factory Test Reports for the transfer switch supplied.

3.3 FIELD TESTING/COMMISSIONING

A. The automatic transfer switch shall be tested once installed at the project site to confirm proper operation of the system. Schedule and witness testing activities shall be coordinated with the project engineer, site contractor, and owner as required in advance of the testing. Qualified local factory-trained field service representatives shall conduct the following tests:

1. Visual Inspection: Electrical and Mechanical inspection to verify the installation is correct as recommended by the transfer switch manufacturer and as per NEC/CEC requirements.
2. Mechanical Tests: As a minimum, the following mechanical tests shall be performed on the transfer switch:
   a. Power conductor torque verification
   b. Verification of mechanical interlock
   c. Manual ATS mechanism operation
   d. All mechanical fasteners/wire connections tight
   e. Confirmation of correct transfer switch voltage, current and withstand ratings as is required for the application.
3. Electrical Tests: As a minimum, the following electrical tests shall be performed on the transfer switch:
   a. Meggar testing the power cabling to the transfer switch.
   b. Verification of correct power cabling phasing and phase rotation, prior to energization.
   c. Confirmation of settings for all timers and voltage sensors.
   d. Full function test - normal operation – three (3) complete cycles of failing the utility supply, and transfer load to/from the generator set.
   e. Verification of all test modes operates correctly.
4. Qualified factory-trained field service personnel shall provide upon request of the project engineer four (4) copies of field test reports noting any deficiencies that require corrective action.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Provide pursuant to specification section 16050 manuals shall in addition contain the following information.

1. Recommended test intervals.
2. Recommended service intervals.
3. Test and service record forms showing proper intervals for tests.
4. Recommended maintenance

5. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and fans.

3.5 COMMISSIONING

A. Select equipment and systems referenced in this section are to be commissioned per Section 019113 - General Commissioning Requirements and Section 260800 - Commissioning of Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 263627

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. General Electrical Requirements

B. Raceways, Boxes, and Fittings

C. Wire and Cable

D. Low Voltage Motor Control

E. Variable Frequency Drives

F. Grounding

G. Lightning Protection System

1.3 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.

1.4 QUALITY ASSURANCE AND PERFORMANCE

A. Each complete suppression unit shall be UL1449 2nd Edition 2005 Revision/Update (effective 2/9/2007) 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:

1. 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.

2. 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.
3. Provide performance test data utilizing the ANSI/IEEEC62.41.2-2002, 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.
4. Provide let through voltage test data and test waveforms used for (N-G) with the submittals for units intended for grounded Wye systems.
5. 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.
6. 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.
7. If available, test data shall be provided for the ANSI/IEEEC62.41.2-2002 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).
8. 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.
9. 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.
10. 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.
11. Maximum Let Through Voltages based on above requirements:

Peak Voltage Let Through Table Peak Let Through Voltages (measured from zero reference per NEMA LS-1) shall not exceed:						
Voltage & Configuration	**Test / Wave**	**L-L**	**L-N**	**L-G**	**N-G**	**Phase Angle**
480/277 Wye - Grounded	C3 – 20 kV/10ka	2500	1600	1900	1700	90
480/277 Wye - Grounded	B3 – 6 kV/3kA	1700	1000	1100	1000	90
480/277 Wye - Grounded	A1 – 2kV – 67A	150	150	150	150	180
480/277 Wye - Grounded	UL1449 Rev2 Update	1500	800	800	800	----
480 Delta	C3 – 20 kV/10ka	2400	N/A	2400	N/A	90
480 Delta	B3 – 6 kV/3kA	2000	N/A	1900	N/A	90
480 Delta	A1 – 2kV – 67A	75	N/A	1200	N/A	180
120/208 Wye	C3 – 20 kV/10ka	1400	1100	1300	1150	90
120/208 Wye	B3 – 6 kV/3kA	950	550	600	550	90
120/208 Wye	A1 – 2kV – 67A	100	75	120	100	180
120/208 Wye	UL1449 Rev2 Update	800	400	400	400	-----
120/240 Split Phase	C3 – 20 kV/10ka	1400	1100	1250	1200	90
120/240 Split Phase	B3 – 6 kV/3kA	1000	600	600	600	90
120/240 Split Phase	A1 – 2kV – 67A	100	75	120	95	180

D. 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.

E. 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.

F. 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.

G. 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.

1.5 CODES AND STANDARDS

A. UL compliance and labeling: Listed per UL 1449, Second Edition 2005 Revision/Update (effective 2/9/2007).

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)

E. IEEE Standard C62.41.1, IEEE Standard C62.41.2 & IEEE Standard C62.45 (latest revisions)

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
2. 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.
3. 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.
4. Fusing shall be present in every mode, including Neutral-to-Ground.
5. 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 2nd Edition 2005 Revision/Update (effective 2/9/2007), 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 1.04.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 2nd Edition 2005 Revision/Update (effective 2/9/2007), 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 1.04.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 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:

Total Protection Solutions SPD/TVSS by Thomas & Betts Power Solutions						
Voltage / Location	**480Y277v 3 Phase Bonded Wye**	**480v 3 Phase Delta**	**208Y120v 3 Phase Bonded Wye**	**208v 3 Phase Delta**	**120/240v Single / Split Phase**	**120v Fire Alarm, Security, PLC, etc.**
Main Services	**ST240-3Y480-FL**	ST240-480NN-FL	**ST240-3Y208-FL**	ST240-240NN-FL	ST240-1S240-FL	N/A
Distribution MCC & Branch Panels	**LP120-3Y480-FL**	ST120-480NN-FL	**LP120-3Y208-FL**	ST120-240NN-FL	LP120-1S240-FL	N/A
Dedicated Equipment	N/A	N/A	N/A	N/A	N/A	**LTE120-30A**
TVSS/SPD Applications Notes: 1. Use 60 Amp Circuit Breakers for Service Entrances and 30 Amp Circuit Breakers for Distribution, MCC & Branch Panel applications. 2. Use Delta units for unbonded/ungrounded and high resistance ground Wye applications.						

Innovative Technology Protector by Eaton/Cutler Hammer						
Voltage / Location	**480Y277v 3 Phase Bonded Wye**	**480v 3 Phase Delta**	**208Y120v 3 Phase Bonded Wye**	**208v 3 Phase Delta**	**120/240v Single / Split Phase**	**120v Fire alarm Security, PLC, etc.**
Main Services	**PTE240-3Y201-L-SD**	PTE240-NN400-L-SD	**PTE240-3Y101-L-SD**	PTE240-NN201-L-SD	PTE240-1S101-L-SD	N/A
Distribution MCC & Branch Panels	**PTE120-3Y201-L-SD**	PTE120-NN400-L-SD	**PTE120-3Y101-L-SD**	PTE120-NN201-L-SD	PTE120-1S101-L-SD	N/A
Dedicated Equipment	N/A	N/A	N/A	N/A	N/A	**LTE120-30A**

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.

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 264300

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 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: Incandescent fixtures shall have housing containing an integral thermal device pursuant to NEC 410-65C.

2.2 LIGHT TRANSMITTING COMPONENTS

A. Virgin acrylic plastic (0.125-inch thick overall minimum) or glass. Shall be contained in a steel frame hinged and which 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.

2.4 LAMPS

A. General Electric, Sylvania or Philips. All lamps supplied shall be by the same manufacturer.

B. Provide for each fixture in the exact number and type for which the fixture is designed or as noted.

C. Fluorescent Type:

1. Bi-pin, T-8 rapid start; color temperature of 3500 K; CRI 82; average life of 20,000 hours.
2. Bi-pin, T-5 high output; color temperature of 3500 K; CRI 82; average life of 16,000 hours.

D. Compact Fluorescent Type:

1. Twin tube, double twin tube, triple tube; 4-pin, amalgam, color temperature of 3500 K; CRI 82; average life of 10,000 hours. (Sylvania – Dulux T/E/IN).
2. Biax; 4-pin, color temperature of 3500 K; CRI 82; high lumen output. (Sylvania – Dulux L)

2.5 Solid State Lighting Fixtures (LED):

1. Fixtures shall provide lighting with a minimum Correlated Color temperature (CCT) of 4000K and shall have a Color Rendering Index of (CRI) of 70 or higher. Verify performance of the light producing solid state components by a test report in compliance with the requirements of IESNA LM 80. Verify performance of the solid state light fixtures by a test report in compliance with the requirements of IESNA LM 79. Provide lab results by a NVLAP certified laboratory. The light producing solid state components and drivers shall have a life expectancy of 50,000 operating hours while maintaining at least 70% of original illumination level. Provide a complete five year warranty for fixtures.

2.6 SOCKETS

A. Porcelain, medium base except where mogul base lamps are standard for the fixture specified.

2.7 BALLASTS - FLUORESCENT (ELECTRONIC)

A. Suitable for lamp type employed and approved by Lighting Design Lab specification committee.

B. Acceptance Manufacturers:

1. Advance
2. Magnetek
3. Motorola
4. Osram/Sylvania

C. UL and CBM labels.

D. Low temperature and/or outdoor application. Provide ballasts suitable for low temperature where outdoors or space ambient is expected to be below 50°F.

E. Electronic ballasts shall be high power factor, greater than 95% and total harmonic distortion (THD) less than 20%. Provide for operation with T-8, T-12 and BIAX lamps. "A" sound rating. Neutral wire to be used in lighting circuit associated with electronic ballasts shall be #10 AWG CU.

F. All ballasts shall be fused (see Section 262813, Fuses).

G. All ballasts shall be provided with a UL listed factory pre-installed ballast disconnect.

H. Ballasts for T5 fluorescent lamps:

1. Ballast factor of 98% or greater.
2. “A" sound rating.
3. Electronic pre-heat starting.
4. The ballast shall operate at 40 - 60 Khz without visible flicker.
5. Five Year Warranty.

I. Ballasts for T8 fluorescent lamps:

1. Advance "Centium" Series or Equivalent programmed rapid start.
2. Ballast factor of 98% or greater.
3. “A" sound rating for 265 MA. (T8 lamps).
4. The ballast shall operate at a frequency below 30 Khz or above 40 Khz without visible flicker.
5. Shall be designed for use with occupancy sensors by providing up to 30,000 lamp starts. The ballast shall heat the lamp cathodes to 650 degree C with no glow current before applying arc voltage to the lamp.
6. Electronic ballast harmonic distortion and current shall be less than 10% THD.
7. Where fluorescent light fixtures are to be located outside, the ballast shall be capable of 0 degree F. lamp ignition.
8. Five Year Warranty.

J. Ballasts for 5 to 30 Watt Compact Fluorescent Lamps:

1. Motorola "Gold" Edition rapid start or Equivalent.
2. Electronic, 4-pin.
3. Ballast factor of 98% or greater.
4. “A" sound rating.
5. The ballast shall operate at a frequency below 30 Khz or above 40 Khz without visible flicker (high frequency operation).
6. Electronic ballast harmonic distortion and current shall be less than 10% THD.
7. Minimum starting temperature –5 degree F/-20 degree C.
8. Five Year Warranty.

K. Fluorescent dimming ballasts: Provide high frequency electronic ballasts suitable for triple & quad tube compact lamps, long twin tube lamps and T8 lamps. Dimming ballasts shall have 100% to 5% full range continuous dimming with programmed start, lamp end-of life (EOL) detection system for compact fluorescent lamps, and operate above 40 KHz. Ballast shall be less than 10% total harmonic distortion at maximum light output. Dimming ballasts shall be suitable for use with dimming controls. See specification section 262726 for specified dimmers. Advance Mark X or equivalent.

2.8 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.

2.9 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 foundations as shown on drawings. Field verify locations with Architect prior to installation of bases.

2.10 Outdoor ground mounted lighting fixtures

A. Provide concrete foundations for mounting of ground mounted lighting fixtures. Foundation shall be a minimum of 6” deeper than the light fixture and a minimum of 6” all around the base of the fixture. Provide #4 rebar with 3” minimum ring ties at 8” on center. The #4 rebar shall be vertically spaced approximately 6” apart. Field verify locations with Architect prior to installation of bases.

2.11 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.

2.12 OCCUPANCY SENSORS

A. Provide occupancy sensor switch(es) for control of lighting in all rooms and offices shown on the drawings. Sensors shall be ceiling or wall mounted to provide adequate coverage. Occupancy sensors shall be “Watt Stopper”, or approved equal. Wall mounted sensors shall be Model DT-300, complete with power pack and associated mounting hardware. Wall mounted sensors shall be model DT-200 complete with powerpack and associated mounting hardware. Combination occupancy sensor/switch shall be WA200. Combination occupancy sensor/switch, dual circuit shall be WA300. Sensors shall be wired to maintain switching and circuits shown on drawings.

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 FLUORESCENT FIXTURES

A. Recessed Troffer Type: For fixtures supported by the ceiling suspension system, provide integral tabs, which rotate into position after fixture is lifted into the ceiling cavity. Provide two safety chains secured to structural members above suspended ceiling. Circuit connection shall be through use of 60-inch flexible conduit from a rigidly supported junction box. For plaster or GWB ceilings, provide a plaster frame compatible with light fixture.

B. Recessed Downlight Type: Mount in frames suitable for the ceiling, with the recessed portion of the fixture securely supported from the ceiling framing. For fixtures supported by a ceiling suspension system, provide two safety chains secured to structural members above suspended ceiling.

C. 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. Ballast Fuses: Provide twenty (20) spare fuses of each size used, packaged and marked to identify fixture type where used.

B. Fixture Diffusers: Provide ten (10) or 10% (whichever is less) spare diffusers of each size and type used, packaged and marked to identify fixture used.

C. Fixture Glass: Provide ten (10) or 10% (whichever is less) spare glass of each size and type used, packaged and marked to identify fixture type.

D. Lamps: Provide Forty (40) spare T-8 lamps, Twenty (20) spare T-5HO lamps, and ten (10) or 10 % spare (whichever is less) of each other lamp type.

3.7 SPARE FIXTURES

A. Provide the following spare devices:

Item	Quantity
EX-1	8

B. Spare fixtures shall include 100 feet of conduit, wire, miscellaneous appurtenances, and all labor, 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.

3.8 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.

3.9 SWITCHING FLUORESCENT FIXTURES

A. Provide two level switching of all three and four lamp fluorescent fixtures such that the center lamp(s) are on one switch and the outer lamps are on another. Required switchlegs in fixture flex connection "whips" are not shown on the drawings. Provide number of ballasts required to accomplish two level switching.

3.10 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.

3.11 COMMISSIONING

A. Select equipment and systems referenced in this section are to be commissioned per Section 019113 - General Commissioning Requirements and Section 260800 - Commissioning of Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 265000

SECTION 270000 - LOW VOLTAGE SYSTEMS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, Divisions 0 and 1 Specification Sections, apply to work of this Specification Section and related Specification Sections listed below.

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. The Installing Vendor/Contractor shall make all corrections as needed, to the satisfaction of the Architect.

C. Provide system documentation and Owner training as specified below.

D. An important aspect of the construction process for this project is the **Pre-Construction Kick Off Meeting**, which shall take place PRIOR to Submittal of equipment data sheets. See “Submittals” and “Coordination” listed elsewhere within this specification.

E. The requirements of the conditions of the Contract, shall be to provide a fully functional system for EACH specific Low Voltage Section listed in this specification, which includes, but is not limited to the following sections;

1.2 CODES AND STANDARDS

A. All work shall be performed in accordance with the latest revisions of the following Codes and Standards:

1. International Building Code (latest edition).
2. International Fire Code (latest edition).
3. International Mechanical Code (latest edition).
4. National Electrical Code (latest edition).
5. Building Industry Consulting Service International (BICSI) (latest edition for each applicable standard).
6. ANSI-TIA-EIA-606-A Administration Standard for Telecommunications Infrastructure.
7. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.

B. EACH Installing Vendor for their Section shall possess a current Washington State 06 Electrical Low Voltage License.

1.3 QUALITY ASSURANCE

A. Device or wiring arrangement shown on the drawings represents the intent of the system. If additional equipment (that may not be shown) is required to make a fully functional system, then provide such equipment as required.

1. Each specification section that is governed by these specifications shall be provided, installed, commissioned, and warranted by a local Installing Vendor that meets the following requirements for the equipment manufacturer that is being submitted:
2. All equipment for EACH Specification Section shall be provided and installed by a single supplier.
3. Have installed a minimum of (3) Systems of similar size and scope within the past five (5) years.
4. Maintain a 24 hour emergency service program using Manufacturer Trained technicians, which shall respond to service calls within 4 hours during and after the warranty period.
5. The Installing Vendor shall be Manufacturer Approved to purchase the equipment, have a local office staffed with Manufacturer Certified installers that are capable to maintain, service, and warrant the equipment being installed, who are full-time employees and are capable of programming, testing, inspecting, maintaining, warranting, inventorying parts for the life of the system, and shall be located within a 100-mile radius of the project site.
6. Offices that require staff from another “Branch Office and/or Company Office” outside of this radius, are not acceptable.

B. Prior to completion of the installation, the Installing Vendor shall provide:
1. A preventative maintenance agreement, which shall at the Owners option, become effective at the end of the warranty period.
2. A proposal for off-site monitoring services (for systems that are applicable).

1.4 SUBSTANTIAL COMPLETION

A. In addition to the “Substantial Completion” requirements, when applied to EACH of the specification sections identified in “Scope and Related Documents” listed elsewhere in this specification, this shall be defined as follows;

B. The stage in the progress of the Work, where the Work or designated portion is sufficiently complete in accordance with the Contract Documents, so that the Owner can utilize the Work for its intended use.

C. ALL of the requirements listed in “Testing & Complete System Functionality” shall be met. Once all conditions have been met, this shall be deemed Substantial Completion. These requirements shall be completed on or before the Substantial Completion date listed in the Contract Documents.

1.5 DOCUMENTATION

A. Document Format:

1. All documents shall be generated on a PC. Provide these documents electronically, with the As-built Documentation, where applicable.

2. Data sheets, installation manuals, technical documents, brochures, and user manuals may be in Adobe Systems © Portable Document Format (.PDF) format.
3. Power Point Presentation(s) shall be in MS-Power Point ©.
4. Test Forms and other project specific documents shall be in an editable format, either MS-Word © or MS-Excel ©.
5. Drawings and details shall be in AutoCAD™ 2012 or newer (.DWG) or Revit BIM 2013 or newer (.RVT).

1.6 SUBMITTALS

A. Pre-Construction Kick Off Meeting:

1. This meeting shall take place PRIOR to the Submittal of equipment Data Sheets and/or Shop Drawings. Submittals or Shop Drawings received prior to this meeting shall be returned as incomplete. Coordinate with the Electrical Contractor to confirm the date and time of this meeting.
    a. See "Coordination" listed elsewhere within this specification for additional information.
    b. The General Contractor, Electrical Contractor, and a Technician from EACH specification Section (identified in the "Scope and Related Documents" listed elsewhere within this specification) shall attend this MANDATORY coordination meeting.
2. Coordination Questions: EACH Installing Vendor shall submit their list of Coordination Questions through the Construction Channels a minimum of 14 Days in advance of the meeting.
    a. Submit a complete list of questions and related items for the Owner to review. At a minimum, submit the Sample List of Questions that is identified in EACH specific Section under the sub-section titled "Coordination". This information shall be discussed during this meeting. Provide adequate space for the Owners "fill in the blank" written response.
3. BRING to the Meeting: As indicated in EACH specification, the Installing Vendor for each specification Section shall bring to this meeting a Preliminary Submittal package.
    a. These items shall be reviewed during the course of the meeting. The intent is to identify incomplete or inaccurate information that was intended to be submitted. The Drawings, Material Lists, and/or Data Sheets will be marked up during this meeting.
    b. The Installing Vendor shall make the necessary corrections and provide a Revised Submittal through the normal construction channels.
        1) Be sure to include ALL responses by the Owner in the Revised Submittal.
    c. A summary of the following items that shall be brought to the meeting are:
        1) See EACH specification Section for a complete list of items that shall be brought to the meeting.
        2) (3) Full-Size complete sets of 95% design engineered Shop Drawings.
        3) (3) Complete sets of 95% design engineered Materials List.
        4) (3) Complete sets of 95% design engineered Test Forms.

B. Refer to "As-Built Drawings" for additional requirements.

C. Data Sheet Submittals and Shop Drawings Submittals shall be provided to the Architect for review for EACH Low Voltage System Specification Section Number and shall contain, but not be limited to the items listed below:

D. Data Sheet Submittals:

1. Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with (7) copies of submittals for approval. Provide the following:
   a. A complete materials list, which shall include: the quantity of each device, the manufacturer's name, model number, and a description of the equipment for each individual system component or device that will be provided. This list shall precede the data sheets.
   b. Equipment Data Sheets. Each System component or device data sheet shall indicate each component or device that is being submitted.

E. Shop Drawing Submittals: Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with (7) copies of submittals for approval. Provide the following:

1. Additional Shop Drawing Requirements are identified in EACH Low Voltage System Specification Section Number, in addition to what is listed below.
2. Shop Drawing Requirements: The Installing Vendors Complete and Full Size set of Shop Drawings shall be issued in the following format:
   a. They shall be clear and legible.
   b. The same sheet size as the Contract Drawings (i.e. 30" x 42", 24" x 36", etc.).
   c. A minimum of 1/8" text height shall be used for all text, symbol text, and subscript text.
   d. Scale of Drawings:
      1) Site Plan Drawings shall be the same scale as issued in the Contract Documents.
      2) Floor Plan Drawings shall be 1/8"=1'-0", unless directed to do otherwise.
   e. The Electrical Legend, Wire Legend, Load and Battery Calculations, Riser Diagram(s), Sequence of Operation info, Wiring Details, and Mounting Details shall precede the Site Plans and Floor Plans.
   f. All sheets, including the Cover Sheet, shall include a Title Block along the edge of each of the drawings, that when the drawings are rolled up, the following information shall be visible;
      1) The Sheet Number.
      2) Project Name, specification Section Number and Section Title name.
      3) Floor Name, area, and/or section of the building, which shall match the name of the area and/or floor description that is on the Contract Drawings.
   g. Architectural information on the Contract Drawings, shall be included on the Installing Vendor Shop Drawing, including, but not limited to; Match Lines, Grid Lines, Grid Bubbles, Key Plan, and Enlarged Floor Plans.
   h. Electrical information on the Contract Drawings shall be included on the Installing Vendor Shop Drawing, including, but not limited to;
      1) All applicable General Notes.
      2) All applicable Construction Notes.

3) Where Enlarged Plans are shown on the Contract Drawings, this information shall be shown on the Installing Vendor Shop Drawings. ALL equipment for EACH specific system shall be identified within EACH room or location. This information will be used to help facilitate and coordinate the installation of the Low Voltage equipment for all systems.

4) An Elevation View of the Wall Mount equipment for the MDF Room and each designated IDF location shall be provided. The proposed locations for EACH wall mount device (control panel(s), power supplies, and other equipment), proposed cable routing, wire management, 120vac conduits (including receptacles and junction boxes) shall be shown to scale. Provide dimensions of the equipment, the space required between the adjacent item and the overall dimensions of the anticipated wall space.

3. Cover Sheet: The first page of the shop drawings shall be a cover sheet, which shall include the following items;
   a. Owners Project information:
      1) Site Information
         a) Name of site, address, city, and zip code of where the installation shall take place.
   b. Installing Vendors Project information:
      1) Business name.
      2) Local office address of the Installing Vendor.
      3) Primary contact person name, phone number, and email address who is responsible for the long-term management of the Owners System.
   c. **Provide a "Sheet Index"**, which assigns a sheet number and unique name for each sheet that is included in the shop drawing submittal package. As part of the sheet index, list every sheet that is part of the system shop drawing package. On the left side of the Sheet Index, provide two columns - "Included" and "Not Included". Include a check box, and provide a check in each box for all sheets that are included or not included, in each submittal.
      1) Each sheet shall have a System Specific Sheet Number and shall match the Contract Drawing sheet numbering system. (i.e. E4.02 shall be T-4.02 [for Telecommunications], E4.02 shall be FA-4.02 [for the Fire Alarm System],).
4. Legend (for symbols and devices): From Left to Right, provide the following information for EACH device:
   a. Use the symbol on the Legend of the contract drawings.
   b. List the manufacturer's name.
   c. List the manufacturer's model number.
   d. Provide a logical description of the device.
      1) Provide the back box requirements and related information. At a minimum, this shall include;
         a) The height, width, and depth of each required back box for each symbol on the legend.
         b) If the device is a back box or comes with a back box (IE: control panel, power supply, enclosure, etc.) then provide the height, width, and depth of the dimensions.
         c) Indicate if this device back box is going to be installed flush, semi-flush, or surface mounted.

5. Wire Legend: From Left to Right, provide the following information for EACH cable type; a unique cable type identifier, the cable manufacturer, model number, cable rating, size of conductors, quantity of conductors, and color of each conductor. **Use the format in the Sample "Wire Legend", (**as it applies to each system) **at the end of this specification.**
   a. The Wire Legend shall include the Cable Manufacturer and Model Number for EACH of the following types of cables (as applicable to the project):
      1) Plenum Cable.
      2) Open Cable.
      3) Wet Rated Cable
      4) Aerial Rated Cable
      5) Conduit/Raceway Cable
      6) EACH cable and EACH cable type shall have a different letter designation.
6. Load and Battery Calculations: For EACH control Panel, Power Supply, and/or Amplifier for EACH System, at a minimum show the following Amp Draw, Circuit, and Battery calculations;
   a. The total Amp Draw load in stand by or non-active mode.
   b. The total Amp Draw load with all devices active and in a maximum load condition.
   c. Provide the spare power information that is available for future additional devices and/or equipment.
      1) Include the quantities of spare circuits that are available (where applicable).
   d. Circuit calculations:
      1) The quantity of each device per circuit.
      2) The Amp Draw per device per circuit (where applicable [this is not applicable to addressable devices that receive their power from an addressable data loop. Simply include the maximum amount of devices than can be placed on each addressable loop and the amount of addressable devices that are included on each addressable loop for this project]).
      3) The total Amp Draw load per circuit.
      4) The cable length distance of each circuit.
      5) The gauge size of wire used for each circuit.
      6) The total Line Loss for each circuit.
      7) The percentage of Line Loss for each circuit.
      8) Factor the line loss and Amp Draw to show the actual voltage available at the end of each circuit (after the last device).
   e. Battery Back Up:
      1) All Batteries shall be sized to provide a minimum of 20% spare capacity in addition to the total load of each power supply. Include this information in all calculations.
   f. Uninterruptible Power Supply(s) (UPS):
      1) For systems that include a UPS, provide the maximum load (allowed by the UPS manufacturer) that EACH UPS is capable of providing, and list each item and its maximum load that will be connected to the UPS. Include the total load of all equipment connected to the UPS, and list the spare capacity available.
   g. Fire Alarm System:
      1) Provide all calculations that are required by the Authority Having Jurisdiction.

7. Riser Diagram: Provide a project specific System One-Line Riser Diagram that shows the entire system. At a minimum, provide the following information:
   a. Identify the major components in each of the following rooms:
      1) The MDF Room.
      2) EACH designated IDF Room (each room shall be shown separately).
      3) Identify the room name that each major system component is located in, and show the connection to the system equipment.
   b. The major components are defined as; Control Panel, CPU, Server(s), Workstation(s), Monitor(s), UPS's, KVM's, Network Extenders, Video Extenders, Power Supply and Terminal Cabinet (where applicable) for each system.
   c. Identify the IP addresses for each major component.
      1) Show the connection to the "Cloud" WAN or LAN, where applicable.
   d. Identify each of the cable types, sizes, and quantities between the MDF and each designated IDF location.
   e. Field Devices and other equipment.
      1) Identify EACH field device with their respective room names and/or room numbers and connections to their associated equipment.
      2) Identify the IP addresses for each device or their point address (where applicable).
   f. Integration to other Systems.
      1) Identify EACH connection point and their respective device names.
      2) Identify each of the devices with their respective room names and/or room numbers.
      3) Provide a brief description of the action performed and/or functional requirement of the integration.
8. Mounting Details: Provide all mounting heights and installation information for; All head-end equipment, Rack(s) (where applicable), and Device(s).
9. Rack Layout (where applicable):
   a. Provide the intended equipment layout within EACH Rack(s), including wire management.
   b. Show blank filler plates in spaces where equipment is not installed.
   c. Identify the quantity of Rack Units for each device and filler plate installed in the rack.
   d. If rack equipment is installed on the rear side of the rack, show the rear view of the rack also.
10. Detailed device wiring information:
   a. Provide point-to-point wiring diagrams for each device.
   b. Show scale drawings of equipment, devices, wiring diagrams, and terminations of:
      1) Each Control Panel, CPU, etc.
      2) Power Supply and/or amplifier
      3) Rack equipment (where applicable).
      4) EACH device type
      5) EACH Terminal Cabinet (where applicable)
11. System Device Naming Matrix: The matrix as defined in the 'System Device Naming Matrix' of each system specification (where applicable).

12. Installing Vendors Engineered Drawings: On the shop drawings, include a letter signed by the Installing Vendors Engineer that is responsible for the design depicted in the Data Sheet Submittals and on the Shop Drawing Submittals. The letter shall state that the equipment and shop drawings design conform to national, state, local codes as adopted by the local authority having jurisdiction, and meet or exceed all of the performance requirements as outlined in the specifications.
    a. The Installing Vendors Engineer shall provide the following:
        1) Provide a "signature" line and signature of the Installing Vendors Engineer.
        2) Provide a "printed name" line, below [or to the right] of the signature line and the printed name of the Installing Vendors Engineer.
        3) Provide a "date" line, below [or to the right] of the printed name line and date of the design.
13. Labels and Labeling:
    a. On the drawings, label each Rack, Control Panel, CPU, Server(s), Workstation(s), Monitor(s), Power Supply(s), and Terminal Cabinet(s) in a logical numeric sequence. (i.e. for CCTV System Power Supplies, list them as CCPS-1, CCPS-2, etc).
    b. Cables: Generate an alpha-numeric label for each cable type and cable run.
    c. For projects with multiple sites, all labeling shall be consistent for all sites.
14. Cable routing.
    a. Indicate on the floor plans the anticipated routing of cables, which shall be shown parallel and perpendicular to all structural framing.
15. Devices: EACH device shall be shown at EACH location on EACH floor plan.
    a. The cabling for EACH device shall be shown from EACH device to the device that it shall be connected to (i.e.: control panel or power supply). EACH cable(s) shown on the floor plan shall be identified as described in the "Wire Legend" portion listed within this specification.
    b. Floor Plans: Show all system related devices and all equipment that the system specific shop drawings will interface to, on each of the floor plans. Provide Cabling for each device and the related wire type (as shown on the "Wire Legend") shown for each of the device(s). Where multiple devices are on the same circuit or an addressable data cable is used, show all devices and their related cable(s).
16. EOL Supervision:
    a. Indicate on the floor plan drawings where EACH of the End-Of-Line Resistor(s) is located (where applicable).
17. Addressable Device information:
    a. **Show each device address next to each device** (where applicable), and clearly displaying this information so that it is not confusing as to which address belongs to which device. For non-addressable devices that will be connected to an addressable module, show the device address next to each device and the addressable module that it will be connected to.
    b. List the System Address Point(s) using a logical numbering sequence for the devices on a single run.
    c. Maintain the "Spare Capacity" requirements listed elsewhere in the specifications (where applicable).
    d. Include the complete Dip Switch and/or Rotary Addressing Scheme (used to set the device address for each addressable point) on the drawings.

18. Graphic Map(s) (where applicable): Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect. Provide the Architect with (7) copies of submittals for approval. These shall be submitted with the Shop Drawings, but not be bound with the Shop Drawings submittal.
    a. Provide the actual full size scale drawing and artwork that will be provided to the Owner for a final product.
    b. The Drawing submittal shall be in color.
19. Complete submittal: All drawing submittals shall be a complete and full set of the system. If drawings are required to be re-submitted, a full and complete set must be re-submitted. Partial system drawing sets will be rejected and the Installing Vendor/Contractor shall reissue a full set of drawings. Any re-submittal(s) shall be provided at the Installing Vendor/Contractors expense.
20. System Requirements: The Installing Vendor/Contractor is responsible for assuring that the conduit size(s), wire quantity, wire size, and wire type is suitable for the equipment supplied. The Installing Vendor/Contractor shall review the proper installation method(s) for each type of device/equipment with the manufacturer's representative, and the AHJ, Prior to Rough-In.

F. Contract drawings shall not be used as Shop Drawings.

G. System Specific Shop Drawings: For example: only CCTV System equipment and connections to other equipment that will be interfaced to the CCTV System, shall be shown on the CCTV System drawings.

1. Telecommunications Shop Drawings shall show EACH device that it is connected to (as indicated on the Contract Drawings). Such as; CCTV Cameras, IP Intercom System equipment, Sound System Racks, etc. Provide EACH device Symbol and related description (as described on the Contract Drawings) on the Telecommunications Legend with the text that states "provided by others".

H. All Shop Drawings shall be completed prior to installing conduit. The Contractor is responsible for ensuring all pathways are installed prior to cover and are of the appropriate length. No additional compensation will be provided for additional pathways or rework that is necessary for a complete and operational system.

I. AutoCAD™ backgrounds: Floor plans for the project have been developed by the Engineer using AutoCAD™ software. These drawing files will be made available to the Installing Vendor/Contractor for development of Shop Drawings and/or As Builts for a fee of $20.00 per sheet.

1.7 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section, related sections or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section, related sections, and the Drawings shall govern. However, nothing in this section, related sections or the Drawings shall be construed to permit work not forming to all governing codes and regulations.

1.8 PROJECT CONDITIONS – REVIEW ALL CONTRACT DRAWINGS

A. Civil Drawings:

1. The Installing Vendor/Contractor shall carefully coordinate the various symbols utilized on the drawings, and shall consult the civil plans to determine site conditions in the various areas.

B. Architectural Drawings:

1. The Installing Vendor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all equipment as defined in each specification and on the drawings.

B. All equipment, panels, power supplies, and devices shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

C. All equipment for each system shall bear the UL label. Partial or pending listings shall not be acceptable. It shall be the Installing Vendor’s responsibility to insure that these requirements are met, and replace any and all equipment up to and including the entire system, if these requirements are not met.

D. EACH of the specified Low Voltage Systems identified in PART 1 of these specifications including the design, devices and/or wiring arrangement shown on the drawings, represent that based on various equipment manufacturers. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor.

1. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the Installing Vendor in writing so as to be received by the Architect not later than (10) days prior to the bid due date. Equipment that is approved by the Engineer will be issued by addendum prior to the bid date.

E. Refer to PART 1 for any equipment that is not specifically defined.

2.2 CONDITION OF MATERIAL

A. All equipment shall be new, in un-opened boxes, and be the most current model available for each component and/or device that is provided for this project. For products that use firmware, the most current version available shall be downloaded and installed at each component and/or device, prior to any programming being performed. Outdated or used equipment, as determined by the Architect, shall be removed and replaced by the Installing Vendor/Contractor at no cost to the Owner.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. All materials shall be in working order as intended by the manufacturer, at the completion of the project.

2.3 COORDINATION

A. The Installing Vendor shall include in their bid the time, staff, and materials that are necessary to perform the following services.

B. See EACH separate specification section identified in “Scope and Related Documents” for additional requirements.

C. Pre-Construction Kick Off Meeting.

2.4 WIRE GUARDS

A. Provide at locations where designated on the drawings. Provide wire guards to protect the device from damage. At a minimum, all field devices located in the Gymnasium(s) and Multipurpose Room(s) shall have Wire Guards installed.

B. Provide and install wire guards that are sized appropriately to protect each device at locations indicated on the drawings, but will not interfere with the operation of any device, and that the device shall operate as intended by the manufacturer after the wire guard has been installed.

C. Wire guards shall be made using 7 gauge welded steel and be chrome plated.
   1. Use Space Age Electronics, HSG Series or PSG Series, or approved equal. Size as required.

2.5 TERMINAL CABINETS, TERMINAL STRIPS, AND ENCLOSURES

A. On-Site System Information Binder and Enclosure: EACH Specification Section identified on the first page of this specification shall have an Information Binder that shall be housed in a System Information enclosure. The enclosure shall have a hinged door with the text "(Section Title here) Information", with each specific system name silk screened onto the enclosure door, and shall bear the Underwriters' Laboratories "UL" label. A "T-Turn" cam lock shall be used to keep the enclosure door closed, and a key shall NOT be required to open the enclosure. Use the following Space Age Electronics model number, or approved equal.

1. All Systems (other than Fire Alarm): Model # YD9048DBXAA. Verify with the Architect the color of the enclosure(s) prior to ordering the enclosure. There shall be no additional charge to the Owner, for changes to the color of the enclosure.

B. Terminal Cabinets (TC):

1. See EACH Specification for Terminal Cabinet requirements (where applicable).

C. Terminal Strips:

1. See EACH Specification for Terminal Strip requirements (where applicable).

D. Enclosures:

1. Each Systems Control Panel(s), Power Supply(s), TC(s), and other metal enclosures shall have the following:
   a. Use key operated locks to secure the enclosure (keyed so that a single key can lock and unlock all enclosure locks for the entire system), and provide ten (10) keys.
   b. Use some form of wire management that uses permanently secured fasteners (no double back tape), and uses reusable and adjustable Velcro style cable straps, which shall be installed approximately every four inches within each enclosure.

2.6 LABELS AND LABELING

A. The alpha-numeric labeling shall be developed by the Installing Vendor.

B. Label all equipment and cables in an identical fashion of a sequential manner.

C. The Installing Vendor proposed alpha-numeric labeling that is intended to be used to identify all components of the system shall be submitted for approval by the engineer and owner with the submittal of equipment data sheets.

D. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

E. Phenolic name plates shall be used for identification of the Racks, Control Panel(s), Power Supply(s), Terminal Cabinet(s), and other appurtenances of each system in a logical numeric sequence. Use an alpha-numeric name of each device for each location (created by the Installing Vendor) to identify the equipment on the Shop Drawings.

1. The size of the plate shall be two-inches high by approximately eight-inches wide. Different colors of backgrounds may be used for each System (but Red shall only be used for Fire Alarm).
2. The text color shall be White Letters that are 3/4-inch high and are 1/2-inch in width.

F. Labeling of Cables must be provided in the following locations: EACH System Control Panel, Power Supplies, Terminal Cabinets, Terminal Strips, Racks, other system related appurtenances, and all junction boxes. Label all cables as shown on the Installing Vendors Shop Drawings.

G. All label printing shall be machine generated using indelible ink ribbons or cartridges, self-laminating labels shall be used on cable jackets, appropriately sized to the outside diameter of the cable, and placed within view at the termination point on each end.

1. Temporary Labels: Shall consist of the following:
   a. Using a fine point permanent style marker, Sharpie® or equivalent, to write directly onto the outer jacket of the cable or use temporary tags.
   b. The Installing Vendor/Contractor shall take all precautions to use care when pulling the cable to insure the integrity of the temporary label.
   c. Remove all temporary labels and tags, prior to installing the permanent label.
2. Permanent Labels: Labels shall be produced using an electronic labeler. Cabling shall be marked with a permanent, electronic printed label with a self-laminating clear wrapping to cover the printed label, and shall be secured to the outer jacket of the cable.
3. Provide Brady Model XSL-116-427 or approved equal.

2.7 SYSTEM CABLES

A. All cable(s) shall be new.

B. All cable types shall be rated to meet all code requirements for site conditions, including, but not limited to; Plenum, Riser, Underground, Wet, and Aerial requirements as mandated per N.E.C. and local AHJ requirements. The Installing Vendor shall be responsible for insuring that all cables meet all national codes, state codes, local codes, AHJ requirements, and each equipment manufacturer's requirements, for a reliable, fully functional, and warrantable system, as intended. Do not exceed the wiring distance limitation of the equipment, device(s), cable(s) and/or conductor(s) as recommended by the manufacturer of either the equipment and/or the cables for each installation application:

1. Use the manufacturer recommended cables for EACH application and as required by Code (i.e. Raceway, Open Cabling, Wet and/or Aerial).
2. All cables shall be stranded, unless otherwise noted and/or recommended otherwise in writing by the manufacturer.
   a. CAT5 through CAT7 cables are excluded.
3. See PART 3 of this section, and of each System specification for more information.

2.8 TEST FORMS

A. See each individual Specification with the paragraph titled "Test Forms" and the associated testing requirements.

B. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the following Test Form(s) for EACH system. Test Forms may be 8½"x11", but shall not exceed 11"x17".

C. See EACH system specification for testing requirements.

D. All testing documents shall provide plenty of space for the required written information to be legibly written. Have a wide underline area that has enough space that is adequate to write in the appropriate text.

E. At the completion of this project provide these documents electronically to the Architect with the As-built Documentation. At a minimum, the testing documents shall include;

F. Forms:

1. The (Section Number and Section Title here) - Operational Test Form.
2. The (Section Number and Section Title here) - Performance Test Form:
3. These are the same document, with the exception to the title at the top of the form.
4. The Governing Acceptance Form - (Section Number and Section Title here) .

G. Format:

1. List the Name or Title of the document, the Section Number, and Section Title. This shall be bold and centered at the top.
2. Header of document:
   a. The Project Name and the current date.
3. Footer of document:
   a. Use multiple pages as required, but identify each page by having the footer state "Page 1 of X", "Page 2 of X", etc.
   b. State the following "Provided and Installed by (Installing Vendor name and phone number here).
4. From left to right, the following information shall be included on the form.
   a. Each row shall have an "Item #".
   b. Provide a Pass, Fail, and N/A column. This shall be checked off during the course of the Testing process, to determine a "Pass" or "Fail".
      1) To obtain a 100% Passing Test EACH row shall have; a "Pass", all answers shall be yes, and shall NOT have any negative comments.
   c. List the Device name (i.e.: Card Reader, Smoke Detector, Motion Sensor, etc.).
   d. List the Device ID number.
   e. List the Device model number.
   f. List the Device Location (for example; South Wing Side Door, MDF Room XXX, etc.).
   g. Include a Comments column on the far right of the test form.

h. The Test Forms shall have the following categories;
1) Software (where applicable);
a) List the functionality of EACH feature set that was discussed during the "Interview with the Owner", listed elsewhere in this specification.
2) Equipment and Devices;
a) Use the information on the System Device Naming Matrix as the basis for this form, where applicable.
3) Provide a separate row for EACH item/equipment/device test listed.

5. List at the bottom of the Operational and Performance Test Form:
a. State in bold text "See the Governing Acceptance Form for more information".
b. "The following parties Witnessed the Performance Test".
1) At a minimum, list the Installing Vendors technician, one representative from the Owner, and the Architect/Engineer. Allow for two additional parties to sign the document.
2) Provide a "signature" line for EACH party.
3) Provide a "printed name" line, below [or to the right] of each signature line for EACH party.
4) Provide a "Representing" line for EACH party.
5) Provide a "date" line, below [or to the right] of each Representing name line for EACH party.

H. The Governing Acceptance Form - (Section Number and Section Title here) .

1. In lieu of listing the testing criteria, provide the following information (from left to right) on the form:
a. Each row shall have an "Item #".
b. There shall be a "Pass / Fail" column.
c. Provide the following text "Training Materials and Training has been provided".
1) For Training Session #1 and Training Session #2, provide a separate row and a "Completed / Incomplete" column (similar to the Pass/Fail column).
2) Provide a "date" line.
d. Include a Comments column each row.
e. Provide a "Date" line.

2. Under the information listed above, state the following: "The undersigned having been engaged as the Installing Vendor for the (Owner Name here) confirm that the (Project Name, Section Number, and Section Title here) - equipment was installed in accordance with the specifications, drawings, wiring diagrams, instructions and directions provided to (Installing Vendor's name here) by the manufacturer. It has been completely tested, demonstrated and accepted by the Owner's representative(s)."
a. State the following: "Once ALL of the above items have 'Passed' the Performance Test and ALL Training has been 'Completed' the Warranty shall be deemed the Owners ability to use the Complete System Functionality as it was designed. From this date forward, the Warranty period as defined in the project documents shall begin and be in full force and effect, from the most current date on this form. This form is only valid when signed by all parties. "
b. The signatures listed below do NOT release the Installing Vendor/Contractor from fulfilling all of the requirements outlined within the project documents. The Owner reserves the right to have any and all corrections made, that do not comply with the project documents.

c. "The following parties witnessed the Performance Test(s) and/or approve of the results on the Governing Acceptance Form".
   1) At a minimum, list the Installing Vendors technician, one representative from the Owner, and the Architect. Allow for two additional parties to sign the document.
   2) Provide a "signature" line for EACH party.
   3) Provide a "printed name" line, below [or to the right] of each signature line for EACH party.
   4) Provide a "Representing" line for EACH party.
   5) Provide a "date" line, below [or to the right] of each Representing name line for EACH party.

2.9 PROOF OF DELIVERY FORM

A. When providing Equipment to the Owner, the Installing Vendor shall provide the following transmittal document and obtain the necessary signatures.

1. The Installing Vendors Transmittal Document is defined as:
   a. Company logo.
   b. Name.
   c. Address.
   d. Telephone number.
   e. Delivery date.
   f. Installing Vendors representative name that is making the delivery.
   g. Quantity of each item.
   h. Manufacturers Name and Model Number.
   i. The exact same description of the device (as used on the shop drawings).
   j. Provide a "signature" line for the Owners representative.
   k. Provide a "printed name" line, for the Owners representative.
   l. Provide a "date" line, below for the Owners representative.

PART 3 - EXECUTION

3.1 WORK ENVIRONMENT

A. General:

1. The Installing Vendor/Contractor shall have implemented an OSHA approved safety plan at their place of business, and is a daily practice for all staff.
   a. Avoiding an injury is the primary concern for this project. Use OSHA industry standards to avoid accidents.
2. Coordination with Other Trades:
   a. It is the responsibility of the Installing Vendor/Contractor to coordinate with all trades for this project. Maintain all requirements for: project schedule deadlines, rough in, installation, programming, training, and ensuring that the Owner receives a fully functional system as defined in this specification.

3.2 APPROVED EQUIPMENT AND PERMITS

A. No equipment shall be delivered to the job site until shop drawings have been reviewed and approved by the Architect and Engineer.

B. An approved set of shop drawings for each system shall be continuously available at the job site during construction, for review by the Architect and Engineer.

C. Obtain all permits as required, prior to installation of any equipment. They shall be continuously available at the job site during construction, for review by the Architect.

3.3 CABLE INSTALLATION – GENERAL

A. Open Cable installation methods are acceptable for this project when they are above accessible ceilings or in attic spaces provided that all requirements identified in this specification are met.

B. All cable types shall be rated to meet all code requirements for site conditions, including, but not limited to; **Plenum, Riser, Underground, Wet, and Aerial requirements as mandated per N.E.C. and local AHJ requirements**.

C. Do not exceed the wiring 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. The Installing Vendor/Contractor shall be responsible for insuring that all cables meet all equipment manufacturers' requirements for a reliable, fully functional, and warrantable system, as intended.

D. Wiring insulation shall be one of the types required by NEC 725-16.

E. Cable Supports: Clamps, "D-Rings", "J-Hooks", Hangers, and Velcro tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable.

1. See each specific Section requirements that shall be applied to this project in addition to these requirements.

F. Allowable Cable Bend Radius and Pull Tension: In general, all cables cannot tolerate sharp bends or excessive pull tension during installation. The minimum radius bend shall be ten (10) times the cable outer diameter with no tensile load applied, and twenty (20) times the cable outer diameter with a maximum tensile load of 25ft/lbs applied during installation. The Installing Vendor/Contractor is responsible for maintaining the cable manufacturers Bend Radius and Pull Tension at all times. Corrections to cable installation shall be made to the satisfaction of the Architect at no additional cost to the Owner.

G. Service Loops and Cable Management:

1. Comb all wires for the duration of the cable run so they are neat, orderly, do not have excessive slack, and are not tangled, prior to any service loop, continuing through any service loop, continuing into EACH Enclosure(s) and/or System Rack(s).
   a. Provide a 10'-0" service loop of EACH device cable (a minimum of 2'-0" above the accessible ceiling (within 5'-0" of plan view) above EACH device.
   b. For ceilings that are open to structure, do NOT provide a service loops, except for the following locations;
      1) MDF Rooms.
      2) IDF Rooms.
      3) Electrical Rooms.
      4) Storage Rooms.
      5) Designated system equipment locations that are NOT in view of the public.
      6) Prior to rough-in, obtain Architects approval.
2. Cable Management shall be used to bundle all cables of like kind, separated by system type.
3. See Systems Plywood Backboard Cabling, listed elsewhere in this specification for more information.

H. The Installing Vendor/Contractor shall insure that communications cable is 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 Installing Vendor/Contractor shall replace all unacceptable cabling at no additional expense to the Owner.

I. The Installing Vendor/Contractor shall order and install the exact cables as specified on the Installing Vendors Shop Drawings. If at any time during the installation and through the warranty period, it is discovered that any cable other than what is called for on the Installing Vendors drawings has been installed, the Installing Vendor/Contractor shall remove all effected cables and shall provide and install the correct cable, as required. The Installing Vendor/Contractor shall also provide the staff to monitor the building during the cable replacement period until the System is fully operational to the satisfaction of the Architect, without any additional cost to the Owner.

J. All horizontal cables shall be supported at a maximum of 4'-0" intervals. At no point shall cables rest on, be tied to or otherwise secured to electrical conduit, plumbing, ventilation ductwork, accessible ceiling and/or light fixture hangers, or any other equipment. Cable shall be secured to building supports or wire hangers (at the structures ceiling) specifically designed to support cables and/or to additional blocks or anchors specifically installed for this purpose.

K. All open cabling and/or conduit shall be installed parallel or perpendicular to the structure. Open cable installations shall use insulated mounting supports or rings approved for such use. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

L. Installing open cabling and/or conduit on an exposed area of wall that could have been installed in a less conspicuous manner, especially where art or murals are to be painted is NOT acceptable. Any installation that does not meet this requirement will be required to be removed, and to patch and paint to match adjacent surfaces to the satisfaction of the Architect. Then install the conduit, fasteners, and wire as required by the project, at no additional cost to the Owner in an acceptable manner that meets with the Architects approval. Obtain direction from the Architect prior to rough-in, for areas that need clarification.

1. In some cases, it may be more aesthetically appealing to install conduit down the wall to the floor and either through the floor or along the floor, to be less conspicuous. Contact the Architect for further clarification.

M. Conduit type and areas where conduit will be required for this project are:

1. Provide EMT metal raceway in the following areas:
    a. Always conceal conduits within walls and/or ceiling spaces wherever possible.
    b. Where required by code. Provide conduit in all areas required by Code, but no less than the following locations.
    c. To Accessible ceiling spaces. Provide conduit from the device to accessible ceiling space where:
        1) Devices are wall mounted.
        2) Are located on hard lid ceiling.
        3) In an inaccessible area. An inaccessible area is defined as less than 2’-0” from an accessible ceiling tile.
    d. Unoccupied areas exposed to view. Unoccupied areas are defined as places that staff or the public will be in the room or area for only a few minutes, with the exception of service/maintenance personnel.
        1) is includes, but is not limited to:
            a) Mechanical rooms
            b) Electrical rooms
            c) Storage rooms
            d) Utility Room
            e) Janitorial Closet
            f) Other unoccupied rooms
        2) Install conduits to an accessible ceiling space, as defined above.
        3) Consult with the Architect for further clarification.
2. Provide conduit, junction boxes, couplers, connectors, cabling and terminations as recommended by the manufacturer and as required by code.
3. Fill Requirements: Conduit, conduit sleeves, raceways, floor boxes, device boxes, mud rings, etc., shall be furnished and installed per the Division 16 requirements. Maintain all Conduit Code Fill Requirements, and provide no less than an additional 40% spare capacity for future growth.
4. Conduit and Raceway Usage: All communications cable shall be dedicated for communications purposes, and not to be shared with other electrical wiring when required by code. Obtain written approval from EACH of the manufacturers if more than one system type is going to be installed in a single conduit.
    a. Fire Alarm Cabling shall be in a separate, dedicated raceway (where indicated on the drawings).
5. Pull Cords: Provide Nylon type pull cords in EACH Conduit raceway.

6. Provide surface mounted raceway in the following areas (For Retrofit/Remodels or as directed by the drawings or Architect):
    a. Occupied areas exposed to view. Occupied rooms. Generally, occupied areas are defined as places that staff or the public will be in the room or area for more than a few minutes.
        1) This includes, but is not limited to:
            a) Administrative areas.
            b) Office space(s).
            c) Other occupied rooms.
    b. Install conduits to an accessible ceiling space, as defined above.
    c. Size conduit(s) as required.
    d. Consult with the Architect for further clarification.
7. Surface mounted conduits of any kind may only be installed after every attempt has been made to conceal wiring and/or conduits specified within this document. Obtain prior approval from the Architect, before installing surface-mount conduit.
8. Prior to installation, contact the Architect if these instructions are not clear, or field conditions require further clarification of the intent of the installation.

N. Cable Lubricants: Lubrications specifically designed for installing cables may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.

1. Recommended Products:
    a. Dyna-Blue.
    b. American Polywater.

O. Horizontal Cabling:

1. Horizontal cable terminations shall be made at the appropriate patch panel and labeled as noted on the Outlet Schedule. At each outlet box, a sufficient length of spare cable shall be provided for terminating outlet devices such that the outlet can be easily removed and inspected. In addition, each cable shall be terminated as indicated below:
    a. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer’s recommendations and/or best industry practices.
    b. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
    c. The cable jacket shall be maintained as close as possible to the termination point.

P. Systems Plywood Backboard Cabling:

1. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Cables shall NOT be tie-wrapped to existing electrical conduit, existing cables, or other equipment. Minimum bend radius shall be observed.
2. Install cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace, Plastic or Velcro tie wrap all similarly routed cables together, and attach to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment and/or other cables.

3. See "Service Loops and Cable Management" listed within this specification for additional information.

3.4 SYSTEMS PLYWOOD BACK BOARD(S)

A. Systems plywood back board(s) shall be used to mount enclosures of any kind, to any wall or surface. The systems plywood backboard shall be securely fastened to the walls to accommodate no less than ten times the total weight of the equipment to be mounted. The systems plywood backboard shall be a minimum of 3/4", APA exterior grade Douglas Fir A-C, and fire retardant with a flame spread rating not more than 25 when tested according to ASTM E-84. Provide the systems plywood backboard from +6" above the finished floor up to +8'-6" above the finished floor on all walls where shown, unless otherwise noted. The entire backboard shall be painted with three (3) coats of fire retardant paint (the color shall match the adjacent surface). Insure that the Fire Retardant Stamp is NOT painted and is exposed to view. EACH enclosure, when mounted, shall bear a minimum of 150 pounds weight on the enclosure.

B. Mounting of equipment shall be logically placed, and shall be located at the top, bottom, left, or right portion of the systems plywood backboards to accommodate future growth of the system. Under no circumstances will the equipment be allowed to be mounted in the middle of the backboards.

3.5 GROUNDING

A. Ground all equipment per the Manufacturers recommendations, per Division 26 and as required by Code.

B. Provide grounding and bonding per ANSI-STD-J-607-A.

C. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit from the Main Electrical Room MDB Ground Busbar to the Main Distribution Frame (MDF) Telecommunication Main Grounding Busbar (TMGB).

D. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit between the MDF Room TMGB and EACH designated Intermediate Distribution Frame (IDF) location shown on the drawings and terminate on the Telecommunication Grounding Busbar (TGB).

E. Provide (1) #3/0 green insulated copper grounding conductor in 1" conduit between the EACH designated Intermediate Distribution Frame (IDF) location shown on the drawings and terminate on the Telecommunication Grounding Busbar (TGB).

F. See Section 272000 "TMGB and TGB (Telecommunication Grounding Busbars)" for additional Grounding requirements.

3.6 DEVICE RELOCATIONS

A. Device location may be changed prior to installation, within 15'-0" without extra charge, if so desired by the Architect.

3.7 INSTALLATION

A. Provide all equipment, wiring, conduit, and outlet boxes required for the installation of a complete, fully functioning, operating system in accordance with applicable local, state, national codes, AHJ requirements, the manufacturer's recommendations, these plans and specifications. All circuits not in conduit must be wired with UL listed power limited cable under NEC 725, Class II wiring. Plenum cable shall be utilized in all return air plenum ceilings.

1. Color coded wires shall be used throughout.
2. Wiring shall conform to the National Electrical Code Article 725.

B. Provide 120vac wiring and connections to the Control Panel(s), EACH Amplifier(s), CPU(s), DVR(s), and Power Supply(s) as required for a fully functional system, while maintaining all of the design requirements described elsewhere within each system specifications. At a minimum, this shall include the following;

1. Multiple Power Supplies and/or the Control Panel(s) may be placed on the same circuit, while maintaining all code mandated load calculations, but shall be on circuit(s) that is dedicated for EACH System.
   a. Consult with the Architect to verify load calculations meet all code requirements.
   b. Install 120 VAC wiring and conduit as specified in Division 26.
   c. Show on the As-Built drawings, the location of each panel board that is being used to power any System equipment, and list each panelboard circuit for each system (at the panel board). (i.e. Panelboard “x”, circuit 12=FAPS-3; Circuit 14=IACP.)

C. Maintain all fire wall ratings, as required.

D. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

E. EACH manufacturer's authorized representative shall provide on-site supervision of the installation for EACH of the systems equipment for the duration of the project. This includes programming, training, and the Owners ability to use the Complete System Functionality as it was designed.

F. Install wire guards at locations as shown on the drawings and as described elsewhere within these specifications.

G. Every attempt shall be made to avoid running telecommunications close to (less than 2’-0") and/or parallel to other communication cables in the building, all lighting, and conduits containing 120vac (or greater). This shall be to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation-mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any conduit and/or riser. Route cables in such a manner to allow other cables to enter the conduit and/or riser without difficulty at a later time by maintaining maximum distance from these openings. Maintain all recommended distances from other cables, as required by the manufacturer. Install cable to whichever of these two requirements are more stringent.

H. Room numbers shown on plans are architectural designs numbers for construction purposes. These numbers are NOT to be used for programming. Final system programming shall reflect the final room numbering plan and actual room signage, unless directed to otherwise in writing or as specified in another specification section. Update the As-Built Drawings to reflect the final room numbering plan and actual room signage.

3.8 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Install all equipment as recommended by the Manufacturer.

B. The installation of EACH device, enclosure, and/or control panel shall be installed so that the Maintenance Staff will be able to access, test and/or replace any component of the system. If this installation does not meet this requirement to the satisfaction of the Architect, it will not be accepted. The Installing Vendor/Contractor shall be required to remove the item, patch and paint the area to the satisfaction of the Architect, and reinstall the device, enclosure, or control panel as required to make the system easily maintainable and acceptable, at no additional cost to the Owner.

C. Control Panel(s), Power Supply(s), and Locations:

1. Mount Control Panel(s), Power Supplies, and Enclosures (provide quantities as required) with approximately two inches of separation between the enclosures.
2. Each enclosure, when mounted, shall meet the following criteria;
    a. Conduit shall not enter any enclosure or panel, except where conduit entry is approved by the manufacturer.
    b. Chase nipple the enclosures together. At a minimum, use (2) 1½" conduits. Size and/or provide additional conduits as required. Provide conduits between enclosures to accommodate an additional 100% conduit fill while maintaining all NEC requirements. Avoid installing chase nipples where batteries are to be installed (contact the manufacturer and/or the Installing Vendor prior to drilling any holes). Any chase nipples installed where batteries are to be located will be rejected, and require the reinstallation as specified, up to and including installing new enclosures.
    c. The bottom of the chase nipples shall be a minimum of two-inches above the location where any batteries are to be installed.
    d. EACH enclosure door shall be able to open no less than 105°.
    e. The top of each enclosure shall be mounted at the same height of 60-inches above the finished floor and shall be level.
    f. If changes to the above requirements are preferred, contact the Architect for approval prior to rough-in.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (IE: devices shall not be supported solely by suspended ceilings). Fasteners and supports shall be able to support the no less than four times the weight of the equipment and/or device.

E. Rack Equipment: EACH Rack shall be securely attached to the floor and/or wall using the manufacturer's recommended mounting hardware.

F. See each system specification for additional mounting information.

3.9 FLUSH MOUNT AND SURFACE MOUNT EQUIPMENT AND ENCLOSURE LOCATIONS

A. Prior to rough-in, consult the Architect for clarification for Flush Mount and Surface Mount locations.

B. Flush mounted equipment and enclosures shall be installed in areas where the rooms are finished such as Administrative Areas, Offices, Work Rooms, Break Room and Corridors. Provide the appropriate finish work around each enclosure as required. This type of equipment includes, but is not limited to the following:

1. Enclosures: Typically are Control Panels, Power Supplies, etc.
    a. Provide the manufacturers flush mount Trim Rings, Adapters, and/or Brackets for this type of equipment.

C. Surface mounted equipment and enclosure shall be installed in areas where the rooms are NOT finished such as Electrical Rooms, MDF/IDF Rooms, Mechanical Rooms, or Utility Rooms. Unless otherwise noted, this equipment shall be installed on the Systems Plywood Back Boards. This type of equipment includes, but is not limited to the following:

1. Enclosures: Typically are Control Panels, Power Supplies, etc.
2. Punch Blocks: Typically are used with Telephone PBX and Intercom equipment.
3. Wall Mounted and Floor Mounted Racks.

3.10 NUMBERING AND LABELING

A. Phenolic Plates:

1. Install phenolic plates at each of the Control Panel(s), Power Supply(s), Terminal Cabinet(s), and Rack(s).
    a. All phenolic plates shall be secured to each enclosure with rivets.
    b. Install each plate 1” from the top of the enclosure, and be centered on the door. Relocate as required to avoid interfering with equipment or components within the enclosure or that may prevent the enclosure door from closing properly. The location of the phenolic plates shall be consistently installed in the same location on each system enclosure, at EACH location.

B. Terminal Cabinets:

1. Label each termination point on the inside of EACH enclosure door. All information shall be legible, as defined by the Architect.

C. Addressable Devices/Address Point Labels (where applicable):

1. Install the Address Label for each addressable device on or near the device. Verify with the Architect, prior to installation.
2. Clean the surface from dust, grease, or lubricants as recommended by the manufacturer of the label.
3. The addressable label shall be able to be viewed by the general public when standing on the ground.

a. Prior to Installation, coordinate with the Owner's Representative for exact location of how and/or where to mount the address label for EACH device type to fulfill this requirement, prior to installation.

4. Provide the following address label format:
   a. The background shall be clear (see through).
   b. The text shall be Black in color, and a minimum of ½" tall.
   c. Use Brothers or P-Touch models to produce the label.

3.11 WIRING

A. For consistency of wiring 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 or data bus (+) positive.
2. Black is (-) Negative voltage or data bus (-) negative.
3. White is common.
4. Green is normally open or normally closed.

B. Wiring within EACH enclosure shall have the outer jacket of the cable removed to within three-inches of the cable entering the enclosure. Individual conductors from each jacketed cable shall be spirally twisted to keep them together, until they are routed into each appropriate individual terminal. Route all conductors parallel with the walls of the enclosure, make 90° turns within the enclosure, and always keep a two-inch minimum spacing from any circuit board and/or terminals.

1. Labeling of Cables.
   a. Prior to installing any label, clean each cable with the appropriate cleaner to remove any pulling compound residue, grease, oil, dirt, etc. in order for the label to properly adhere to the cable jacket.
   b. The Label shall indicate the Device or Outlet and the area or wing of the building that the cable is being routed from. The Label shall also indicate the MDF Room or designated IDF location that the cable is being routed to.
   c. Each label shall be located on each cable that enters any enclosure or junction box, and shall be easily visible and readable.
   d. The cable numbering system shall be consistent with shop drawings.

C. End-of-Line (EOL) Resistors: Each device that is capable of being supervised by the Control Panel and/or Power Supply shall be supervised. Install equipment and/or program as required.
   1. Indicate on the As-Built drawings where EACH of the End-Of-Line Resistors is located.
   2. Each End-of-Line Resistor shall be installed at the last device on each circuit. Locating the EOL in the Control Panel and/or Power Supply is NOT acceptable.

D. The telephone dialer connections and Ethernet WAN connections shall be made by the Installing Vendor. Coordinate with the Owner for scheduling the Owners IT Department to supervise all terminations and connections.

E. All wiring routed under slab or underground shall be suitable for wet locations.

F. The Installing Vendor/Contractor shall clean all dirt and debris from the inside and the outside of EACH enclosure after completion of the installation, and prior to any testing being performed.

G. All circuits shall be identified in accordance with table below and all labels shall include wire type, quantity and circuit number. Wire code shall match approved shop drawings wire code.

Table

Example: C2HX3
C = Signal Circuit Wire
2 = Signal circuit number
H = LCD Keypad wire
X = Addressable initiating device circuit wire
3 = Addressable initiating device circuit number

3.12 SPLICE CONNECTORS AND CONNECTIONS

A. All references to splices are for cables that are 50 volts or less.

B. A continuous cable run without any splices is the preferred method. When a splice is required the following information shall apply.

1. Cable splices are only allowed in accessible, dry locations, in a junction box or terminal cabinet suitable for the purpose. The only exception is for field devices that have wire leads (i.e. Pigtail) and require a connection of two wires at the device.
   a. Each cable end that is spliced must be labeled, as specified. (i.e.: At the splice point, “From FACP in MDF Room XXX” on one cable, and “To the East Wing RCAP” on the other cable).

C. All splices shall be performed in one of the following methods:

1. Wire nuts shall NOT be used on this installation, will be deemed unacceptable, and shall be removed and installed as outlined below.
2. In Junction Boxes:
   a. Either one of the following Splice Methods are acceptable:
      1) Use the Tool-less Terminal Strip, Model Number SSU00470 (Black) or SSU00471 (White), and SSU00465 (the Back Box Bracket) for use with extra deep 4S boxes. This equipment is manufactured by Space Age Electronics.
      2) Use Model DC-100-S Blue Dolphin Connectors (with Sealant), Manufactured by Dolphin Components Corporation, on all splice connections that are size 18 gauge or less. The rubber coated outer jacket of the inch-long connector shall contain non-curing sealant that fills the crimp cavity when crimped. Strip the color coded outer jacket of each individual conductor that is going to be crimped, approximately 1/8-inch shorter than the length of the crimp connector, so that when the conductors are inserted all of the way in the connector, no bare wires (or any strands of wire) are exposed or visible out of the connector.
3. In Terminal Cabinets:
   a. In Terminal Cabinet(s) with each conductor to be landed on a separate terminal.
   b. Indicate on the Shop Drawings and As-Builts, the locations of EACH Terminal Cabinet.
   c. Maintain the “Spare Capacity” requirements, as specified.
4. At Field Devices (where the device has wire leads and not a terminal strip).

a. Use Model DC-100-S Blue Dolphin Connectors as described above.

5. Spare or unused conductors shall be:
   a. Landed on terminal strips.
   b. Shall have the Blue Dolphin Connectors crimped on the end of each conductor.
      1) Field devices with pigtails shall have a Blue Dolphin Connectors crimped on the end of any unused conductor(s).

D. All conductors, if spliced, shall be ONLY spliced to the same gauge size and color of conductor. Changing of gauge size or color at any point within any cable run is strictly prohibited, and all cables will be replaced at no additional cost to the Owner, and to the satisfaction of the Architect.

1. If the field device has wire leads, then wire as necessary at the device for proper operation. Indicate the color code change on the shop drawings per point wiring diagrams. Update any and all changes to the drawings, for accurate as-builts.

3.13 ON-SITE SYSTEM INFORMATION BINDER ENCLOSURE

A. The Installing Vendor shall install the wall mount enclosure that is labeled "(Section Title here) information". The enclosure shall be located in the administrative area or the MDF room. Verify the exact location with the Architect, prior to installation.

B. The enclosure shall have a Site specific manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the enclosure.

C. See "As-Built Documentation" for more information.

3.14 TESTING & COMPLETE SYSTEM FUNCTIONALITY

A. The warranty shall NOT begin until the following conditions have been met:

1. Obtain the AHJ signature, printed name, date, and telephone number on the Permit(s) and other required documentation. Provide this documentation with the As-Built documents.
2. The Installing Vendor shall provide a copy of the (Section Number and Section Title here) - Operational Test Form that has been performed (the system was actually tested) and submitted to the Architect for review. The purpose of this document is to show that the Installing Vendor has in fact performed a complete test. In some cases, every device may not pass the test. This shall serve as the Installing Vendors own punch list, to make corrections prior to the actual Performance Test. This must be completely filled out, and have an original signature of the representative of the Installing Vendor. Allow for a minimum of (10) business days for the Architect to review this document.
3. After the Architects review of the System Operational Test Form, the Architect will discuss the results of the test with the Installing Vendor.
4. The Installing Vendor shall coordinate with the Architect/Engineer to witness the Performance Test. Allow for a minimum of (10) business days to schedule this testing.
5. System Testing:
   a. The Installing Vendor shall provide two-way communication devices for their own staff, each Owners Representative, and the Architect, so that all parties can communicate as required to perform all tests.

b. The Installing Vendor shall demonstrate the testing of each device, to the Owners Representative and the Architect, and document this information on the (Section Number and Section Title here) - Performance Test Form.
c. Upon the completion and passing the Performance Test with 100% positive results, the Governing Acceptance Test form shall be signed by the Installing Vendor, the Owners Representative, and the Architect.
1) If the Installing Vendor fails this test by NOT passing the test with 100% positive results, the following shall occur;
2) The Installing Vendor shall make all of the necessary corrections to provide 100% positive results.
3) The Installing Vendor shall document the corrective action taken for each item that failed the Test, and submit to the Architect for review. Upon approval by the Architect, the Governing Acceptance Test shall be rescheduled.
4) The Installing Vendor is subject to the Close Out requirements as specified in Section 260000, Schedule of Values.

6. As-builts:
a. Refer to the "As-Built Documentation" of this specification for more information.
7. Training:
a. Refer to EACH specific Section for the Training Requirements as described in "Training Materials and Programming Survey".
8. Complete System Functionality:
a. After ALL the above conditions have been met as deemed by a "Pass" on the Governing Acceptance Form - (Section Name and Section Title here), all training has been completed, and the required signatures have been acquired, this shall then be deemed that the Owners ability to use the Complete System Functionality as it was designed.
9. Warranty:
a. The Warranty period shall now begin, and the initiating date of the Warranty period shall commence on the date of the Owners ability to use the Complete System Functionality as it was intended. Refer to the "Warranty" of this specification for more information.

3.15 WARRANTY

A. See "Testing & Complete System Functionality", listed elsewhere in these specifications, to establish the requirements and confirm when the actual warranty period shall begin.

B. The Installing Vendor shall include in the pricing of their bid that they will honor and provide EACH of the manufacturers Full Term Warranty period for the provision of replacement equipment for EACH individual device and/or component provided for this project. The completed and fully functional System, including wiring, installation, and all equipment shall be free from inherent mechanical and electrical defects. At a minimum, this shall be no less than one (1) year from the date of Complete System Functionality as defined in "Testing & Complete System Functionality" portion of this specification. Warranty service for the on-site replacement of equipment shall be provided by the system supplier's Manufacturer trained representative during normal working hours, Monday through Friday, excluding holidays, and respond for service no later than the following business day after the call was received.

C. When the manufacturers warranty exceeds one year, the Installing Vendor shall be responsible for replacing the actual component or device for the Full Duration of the manufacturer's warranty, if the Owner or their representative chooses to take the item to the Installing Vendors place of business. If the Owner chooses to have the Installing Vendor provide on-site service, then the Installing Vendor is entitled to their standard published (or negotiated) labor rates and miscellaneous material items to replace the damaged warranty item.

D. The Installing Vendor who is authorized to provide Warranty Service for this project is defined in "Quality Assurance" located in Part 1 of this specification.

3.16 AS-BUILT DOCUMENTATION

A. The following documentation must be completed to the satisfaction of the Architect, in order to fulfill the Close Out requirements as specified in Section 260000, Schedule of Values.

B. All electronic and hard copy information submitted to the Owner shall immediately become the Owners property to use as best determined by the Owner, without any compensation to any party.

C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings).

D. Operation and Maintenance Manuals: The Installing Vendor/Contractor shall provide three (3) sets of detailed Operation and Maintenance manuals in a "D" style 3-ring binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label " (Project Name, Section Number, and Section Title here) Operation and Maintenance Manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the binder, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder; the Project Name and Project Number, Specification Section Number and Section Title, the Owners name, the Site Name and Site Address, the Installing Vendors Name, Address, and Contact Name. These O & M Manuals shall include the following;

1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed. Provide these items in the following order.
    a. Provide an 8½" x 11" clear heavy plastic sheet in front of a Table of Contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.
    b. The System Software User Guide.
    c. The Web Server "Web-based" software User Guide.
    d. The System Control Panel LCD Display User Guide.
    e. The Remote LCD Display User Guide (Where Applicable).
        1) Provide Step-By-Step instructions for typical Basic Operation of EACH System.
    f. Warranty information. The Installing Vendor shall provide Warranty information in the form of a matrix from left to right, list the following information:
        1) Use the symbol on the Legend of the contract drawings.
        2) List the actual manufacturer's name of each device shown on the Installing Vendors shop drawings.

3) List the actual manufacturer's model number of each device shown on the Installing Vendors shop drawings.
4) Provide the description of the device that is used for each symbol on the legend.
5) On the matrix, indicate recommended testing frequency for each item.
6) State the Manufacturers Full Term of the Warranty for EACH control panel, EACH power supply, and EACH device provided.
7) Indicate where the Owner may purchase each of these devices. Provide the Business Name, Address, City, State, Zip Code, Phone Number, and list (2) contact names.

g. A reduced copy (11"x17") of record drawings. Enlarge all notes, text, and symbols to a legible (as defined by the Architect) reading format.

h. Provide (1) original and (2) copies of the "Spare Parts Proof of Delivery" form that was signed by the Owners representative.

i. A printed copy of the final completed version of the (Section Number and Section Title here) technical configuration and this document shall be dated.

j. A printed copy of the final completed version of the (Section Number and Section Title here) software 'point status report' (where applicable) and this document shall be dated.

k. Update the matrix as defined in the 'System Device Naming Matrix' for each specification section, to correct any changes that may have occurred through the course of this project. This list shall follow the above equipment list.

l. Data Sheets: The technical data sheet for EACH Control Panel, Power Supply, Terminal Cabinet, field device and component installed. Use a separate tab for each of these that were supplied and/or installed.

m. Installation Manuals: Include the installation manual for EACH device that was installed. Put this information immediately behind the testing documentation.

n. Testing Documentation: Include all testing documentation and the procedure to properly test each device.
1) Provide (1) original and (2) copies of the AHJ approved document(s).
2) Provide (1) original and (2) copies of the completed documents:
3) The (Section Number and Section Title here) - Operational Test Form.
4) The (Section Number and Section Title here) - Performance Test Form.
5) The approved Governing Acceptance Form - (Section Number and Section Title here) .
6) If the Governing Acceptance Form has not been approved, accepted, and signed by the Architect, this binder will be rejected.

o. Each binder shall not exceed three-inches in width. Use multiple binders as required. Indicate Volume 1 of X, Volume 2 or X, etc.

p. Provide the above information on (6) CD's and label each one (with a PC generated label) " (Owners Name, Project Name, Section Number, Section Title, and the current date goes here) - Operation and Maintenance Manuals, Data Sheets, Installation Manuals, Testing Documents/Test Reports, and As-Built Shop Drawings". Organize the manuals, data sheets, documents, and drawings into separate folders.
1) For EACH system Specification Section, provide the following information on EACH CD:
a) The complete set of As-Built Drawings in editable AutoCAD (.DWG) or Revit BIM (.RVT).

b) The complete set of As-Built Drawings in Adobe Systems © Portable Document Format (.PDF).
c) The Technical Data Sheets of EACH item identified on the Materials List shall be in Adobe Systems © Portable Document Format (.PDF).
d) The Installation Manual of EACH item identified on the Materials List shall be in Adobe Systems © Portable Document Format (.PDF).
e) The Load Calculations of EACH item included in the Submittal shall be in editable MS-Excel ©.
f) ALL remaining document shall be provided in editable format.

2) EACH of the (3) Operation and Maintenance Manuals shall have one CD securely fastened inside the O & M Manual.
3) The remaining (3) CD's shall be provided to the Engineer.

E. On-Site System Information Binder: The Installing Vendor shall provide Individual Site Manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the "(Section Title here) information" enclosure. See the "On-Site System Information Binder Enclosure" listed elsewhere in these specifications, for the enclosure information and location. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label " (Section Title here) information". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder; the Project Name and Project Number, Specification Section Number and Section Title, the Owners name, the Site Name and Site Address, the Installing Vendors Name, Address, and Contact Name. Each binder shall include the following;

1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed.
   a. Provide these items in the following order.
      1) Provide an 8½" x 11" clear heavy plastic sheet in front of a Table of Contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.
   b. The Installing Vendor shall coordinate with the Owner to obtain the information listed below. A single sheet shall list the following items;
      1) The Site Name and Site Address.
      2) State **"In case of emergency *during* regular business hours:** (list the appropriate name and telephone number)". List the Owners Representative who should be contacted during regular business hours.
      3) State **"In case of emergency *after* regular business hours:** (list the appropriate name and telephone number)". List the Owners Representative who should be contacted after regular business hours.
      4) List the following information (where applicable). State "The monitoring of the (Section Title here) is being monitored by (list the name of the central monitoring station here), Phone Number: (list the central station phone number here) Account # (enter the account number here)".
   c. Provide each of the items identified in the operation and Maintenance Manuals, with the following exceptions. Do NOT provide:
      1) Spare Parts Proof of Delivery form.
      2) As-built Operation and Maintenance CD's of the project.

F. As-Built Drawings: The Installing Vendor shall provide (3) sets of hard copy As-Built drawings. Drawings shall be the same size that were issued for the shop drawings and clearly indicates the following:

1. Update the Shop Drawings:
   a. To address any changes, including but not limited to the Riser, point-to-point wiring diagrams, and mounting details.
   b. To accurately reflect the final installation of equipment and devices that were relocated, added or removed.
   c. Update the matrix as defined in the 'System Device Naming Matrix' of the specification, to correct any changes that may have occurred through the course of this project.
   d. Actual routing of all raceways.
   e. Actual routing of all Open Cables.
   f. Actual cable type, color, and numbers.
   g. Actual splice locations.
   h. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.
   i. Provide scale drawings of the internal components of the main panel, and each power supply. Show each circuit number coming from the terminals of each Control Panel and/or Power Supply.
   j. Actual room number and programming addresses (where applicable) for all components in the system.
   k. Show on the As-Built drawings the location of each panel board that is being used to power any System equipment, and list each panel board circuit used (at the device that is connected to that circuit. IE: FACP or FAPS).
   l. Indicate on the As-Built drawings where EACH of the End-Of-Line Resistors is located.
   m. Provide all updated As-Built drawings in AutoCAD™ and put this electronic files on the Operation and Maintenance Manuals CD, as described elsewhere in these specifications.

G. Provide all As-Built Documentation to the Architect prior to any Training and no less than (10) business days prior to project completion.

H. Any re-submittal(s) shall be provided at the Installing Vendor/Contractors expense.

****Sample** WIRE LEGEND**												
CONDUIT/RACEWAY SINGLE CONDUCTOR								**OPEN CABLE**				
LETTER	**FUNCTION**	**CONDUCTOR OR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFR**	**CABLE MFR PART #**	**AWG**	**QTY**	**TYPE**	**CABLE MFG**	**CABLE MFR PART #**
A	ADDRESSABLE INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID			#16/2	1	16/2 – FPLP		
		+ RED	#16	1								
B	ADDRESSABLE INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID			#16/2	2	16/2 – FPLP		
		+ RED	#16	2								
C	HORN/STROBE CIRCUIT	- BLUE	#14	1	THWN-SOLID			#14/2	1	FPLP		
		+ WHITE	#14	1								
D	HORN/STROBE CIRCUIT LOOP	- BLUE	#14	2	THWN-SOLID			#14/2	2	FPLP		
		+ WHITE	#14	2								
E	CONVENTIONAL INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID			#16/2	1	16/2 – FPLP		
		+ YELLOW	#16	1								
F	CONVENTIONAL INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID			#16/2	2	16/2 – FPLP		
		+ YELLOW	#16	2								
G	24V DC POWER CIRCUIT	- BLACK	#14	1	THWN-SOLID			#14/2	1	FPLP		
		+ RED	#14	1								
H	SPEAKER CIRCUIT	RED	#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN			#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN		
I	SPEAKER CIRCUIT LOOP	RED	#14/2	2	TWISTED SHIELDED FPLP W/ DRAIN			#14/2	2	TWISTED SHIELDED FPLP W/ DRAIN		

****Sample****
WIRE LEGEND

CONDUIT/RACEWAY SINGLE CONDUCTOR								**OPEN CABLE**				
LETTER	**FUNCTION**	**CONDUCTOR OR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFR**	**CABLE MFR PART #**	**AWG**	**QTY**	**TYPE**	**CABLE MFG**	**CABLE MFR PART #**
J	ANNUNCIATOR CIRCUIT	BROWN BLUE	#16 #16	1 1	THWN-SOLID			#16/2	1	16/2 – FPLP		
		- BLACK	#14	1				#14/2	1	FPLP		
		+ RED	#14	1								
K	FIREMANS PHONE CIRCUIT	RED	#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN			#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
L	FIREMANS PHONE CIRCUIT LOOP	RED	#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN			#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
M	CONTROL CIRCUIT	- PURPLE	#14	1	THWN-SOLID			#14/2	1	FPLP		
		+ ORANGE	#14	1								
ADD PROJECT SPECIFIC NOTES HERE								**ADD PROJECT SPECIFIC NOTES HERE**				

END OF SECTION 270000

SECTION 272000 - DATA AND VOICE INFRASTRUCTURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

B. WSSP Requirements: The work of this Section is part of the overall requirements to comply with the required minimum Washington Sustainable School Protocol (WSSP) requirements. Comply with Section 018113 – WSSP Requirements; refer to WSSP Scorecard in Section 018113 for WSSP edition and Credit identification.

C. 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 015700 – Environmental Protection.

1.2 SCOPE

A. The Installing Vendor shall furnish and install all materials for a complete, fully functional data and voice Telecommunications Infrastructure system in accordance with this specification and the contract drawings. The system shall be in full compliance with a 25 Year “Application Warranty”. The Installing Vendor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

B. The installation shall include Fiber Optic Cable and Copper Category Rated Cables, innerduct, interconnect equipment, connectors, jumpers punch blocks, fiber optic patch panels, copper patch panels, patch cables, telecommunication outlets, fire rated penetration assemblies, conduit, cable tray, wire management, and racks.

C. The Installing Vendor is required to coordinate with the Owner so that the telephone system can be patched into the Data and Voice infrastructure by the Installing Vendor.

D. All copper Horizontal Cables shall be terminated on patch panels in the Telecommunication Rooms (MDF and designated IDF locations) and on Telecommunications Outlets. All copper backbone cables shall be terminated on punch blocks at main cross connects and on patch panels at the horizontal cross connect end, unless noted otherwise.

E. Upon completion of installation, the Installing Vendor shall test all fiber and copper cables. All cables shall be tested as defined elsewhere within this specification.

F. 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.

G. The system shall meet ALL of the requirements listed in Section 270000 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

H. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 272000 includes, but is not limited to the sections identified in Section 270000.

I. See “Horizontal Cable” and “Racks” located in this specification for additional work and equipment. This includes, but is not limited to; CAT6 Cabling for ALL Local Area Network (LAN) based Systems as shown on the plans, detail sheets, and riser diagrams.

1.3 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.

B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:

1. BICSI Information Technology Systems Installation Methods Manual, 6th Edition
2. BICSI Telecommunications Distribution Methods Manual, 12th Edition
3. ANSI/TIA 606-A (2002) Administration Standard for Commercial Telecommunications Infrastructure.
4. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA-455-61 (latest edition). "FOTP-61, Measurement of Fiber or Cable Attenuation Using An OTDR".
6. TIA-526-7. Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7.
7. ANSI/TIA 568-C.0. "Generic Telecommunications Cabling for Customer Premises."
8. ANSI/TIA 568-C.1. "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements."
9. ANSI/TIA 568-C.2. “Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components."
10. ANSI/TIA 568-C.3. “Optical Fiber Cabling Components Standard."
11. EIA/TIA 569-B. "Commercial Building Standard for Telecommunications Pathways and Spaces."
12. IEEE 802.3 (latest edition) "Carrier Sense Multiple Access With Collision Detection.”
13. Uniform Building Code (latest edition).
14. Uniform Fire Code (latest edition).
15. NEC (National Electrical Code) (latest edition).
16. Telecommunications Architectural Standards - In Washington State Government (latest edition).

1.4 DOMESTIC PRODUCTS

A. Products shall comply with the requirements of the “Buy American Act - Construction Materials Under Trade Agreements”, current adopted edition.

1.5 QUALITY ASSURANCE

A. Installing Vendor Qualifications:

1. The Installing Vendor project manager shall hold a valid and current Registered Communications Distribution Designer (RCDD) certification issued by Building Industry Consulting Service International (BICSI). The project manager shall have a minimum of five years experience with projects of similar size and scope.
2. The Installing Vendor field staff installers shall hold valid and current Installation certifications issued by Building Industry Consulting Service International (BICSI) or hold documented certification of training from the manufacturer of the cabling and equipment that is being installed. The field staff shall have a minimum of five years experience with projects of similar size and scope.
3. The Installing Vendor shall be an Authorized Partner of the Manufacturer of the equipment being installed and shall furnish documentation showing that the Installing Vendor is trained and certified. The Installing Vendor shall be capable of providing the Owner with a documented 25 Year "Performance and Application Warranty" of the equipment being installed at the time of project bid, to be approved for bidding.
4. Work in this section shall be performed by a licensed and bonded low voltage Installing Vendor with a minimum of five year's experience in the installation and maintenance of high speed data and voice networks. Only Installing Vendors whose primary business is that of installing, maintaining, troubleshooting, and testing Telecommunication Infrastructures shall perform this work.
5. In order to qualify for installation of the Telecommunications Infrastructure Installing Vendor must possess the required license classification, a performance history, experience in the installation and termination of copper and optical fiber cable systems, and proof of time in business.
6. License Classification: Installing Vendor must possess a valid Washington State 06 Electrical Low Voltage License.

1.6 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.7 PROJECT CONDITIONS - ARCHITECTURAL PLANS

A. The Installing Vendor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.8 SUBMITTALS

A. Refer to specification 27 0000 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

B. Refer to "As-Built Drawings" for additional requirements.

C. Data Sheets and other documentation.

1. Installing Vendor Staff qualifications. Provide the following information (Certification and Training documents):
   a. The Project Managers Registered Communications Distribution Designer (RCDD) certification issued by Building Industry Consulting Service International (BICSI).
   b. The Installing Vendor field staff installers (a minimum of two) Installation certification issued by Building Industry Consulting Service International (BICSI) or certification of training from the manufacturer of the equipment that is being installed for:
      1) Fiber Optic Cables that are being installed for this project.
      2) Copper Cables that are being installed for this project.
2. Installing Vendor/Manufacturer Agreement. Provide the following documentation of the Manufacturer of the equipment being installed:
   a. The Installing Vendor shall be an Authorized Partner that is trained and certified by the Manufacturer of the equipment being installed and the Manufacturer of the equipment being installed/Installing Vendor shall provide the documented 25 Year "Performance and Application Warranty" at the completion of the project.
3. Pre-Installation project kick-off meeting:
   a. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.
4. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under "Coordination" identified elsewhere in this specification.
5. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.
   a. Provide data sheets for each item listed on the materials list.
   b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

D. Shop Drawings shall include the following items:

1. The Telecommunications Riser Diagram shall show EACH Telecommunications Equipment location (the MDF and EACH designated IDF separately).
   a. Indicate each cable type, size, and quantities between the MDF and each designated IDF location.
2. Floor Plans shall show each Outlet and each individual ports alpha-numeric Owner approved label identification.
   a. Rack Layout (where applicable).
      1) Show the intended equipment layout within EACH of the Rack(s).
      2) Indicate the rack unit size of each device or filler plate in the rack.
      3) Show blank filler plates in spaces where equipment is not installed. This information shall only be shown on enclosed racks.
      4) If rack equipment is installed on the rear side of the rack, show rear view of the rack also.
3. Submit copies of EACH T-GMP Graphic Map.

PART 2 - PRODUCTS

2.1 Materials

A. See Section 270000 Low Voltage Systems General Requirements for additional requirements.

B. The Installing Vendor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Vendor of this section.

C. CommScope / Systimax manufactures the products that are used for the basis of design of this specification.

1. Products of equal quality must be submitted for approval 10 days prior to bid.
2. Minimum-compliant cable will not be accepted.

D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All Telecommunications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:

1. CMR General Purpose Communications Riser Cable.
2. CMP Plenum-rated Communications Cable.
3. And other cable ratings to comply with the National Electrical Code requirements for the installation.

E. All products shall meet the certification requirements of the warranty. All device products and all cabling products shall be of a single manufacturer.

F. Provide all equipment as defined in the specification(s) and shown on the drawings.

G. Refer to PART 1 for any equipment that is not specifically defined.

2.2 MATERIALS NOT INCLUDED (PROVIDED & INSTALLED BY OTHERS)

A. Telephone switching equipment and related appurtenances.

B. Telephones.

C. Switchers, routers, network hubs, data concentrators and other similar active electronic equipment for data communications.

D. Computers, printers, facsimile machines, modems and other similar utilization equipment.

2.3 COORDINATION

A. The Installing Vendor shall include each of the following items in their bid for this project.

B. Refer to "Installation of Owner Furnished Equipment" for additional coordination and installation requirements.

C. Refer to "Submittals" for additional coordination requirements.

D. Pre-Installation Project Kick-off Meeting. The Installing Vendor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner (somewhere within the District). This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Vendor shall be responsible for providing the following items.

1. A sign in sheet (with the project name, Section number and title that the Installing Vendor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address).
2. Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee.
3. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:
    a. Sample Port Address labeling of each type of Outlet included in this project.
    b. Sample Patch Panel Port Address labeling.
        1) Provide follow up documentation shall include an illustration of EACH Outlet Type.
    c. Sample Cable ID labeling.
        1) Provide follow up documentation shall include an illustration of Labeling for EACH Outlet Type.
    d. Sample Rack ID labeling.
    e. Sample Punch Block labeling.
    f. Port Count for EACH Patch Panel of EACH System Type within the MDF Room and EACH designated IDF location.
    g. Confirmation of the Fiber Optic Connector Type.
    h. Owner furnished equipment to be installed by the Installing Vendor. Such as Wireless Access Points (where applicable).
    i. Equipment configuration within EACH Rack.
    j. Rack locations and orientation within the MDF Room and EACH designated IDF location.
        1) Provide follow up documentation shall include an illustration of the Front and Rear of each Rack.
    k. The placement of wall mounted Equipment shall be identified, discussed, and confirmed for the placement of the equipment in the MDF Room and EACH designated IDF location.

E. Follow up documentation for the Pre-Installation Project Kick-Off Meeting. The purpose of this information is to illustrate to the Owners IT Department that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Vendor.

1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

2.4 INSTALLATION OF OWNER FURNISHED EQUIPMENT

A. The Installing Vendor shall install the following Owner Furnished equipment:

1. Wireless Access Points (WAP's). Coordinate with the Owner as required.
   a. Install each WAP where indicated on the plans.

2.5 ADDITIONAL REQUIREMENTS.

A. Refer to "As-Built Drawings" listed elsewhere in this specification for additional equipment required for this project.

2.6 SEISMIC BRACING

A. Provide Seismic Bracing as required by the AHJ.

B. This includes, but is not limited to:

1. Racks.
2. Cable Tray.
3. Cable Supports.

2.7 TELECOMMUNICATIONS SYSTEM DESCRIPTION

A. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or designated IDF location. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Legend, unless noted otherwise.

B. Horizontal cables are to be terminated on rack-mounted patch panels of the same data speed transfer rating. Horizontal Cabling shall be to Patch Panels within each designated rack. Horizontal Cabling shall be cross-connected to backbone cables.

C. A fiber optic backbone shall be installed between the Main Distribution Frame (MDF) and each designated Intermediate Distribution Frame (IDF) for data connectivity. Within the MDF and the IDF's, the backbone fiber strands shall be terminated and housed in rack-mounted fiber optic enclosures. Both ends of EACH fiber shall be terminated.

D. "High" pair count, 24 AWG, cables shall be installed between the MDF Analog (POTS) and each designated IDF Analog (POTS) for voice connectivity, unless noted otherwise. The MDF Room and EACH designated IDF location backbone copper pairs shall be terminated on punch blocks and cross connected to voice patch panels, unless otherwise noted.

E. Modems, fax machines, wall mount voice outlets for telephone handsets, etc. shall be connected to the data and voice infrastructure via Horizontal Cabling.

2.8 LABELING

A. See Section 270000 for additional label type and additional requirements.

B. The alpha-numeric labeling shall be developed by the Installing Vendor, under the direction of the Owners IT Department at the Pre-Installation project kick-off meeting. If the Owners IT Department has no preference as to the labeling scheme, than each outlet port label shall indicate the Telecommunication Room termination (the MDF or the designated IDF location) rack and each patch panel port. (Example: MDF-1-1-01)

C. The Installing Vendor shall label all equipment and cables in an identical fashion of a sequential manner to the satisfaction of the Owner.

D. All label printing shall be machine generated using indelible ink ribbons or cartridges, and self-laminating labels shall be used on cable jackets appropriately sized to the outside diameter of the cable.

E. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

F. Patch panels shall have each port labeled to identify each outlet port.

G. Racks shall have phenolic labels installed at the Top and Centered of EACH Rack installed on this project. Phenolic labels shall be size 36 font.

H. Cable Identification Labels shall be places in the following locations:

1. Horizontal Cables. Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel and placed within view.
2. Backbone Cables. Each cable shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of the each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and each designated IDF location.

2.9 TELECOMMUNICATION OUTLETS

A. Review the Site Plan(s), Floor Plan(s), Riser Diagram(s), and Detail Sheet(s) for all cable types and quantities required for this project.

B. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Electrical Legend, unless otherwise noted.

C. Provide Horizontal Cabling from EACH Telecommunication Outlet port to the nearest MDF or designated IDF location.

D. Telecommunication Outlet:

1. Each Outlet shall accommodate individual modular ports and each modular port shall be individually removed without affecting any other port within the outlet.
2. Coordinate the selection of icon color and icon symbol type and/or labeling requirements with the Owner's IT department.
    a. Outlet label identification information shall be typed text and indicate patch panel and port for each jack and shall comply with the Owners Labeling Standards. Hand written information will not be acceptable.
    b. The Installing Vendor shall match the color and finish of the devices specified in Section 262726. Modify the model number if a different color or finish is identified in Section 262726.
    c. 1-Port Telecommunication Outlets, where shown on the plans, shall be manufactured by CommScope / Systimax: Model # M11SP-L, or approved equal. Provide quantities as required.
    d. 2-Port Telecommunication Outlets, where shown on the plans, shall be manufactured by CommScope / Systimax: Model # M12SP-L, or approved equal. Provide quantities as required.
    e. 4-Port Telecommunication Outlets, where shown on the plans, shall be manufactured by CommScope / Systimax: Model # M14SP-L, or approved equal. Provide quantities as required.
3. Surface Mount Outlet Locations shall only be installed above accessible ceiling spaces, the MDF Room, and designated IDF locations. They are not to be installed below the ceiling surface or exposed to view, unless approved in writing by the Engineer.
    a. Provide modular single-port or dual port Surface Mount Outlet where indicated on the Plans. This includes, but is not limited to:
        1) Wireless Access Points.
        2) Projector Mounts.
        3) CCTV Cameras.
        4) Intrusion Alarm Control Panel.
        5) Access Control Panel.

E. Modular Inserts:

1. 8-position, 8-conductor (8P8C). Individual port modules shall be Category 6 rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.
2. EACH port shall be Category 6 rated.
3. Cables shall be wired in accordance with TIA/EIA-T568B, unless noted otherwise.
4. Each individual insert shall be fully compatible with the Face Plates provided.
    a. Provide "DATA" identification icon tabs for each jack designated for data.
    b. Provide "VOICE" identification icon tabs for each jack designated for voice.
    c. The Installing Vendor shall match the color and finish of the devices specified in Section 262726. Modify the model number if a different color or finish is identified in Section 262726.
    d. Manufactured by CommScope / Systimax: Model # MGS400 Series, or approved equal. Provide quantities as required.

5. Blank inserts. Fill all remaining unused ports with a blank filler insert that is approved by the manufacturer.
   a. The Installing Vendor shall match the color and finish of the devices specified in Section 262726. Modify the model number if a different color or finish is identified in Section 262726.
   b. Manufactured by CommScope / Systimax: Model # M81 Series, or approved equal. Provide quantities as required.

F. Surface Mount 8P8C:

1. Provide modular single-port Surface Mount 8P8C located above the accessible ceiling space, unless noted otherwise.
2. Manufactured by CommScope / Systimax: Model # M101SMB-B Series, or approved equal. Provide quantities as required.

G. Wall Mount Telephone Outlet:

1. Provide modular single-port stainless steel wall phone outlet with mounting studs.
2. Manufactured by CommScope / Systimax: Model # M10LW, or approved equal. Provide quantities as required.

2.10 FIBER OPTIC CABLE

A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. All cables shall be UL listed and suitable for indoor and outdoor installation. Provide other cable types where required by Code and the AHJ.

C. EACH Cable installed shall be rated for the appropriate application, such as; Riser Rated, Plenum Rated, Wet Rated, etc.

D. Multi-Mode Fiber Optic Cable:

1. Fiber optic cables shall be utilized to provide backbone connectivity between the Main Distribution Frame (MDF) and EACH designated Intermediate Distribution Frame (IDF) location.
2. Fiber optic cables shall be 50/125 micron, graded index, tight-buffered indoor/outdoor riser rated, unless otherwise noted. The core fiber shall have a diameter of 50 microns, and a cladding diameter of 125 microns.

E. Single-Mode Fiber Optic Cable:

1. Fiber optic cables shall be utilized for connectivity between areas as shown on the plans (where applicable).
2. Fiber optic cables shall be 8/125 micron, graded index, loose-tube indoor/outdoor riser rated, unless otherwise noted. The core fiber shall have a diameter of 50 microns, and a cladding diameter of 125 microns.

F. The Installing Vendor shall provide Single-Mode Fiber Optic Cable (where applicable) as shown on the plans. For Multi-Mode Fiber Optic Cable, the Installing Vendor shall determine the maximum cable distance, based on the information shown on the plans, and shall provide OM3 or OM4, based on the information listed on the chart below:

		Total Cable Length	Attenuation (dB/km)	Overfilled Launch (OFL) (MHz-km)	Effective Modal Bandwidth (EMB) (a.k.a. Laser Bandwidth) (MHz-km)
Fiber Designation and Type	Maximum Loss	Shall NOT Exceed	Maximum 850 nm / 1300 nm	Maximum 850 nm / 1300 nm	850 nm
OM3 (50/125)	1.0 dB	Use OM3 when the TOTAL cable distance is 300 Meters or less, unless otherwise noted.	3.5/1.5	1500/500	2000
Fiber Designation and Type	Maximum Loss	Shall NOT Exceed	Maximum 850 nm / 1300 nm	Maximum 850 nm / 1300 nm	850 nm
OM4 (50/125)	1.0 dB	Use OM4 when the TOTAL cable distance is greater than 301 ~~300~~ Meters but does not exceed ~~400~~ 550 Meters, unless otherwise noted.	2.5 / 0.8	3500 / 500	4700
Fiber Designation and Type	Maximum Loss	Cable Distance	Maximum 1310 nm / 1550 nm		
OS1 OSP (8/125)	1.0 dB	As shown on plans	0.5 / 0.5		
OS1 ISP (8/125)	1.0 dB	As shown on plans	1.0 / 1.0		

G. Attenuation shall be measured in accordance with EIA fiber optic test procedures (FOTP's) 46 or 53, 57 and 30. Information transmission capacity shall be measured in accordance with the following ETA FOTP's 51 or 30, 54 and 57. Submit all test results to the engineer for review and approval.

H. All fiber optic cable shall be installed in inner-duct with no splices in the fiber unless noted otherwise.

I. All Inside Plant (ISP) Cables shall be PLENUM rated unless noted otherwise.

J. Provide (1) 12-Strand Fiber Optic Cable to EACH location, unless noted otherwise.

K. Provide the following cables as shown on the plans and where required to provide the connectivity of equipment listed in this specification.

1. OM3 Multi-Mode Outside Plant (OSP) and OM3 Multi-Mode Inside Plant (ISP) Fiber Optic Cable shall be Manufactured by CommScope / Systimax: Model # LazrSPEED 300 Series, or approved equal.
2. OM4 Multi-Mode Outside Plant (OSP) and OM4 Multi-Mode Inside Plant (ISP) Fiber Optic Cable shall be Manufactured by CommScope / Systimax: Model # LazrSPEED 550 Series, or approved equal.
3. Single-Mode Outside Plant (OSP) and Single-Mode Inside Plant (ISP) Fiber Optic Cable shall be Manufactured by CommScope / Systimax: Model # TeraSPEED Series, or approved equal.

2.11 FIBER OPTIC CABLE TERMINATION HARDWARE

A. Fiber Optic Connectors: Provide keyed, ceramic–tipped connector plugs for termination at each fiber optic LIU's. Multi-mode Fiber Optic Cable (single mode as required).

B. EACH fiber optic cable shall be FUSION SPLICED and terminated in the MDF and in each designated IDF location.

C. Light Interface Unit (LIU):

1. MDF Room:
   a. Provide rack-mount multi-capacity terminal that is capable of up to 144 fiber strands.
   b. Provide label holders and color-coded labels.
   c. Manufactured by CommScope / Systimax: Model # 360G2-2U-MOD-SD, or approved equal. Provide quantities as required. Provide (1). Provide all necessary appurtenances to terminate all fiber optic cables. This includes, but is not limited to:
      1) Provide fiber termination adapter panels for LC connectors.
         a) Manufactured by CommScope / Systimax: Model # 760109470, or approved equal. Provide quantities as required to terminate each multimode fiber routed to the MDF Room.
         b) Manufactured by CommScope / Systimax: Model # 760109496, or approved equal. Provide quantities as required to terminate each single mode fiber routed to the MDF Room.
      2) Fan out kit.
         a) Manufactured by CommScope / Systimax: Model # 760018838, or approved equal. Provide quantities as required.
      3) Provide retaining trough mounted underneath each LIU.
2. Designated IDF Locations:
   a. Provide rack-mount multi-capacity terminal that is capable of a minimum of 24 fiber strands.
   b. Provide label holders and color-coded labels.

c. Manufactured by CommScope / Systimax: Model # 360G2-1U-MOD-SD, or approved equal. Provide quantities as required. Provide all necessary appurtenances to terminate all fiber optic cables. This includes, but is not limited to:
   1) Provide fiber termination adapter panels for LC connectors.
      a) Manufactured by CommScope / Systimax: Model # 760109470, or approved equal. Provide quantities as required to terminate each multimode fiber routed to the MDF Room.
      b) Manufactured by CommScope / Systimax: Model # 760109496, or approved equal. Provide quantities as required to terminate each single mode fiber routed to the MDF Room.
   2) Provide blank cover(s) for each unused adapter panel's space.
   3) Fan out kit.
      a) Manufactured by CommScope / Systimax: Model # 760018838, or approved equal. Provide quantities as required.
   4) Provide retaining trough mounted underneath each LIU.

2.12 PATCH CABLES – FIBER OPTIC

A. Upon completion of the project, the Data and Voice Infrastructure Installing Vendor shall deliver the following Fiber Optic patch cables for the MDF and EACH designated IDF location to the owner, as identified below:

1. EACH Data Rack shall have a Qty of 2 – 3' (1 meter) Fiber Optic multimode patch cords with Duplex LC connectors.
   a. Manufactured by CommScope / Systimax: Model # FEXLCLC52-MXM001, or approved equal. Provide quantities as required.
   b. Provide Single Mode patch cords when Single Mode Fiber is shown on the Drawings.
2. EACH Data Rack shall have a Qty of 2 – 6' (2 meters) Fiber Optic multimode patch cords with Duplex LC connectors.
   a. Manufactured by CommScope / Systimax: Model # FEXLCLC52-MXM002, or approved equal. Provide quantities as required.
   b. Provide Single Mode patch cords when Single Mode Fiber is shown on the Drawings.

2.13 HORIZONTAL CABLE – INSIDE PLANT (ISP)

A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. EACH Cable installed shall be rated for the appropriate application, such as; Riser Rated, Plenum Rated, Wet Rated, etc.

C. Provide Horizontal Cabling from each Telecommunication Outlet to the nearest MDF or the nearest designated IDF location.

D. Analog Plain Old Telephone Service (POTS) lines shall be provided for, but not limited to, the following items. These items shall be installed complete without splices between the jack and cable termination point.

1. Fire Alarm System.

2. Intrusion Alarm System.
3. Elevator (where applicable).
4. Terminate all telephone jacks as described elsewhere in these specifications.

E. Cable Colors: The outer jacket of the cable shall be different for EACH System, as defined below:

1. Yellow – CCTV Cameras, Intrusion Alarm System (Data), Access Control System (Data).
2. Green – Wireless Access Points.
3. Blue – Horizontal Cable (Data).
4. Red – Fire Alarm System (POTS) for digital communicator.

F. The Telecommunication Horizontal Cable shall be Category 6 rated, 4-pair, 23 AWG UTP, unless noted otherwise.

1. Manufactured by CommScope / Systimax: Model # 2071 Series plenum rated cable, or approved equal.

2.14 HORIZONTAL CABLE – OUTSIDE PLANT (OSP) & WET RATED LOCATIONS

A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. Outside Plant (OSP) cables shall be used where conduits are routed below grade. Such as; slab on grade floor boxes, underground conduits to another building, where required by code, etc. All Outside Plant (OSP) cable extending within the building at a distance greater than 49 feet shall be run in conduit.

C. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or the nearest designated IDF location.

D. Cable Colors. Utilize the same cable colors that are identified in "Horizontal Cable – Inside Plant (ISP)".

E. The Telecommunication Horizontal Cable shall be Category 6 rated, 4-pair, 23 AWG UTP, unless noted otherwise.

1. Manufactured by CommScope / Systimax: Model # 1571 Series, or approved equal.

2.15 PATCH PANELS – COPPER

A. All patch panels shall be located at the MDF and each designated IDF location. They shall be rack mounted unless specifically otherwise noted.

B. Provide a minimum of 25 % spare patch panel jack capacity. Each patch panel shall be fully loaded.

C. All patch panels shall be tested and approved for Category 6 wiring, per TIA/EIA-568C; shall have rear covers to protect printed circuit boards, rear cable management bar and front and rear labeling.

D. Provide separate Patch Panels for the following equipment connection types:

1. Data Cables.
2. IP Telephones.
3. Wireless Access Points.
4. IP Speakers / IP Intercom System equipment.
5. Analog Voice Cables.
6. Section 282300 CCTV System.
   a. Prior to running any cables, coordinate with the CCTV System Installing Vendor for actual Patch Panel locations within each Rack.

E. Patch panels shall be 48 port unless noted otherwise.

1. Manufactured by CommScope / Systimax: Model # 360-PM-GS3-2U-48 Series, or approved equal.

2.16 MULTI-CONDUCTOR BACKBONE CABLE

A. Provide multi-pair plenum cables from the MDF Room to each designated IDF location unless noted otherwise.

1. See the riser diagram for more information.
2. Provide (2) 25-pair riser service cables, unless noted otherwise. Provide Plenum Rated Cable or Wet Rated Cable where required by Code. Cable shall be 24 gauge with pair count as indicated, UL listed for the application that which it is installed in Manufactured by Superior Essex: Model # ARMM" series, or approved equal.

2.17 PATCH CABLES - COPPER

A. The Patch Cables shall be Category 6 rated, 4-pair, 23 AWG UTP, unless noted otherwise.

B. The outer cable jacket shall match the color selection of the Horizontal Cable Color identified in “Horizontal Cable”.

C. Upon completion of the project, the Data and Voice Infrastructure Installing Vendor shall deliver the following patch cables:

The following items shall apply ONLY to the MDF Room and designated IDF locations.					
Item #	Cable Length	Color	Quantity of Patch Cables (provide the following percentage of patch cables based on the Total patch panel Ports provided for this project) Unless noted otherwise.	Manufactured by	Model #
5	5'-0"	Yellow	5 Total	CommScope	CPC3312-09F005

The following items shall apply ONLY to the MDF Room and designated IDF locations.					
Item #	Cable Length	Color	Quantity of Patch Cables (provide the following percentage of patch cables based on the Total patch panel Ports provided for this project) Unless noted otherwise.		
				Manufactured by	Model #
				/ Systimax	
6	7'-0"	Yellow	5 Total	CommScope / Systimax	CPC3312-09F007
9	5'-0"	Green	6 Total	CommScope / Systimax	CPC3312-04F005
10	7'-0"	Green	6 Total	CommScope / Systimax	CPC3312-04F007
13	5'-0"	Blue	50%	CommScope / Systimax	CPC3312-0ZF005
14	7'-0"	Blue	50%	CommScope / Systimax	CPC3312-0ZF007
15	9’-0”	Blue	20%	CommScope / Systimax	CPC3312-0ZF009
16	15'-0"	Blue	10%	CommScope / Systimax	CPC3312-08F015

2.18 T-GMP (TELECOMMUNICATIONS GRAPHIC MAP PLAQUE)

A. Prior to manufacturing, submit the Graphic Map plan(s) for approval.

B. Provide a graphical representation of the floor plan(s) for all structures.

C. The Graphic shall have the following physical characteristics and features:

1. The Graphic 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.
2. Locate at the top of the Graphic, the name of the Owner, the building name or project name, and the Area or Wing of the Building, each approximately one-inch in text height. The size and font type of text shall be consistent on EACH Graphic that is submitted.
3. A Key Plan of the building shall be located in the upper right-hand corner of the sheet. The Key Plan shall indicate the area being served by the MDF or designate IDF location.
4. For multi-story buildings and also areas with a Mezzanine space, the bottom of the graphic shall be the lowest level of the building, continuing to the top of the graphic with the highest level of the building.
5. Show the “North” arrow on the drawing.
6. Show a “You Are Here” (in Red) with an arrow pointing at the wall or area location of where Graphic Map is to be installed.

7. Identify EACH Port Address serving the MDF or designated IDF Room for EACH Telecommunication Outlet. Include Site Cameras and other devices located outside of the building.

D. T-GMP #1: The Graphic for the MDF and EACH designated IDF location shall have the following features:

1. Provide a graphical representation of the building floor plan AREA of the location of the building, which the MDF or EACH designated IDF is serving EACH Telecommunication Outlet within that specific area. For example, the MDF Floor Plan shall only show the area of the building (a partial floor plan) of EACH Telecommunication Outlet that is being home run to the MDF Room.
2. General building information: At a minimum, include the following items;
   a. Building name(s) and Building numbers (where applicable).
   b. Room names and Room numbers.
   c. Doors.
   d. Toilets and urinals.
   e. Gym/Multi-purpose Room with basket ball court(s).
3. Telecommunication Symbol Legend:
   a. Device Symbol, which shall list EACH device type; Data, Analog Voice, Wireless Access Point, CCTV Camera, etc.
   b. For EACH device symbol, provide the description of the device, the manufacturer, the Outlet (face plate) Model Number, EACH Model Number of Port Types in each outlet, and blank insert model number.
4. Label Scheme Identification, which shall indicate the MDF/designated IDF Room designator, Rack Number, Patch Panel Number, Jack ID number, etc.
   a. Show a Sample Telecommunication Outlet with EACH Port properly labeled.
5. Coordination item:
   a. Coordinate with the CCTV System Installing Vendor for Camera Symbols and Camera Port Addresses. Show EACH Camera Symbol, EACH Cameras ID Number, and EACH Cameras Port Address.
6. Graphic Image Surface:
   a. The Graphic shall be scaled to the size of the frame indicated in the model number and shall be printed on paper.

E. T-GMP #2: The graphic for the MDF and EACH designated IDF location shall have the following features:

1. Provide a graphical representation of the Site Plan, which shall include the entire building floor plan.
2. Site Plan.
   a. The actual graphic shall include the information on the Site Plan, which includes, but is not limited to: Bus Parking, EACH Parking Lot, Side Walks, and other Site features.
   b. Indicate the conduit routing, quantities, and conduit sizes for EACH Outside Plant conduit as indicated on the plans.
   c. Provide cable type, size, and quantity for EACH Outside Plant cable as indicated on the plans.
3. Floor Plan:
   a. Scale down the entire building floor plan to accurately fit onto the Site Plan graphic.

b. Building Room names and numbers. For large rooms, enlarge the actual text height to be 1/8". For smaller rooms, where the text won't fit within the room, the room name and number is not required and may be omitted from this graphic.
c. Show a thick bold outline around the walls of the MDF and EACH designated IDF location.
d. MDF Room name and number and designated IDF location names and numbers shall be enlarged for the actual text height to be approximately 1/2" and make the text bold. Provide the room text with an arrow pointing to the room location.
e. Indicate the conduit routing, quantities, and conduit sizes for EACH Inside Plant conduit as indicated on the plans.
f. Provide cable type, size, and quantity for EACH Inside Plant cable as indicated on the plans between the MDF Room name and number and designated IDF location.

4. Coordination item:
   a. Coordinate with the CCTV System Installing Vendor for Camera Symbols and Camera Port Addresses. Show EACH Camera Symbol, EACH Cameras ID Number, and EACH Cameras Port Address.
5. Graphic Image Surface:
   a. The Graphic shall be scaled to the size of the frame indicated in the model number and shall be printed on paper.
6. Manufactured by HR Kirkland: Frame Kit – Glass. Provide (2) in the MDF (one T-GMP #1 and one T-GMP #2) and (2) in EACH designated IDF location (one T-GMP #1 and one T-GMP #2) at EACH location. Frame Kit shall be sized appropriate to the size of the T-GMP in Each location. Not all locations with accommodate 30" x 42" Frame kit.
   a. Prior to mounting, coordinate the exact location with the Owners IT Department.

2.19 RACKS

A. Rack Mount all equipment that is capable of being Rack Mounted.

B. Provide seismic bracing as required by the AHJ.

C. Section 272000 shall provide ALL Racks and related equipment, including but not limited to; Patch Panels, Patch Cords, Wire Management, Power Strip assemblies, etc. for ALL Local Area Network (LAN) bases Systems as shown on the site plans, floor plans, detail sheets, and riser diagrams. This includes, but is not limited to;

1. Section 275113 Communication/Clock/Program System:
   a. Prior to installation, coordinate with the System Installing Vendor for the exact locations of the Patch Panels and wire management.
2. Section 282300 CCTV System:
   a. Prior to installation, coordinate with the System Installing Vendor for the exact locations of the Patch Panels and wire management.

D. Free Standing 2-Post Data Rack (located in the MDF Room and each designated IDF Room, unless otherwise noted):

1. The Rack shall have the following features:
   a. Complies with 19" wide rack EIA-310-D standards.
   b. UL listed.
   c. Rack Height: 45RU.

d. Color: Black.

2. Rack installation:
   a. Secure EACH Rack to the floor using the manufacturer recommended installation method and the manufacturers recommended hardware/bolt down kit.
   b. Secure EACH Rack to the Cable Tray using the manufacturer recommended installation method.
3. Manufactured by Chatsworth Products Inc (CPI): Model # 48353-703. Provide the quantities as required, unless otherwise noted on the drawings.

E. Grounding Terminal Block for Rack: For EACH Rack provided for this project, provide one Grounding Terminal Block.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 40167-001, or approved equal. Provide quantities as required.

F. Surge Suppressor:

1. EACH Rack shall have a 2 RU rack-mountable surge suppression unit. It shall be capable of a 25 AMP load at 120 volts. Its UL 1449 Adjunct Classification Test result shall have zero failures at 1000 surges of 6000 volts, 3000 amps, B3 pulse. The measured suppressed voltage of this test shall be 170 volts with zero failures.
2. The surge suppressor will also have an EMI and RFI filter for power conditioning. It shall have the following cut off frequencies in "Normal" mode (50-ohm load): 40 dB @ 100 kHz; 50 dB @ 300 kHz; 50 dB @ 3MHz; 50 dB @ 30MHz.
3. The unit shall also be capable of remote turn-on with an applied voltage range of 5-30 volts DC. And shall provide sequential power for all of the system rack devices.
4. Manufactured by Surge-X: Model # SEQ, or approved equal. Provide (1) for EACH Rack provided.

G. Power Strips:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 13239-757, or approved equal. Provide one (1) Power Strip within EACH Rack provided.

H. Cable Management:

1. Vertical Cable Management: Provide vertical cable management on both sides of each rack. Where two racks are installed side-to-side, provide one section between the Racks for each Rack provided for this project.
   a. At both ends of each row of Racks, provide the Master Cabling Section (MCS).
      1) Manufactured by Chatsworth Products Inc (CPI): Model # 30092-703, or approved equal. Provide quantities as required.
   b. Between EACH Rack, provide the Master Cabling Section (MCS).
      1) Manufactured by Chatsworth Products Inc (CPI): Model # 30092-703, or approved equal. Provide quantities as required.
2. Horizontal Cable Management: For EACH Patch Panel provided for this project, provide (1) Horizontal Cable Management unit.
   a. Manufactured by Ortronics: Model # OR-808044915, or approved equal. Provide quantities as required.

2.20 INNERDUCTS AND CONDUIT SEALS

A. Innerduct (Fabric Mesh):

1. The Installing Vendor shall provide the proper type of fabric mesh innerduct for the application in which it is being used.
2. Provide flexible multi-cell fabric mesh innerduct consisting of White Polyester and Nylon resin polymer.
3. EACH Cell shall contain a factory installed pull tape, which shall be a different color of pull tape for EACH Cell.
4. Manufactured by MaxCell: Model # MXC3456BK (Black), or approved equal. Provide quantities as required where shown on plans.
    a. This shall be the default color for one 3-Cell innerduct.
5. Manufactured by MaxCell: Model # MXC3456RD (Red), or approved equal. Provide quantities as required where shown on plans.
    a. Where two 3-Cell innerducts are shown in a single conduit on the plans, this shall be the second color.
6. Manufactured by MaxCell: Model # MXC3456BL (Blue), or approved equal. Provide quantities as required where shown on plans.
    a. Where three 3-Cell innerducts are shown in a single conduit on the plans, this shall be the third color.

B. Inner Duct (Non-Metallic Tubing):

1. Provide 1” corrugated inner duct for EACH fiber optic cable run.
2. Inner duct shall be rated for the application and environment that it is installed in and shall meet all Code and AHJ requirements.
3. Non-Metallic Tubing for Fiber Optic Cables shall be Orange in color.
4. Provide quantities as required where shown on plans.
5. Approved Manufacturer: Pyramid Industries or approved equal.

C. Inflation Bags (for 3” Conduits and 4” Conduits):

1. Inside EACH Hand Hole and inside EACH Man Hole, install inflation bags in 3” Conduit(s) and 4” Conduit(s) that comes into the building. Provide inflation bags in EACH conduit at the opposite end (in the MDF and designated IDF locations).
2. Provide inflation bags
3. Locate inflation bags in EACH 3” underground conduit and in EACH 4” underground conduit (at each end of the conduit) that is routed between the MDF and EACH designated IDF location.
4. Manufactured by MaxCell: Model # MXCITB3 (for 3” conduits), or approved equal. Provide quantities as required.
    a. Seal each conduit as described above using the manufacturer approved inflation seal method at the completion of the project.
    b. Provide (6) 3” conduit inflation bags (when this sized conduit is used on this project) to the Owner at the completion of the project.
5. Manufactured by MaxCell: Model # MXCITB4 (for 4” conduits), or approved equal. Provide quantities as required.
    a. Seal each conduit as described above using the manufacturer approved inflation seal method at the completion of the project.

b. Provide (6) 4" conduit inflation bags (when this sized conduit is used on this project) to the Owner at the completion of the project.

6. Inflation Tool.
   a. Provide (1) new (unopened package) inflation tool to the Owner at the completion of the project.
   b. Manufactured by MaxCell: Model # MXCITT, or approved equal.
7. Gas Cartridges.
   a. Provide (12) new (unopened packages) gas cartridges to the Owner at the completion of the project.

D. Duct Seal (for conduits that are 2.5" or less):

1. Inside EACH Hand Hole and inside EACH Man Hole, install a water tight seal in EACH Conduit that comes into the building. Provide a water tight seal in EACH conduit at the opposite end (in the MDF and designated IDF locations).
2. In addition to the above locations, provide Duct Seal that includes, but is not limited to other conduits such as:
   a. Reader Boards.
   b. Portables.
   c. Hand holes for future equipment.
3. Manufactured by Ideal: Model # 31-601, or Manufactured by Gardner Bender: Model # DS-130, or approved equal.

2.21 OPEN CABLING SUPPORT & HARDWARE

A. Each Cable Support shall be UL Listed for the Application and meet the TIA requirements for structured cabling systems.

B. Provide manufacturer approved mounting brackets and fasteners.

C. Do not exceed the cable support manufacturer's cable fill capacity for each type provided for this project.

D. Do not exceed the cable manufacturer's recommendations for cable suspension in open cabling environments.

E. J-Hooks shall have a galvanized finish.

1. Manufactured by Erico CADDY: Model # CAT32HP, or approved equal. Provide quantities as required.
2. Manufactured by Erico CADDY: Model # CAT48HP, or approved equal. Provide quantities as required.

F. Mounting Tree:

1. Manufactured by Erico CADDY: Model # CATHPTM, or approved equal. Provide quantities as required.

G. Adjustable Cable Support:

1. Manufactured by Erico CADDY: Model # CAT425 Series, or approved equal. Provide quantities as required.

H. Inner Duct (Non-Metallic Tubing).

I. Waterfalls:

1. Conduit Waterfalls shall be used where conduits empty into cable trays.
2. Manufactured by Panduit: Model # CWF400, or approved equal. Provide quantities as required.

J. Cable Tray – Wire Basket Style:

1. Provide Seismic bracing where required by the AHJ.
2. The Cable Tray shall be UL Classified.
3. The Cable Tray shall be 4” high x 18” wide (unless otherwise noted).
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 34821-618, or approved equal. Provide quantities as required.
4. Splice Bar, Splice Bolt/Washer Trapeze Support Bracket, Cable Radius Drop, Ground Clam and other related materials:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 34728-501, or approved equal. Provide quantities as required.
   b. Manufactured by Chatsworth Products Inc (CPI): Model # 34739-501, or approved equal. Provide quantities as required.
5. Trapeze Support Bracket:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 34730-620, or approved equal. Provide quantities as required.
   b. Unistrut may be used in lieu of the above model number if approved by the AHJ.
6. Cable Radius Drop:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 34747-701, or approved equal. Provide quantities as required.
7. Ground Clamp:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 34838-001, or approved equal. Provide quantities as required.

K. Cable Tray – Ladder Style:

1. Provide Seismic bracing where required by the AHJ.
2. The Cable Tray shall be UL Classified.
3. The Cable Tray shall be 1.5” high x 18” wide (unless otherwise noted) with 9” rung spacing in Steel construction that has been painted by the manufacturer.
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 11275-718, or approved equal. Provide quantities as required.
4. Butt Splice, Junction Splice, Swivel Butt Splice, Swivel Junction Splice, Wall Mount Bracket, Rack Mount Plate, Ground Strap, Cable Runway Dividers and Cable Radius Drop:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 16301-701, or approved equal. Provide quantities as required.

5. Junction Splice:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 16302-701, or approved equal. Provide quantities as required.
6. Swivel Butt Splice:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 16487-701, or approved equal. Provide quantities as required, where applicable.
7. Swivel Junction Splice:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 16488-701, or approved equal. Provide quantities as required, where applicable.
8. Wall Mount Bracket:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 11746-718, or approved equal. Provide quantities as required.
9. Ground Strap:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 40164-001, or approved equal. Provide quantities as required.
10. Cable Runway Dividers:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 13392-721, or approved equal. Provide quantities as required.
11. Cable Radius Drop:
   a. Manufactured by Chatsworth Products Inc (CPI): Model # 12100-718, or approved equal. Provide quantities as required.
   b. Manufactured by Chatsworth Products Inc (CPI): Model # 12101-702, or approved equal. Provide quantities as required.

2.22 BUILDING ENTRANCE TERMINAL

A. Building Entrance backbone cabling shall be terminated in the MDF onto Building Entrance Terminal with fused protection.

B. Manufactured by CommScope / Systimax: Model # 489AC1-025, or approved equal. Provide quantities as required

C. Manufactured by CommScope / Systimax: Model # 3B1EW, or approved equal. Provide quantities as required.

2.23 TERMINATION HARDWARE (PUNCH BLOCKS) – COPPER CABLES

A. Telecommunication backbone cabling shall be terminated in the MDF and each designated IDF location on wall mounted 110 blocks, unless noted otherwise.

B. Manufactured by CommScope / Systimax: Model # 110AW2-100, or approved equal. Provide quantities as required.

2.24 WIRE RINGS

A. Cables on backboards shall be supported using open distribution rings. Rings shall be located within 12" of entering or exiting conduit, 6" prior to any radius bends and at least 12" on center. The rings shall have rounded edges and be designed in a "C" configuration. Securely mount distribution rings to the plywood backboard.

B. Chatsworth Products Inc (CPI): Model # 12035-001, or approved equal. Provide quantities as required.

2.25 CABLE MANAGEMENT TIES

A. Wire ties of any type shall NOT be used anywhere in this installation.

B. Bundle all Horizontal Cables together with Velcro-type tie wraps.

1. Adjustable Velcro Straps shall be used for all cable bundles.
   a. Provide Velcro Straps every two-feet (approximately) above accessible ceilings, in Cable Trays (where applicable) and throughout the cable run.
   b. Provide Velcro Straps every twelve-inches (approximately) within the MDF and each designated IDF location.
2. Chatsworth Products Inc (CPI): Model # 020XX-201, or approved equal. XX indicates actual length. "06" (6-inches long for two-inch diameter cable bundles), "09" (9-inches long for three-inch diameter cable bundles), and "12" (12-inches long for four-inch diameter cable bundles). Provide quantities as required.

2.26 TMGB AND TGB (TELECOMMUNICATION GROUNDING BUSBARS)

A. See Section 270000 for additional Grounding requirements.

B. Ground all equipment per the Manufacturers recommendations, per Division 26, and as required by Code.

C. Provide grounding and bonding per ANSI-STD-J-607-A, which includes, but is not limited to: Cable Tray, Rack(s), conduit sleeves, and other equipment connected to the TMGB/TGB.

1. The minimum conductor size shall be #6 green insulated copper grounding conductor. However, size each conductor shall be based on the actual cable length as defined in ANSI-STD-J-607-A.

D. TMGB: Provide and install (1) 4" high x 20" wide Copper Telecommunication Main Grounding Busbar (TMGB). Use standoff brackets to wall mount the copper busbar and insulators.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 40153-020, or approved equal.

E. TGB: Provide and install at EACH designated IDF location (1) 2" high x 12" wide Copper Telecommunication Grounding Busbar (TGB). Use standoff brackets to wall mount the copper busbar and insulators.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 13622-012, or approved equal.

F. Lug Style: EACH connection to the TMGB/TGB shall be a Copper 2-Hole Lug Straight Long Barrel Connection.

1. Manufactured by Thomas & Betts: Model # 256 Series, or approved equal.

2.27 FIRE RATED PENETRATIONS

A. Provide Fire Rated Penetration equipment at EACH location shown on the Plans and at EACH wall that is rated for 1-Hour or more.

B. A firestop system shall be comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise of an effective block for fire, heat, vapor, and pressurized water stream.

C. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

D. Firestop systems shall be UL Classified to ASTM E814 (UL 1479).

E. Indicate on the Shop Drawings EACH location showing the proposed firestopped system location for approval, prior to installing the firestop system(s).

F. 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.

G. For EACH penetration, the following requirements shall apply:

1. Provide pathway assemblies for EACH Low Voltage System Cables for each individual assembly opening.
2. Provide the quantity of pathway assemblies required for the Horizontal cables, while maintaining all code requirements. Additionally, provide (1) pathway assembly opening for EACH System listed on the Electrical Legend. This includes, but is not limited to: Fire Alarm System, Intrusion Alarm System, Intercom System, Access Control System, CCTV System, etc.) and no less than (2) Spare empty assembly openings, which shall remain empty at the completion of the project.

3. Manufactured by Specified Technologies, Inc (STI): EZ Path Model # 33 Series and/or EZ Path Model # 44 Series. Provide quantities as required.
   a. For EACH penetration, provide the Stud Wall Attachment (for either series provided), filling the entire stud wall space with cable pathways for all cabling required and future cabling. Maintain all spare capacity requirements.
   b. For EACH EZ Path Model # 33 Series provided, provide one pair of Radius Control Modules.
   c. Manufactured by Specified Technologies, Inc (STI): EZ Path Model # RCM33.

2.28 NETWORK EXTENDER

A. See the Site Plans, Floor Plans, and CCTV System Riser Diagram for Equipment Quantities, Cables, and Installation Requirements.

2.29 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 - EXECUTION

3.1 GENERAL

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.2 PRODUCT INSPECTIONS

A. The Installing Vendor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un-uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.3 CABLE INSTALLATION - GENERAL

A. Each cable run shall be continuous, without any splices, from the Telecommunications Outlet to the patch panel(s). Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. The Installing Vendor shall insure that EACH Telecommunications cable is 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 Installing Vendor shall replace unacceptable cabling at no additional cost to the Owner.

C. Conduit and Raceway Usage: All Telecommunications cable shall be installed in grounded metal conduit or raceway dedicated for Telecommunications purposes, when called for on the Project Drawings, and not to be shared with electrical wiring.

D. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

E. All wiring to be installed in a neat and inconspicuous manner and per local code requirements. Route wires parallel or perpendicular to the building structure using the specified cable supports. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

F. Cable Lubricants specifically designed for installing Telecommunications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.

1. Recommended Products:
   a. Twisted-pair cable: Dyna-Blue, American Polywater.

G. Backboard and Rack Cable Supports: Clamps, "D-Rings" and Velcro tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable.

3.4 HORIZONTAL CABLING

A. Horizontal Cables shall be dressed and terminated in accordance with TIA/EIA-568-B requirements and the cable manufacturer’s recommendations.
1. Untwisting of pairs at the termination point shall not exceed one-half an inch for Category 6 connecting hardware.
2. Bend radius of the cable in the termination area shall not be less than the manufacturer’s recommendation.
3. The Horizontal Cable jacket shall be maintained as close as possible to the termination point.

B. Every attempt shall be made to avoid running Horizontal Cables close to (less than 24") and parallel to power raceway and wiring, or close to light fixtures.

C. When a J-hook or trapeze cable support is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals with UL approved cable support. At no point shall cables rest on acoustic ceiling grids or panels. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the Installing Vendor shall install clips to support the cabling.

D. The installation of Horizontal Cables around moveable devices, instruments, subpanels, etc. shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.

3.5 PLYWOOD BACKBOARD CABLING

A. Horizontal Cable installation must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining maximum distance from these openings.

B. Horizontal Cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Horizontal Cables shall not be connected or attached to electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Velcro wrap all similar cables together and attached by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment or other cables.

D. Horizontal Cables that are not dressed in a neat fashion, or with excessive slack, will not be accepted.

3.6 TELEPHONE RISER BACKBONE CABLE

A. Backbone Cable splices are only allowed in accessible, dry locations and housed in a splice case enclosure intended and suitable for the purpose. Each cable end that is spliced must be labeled. Verify intended splice locations with Engineer prior to installation.

B. Backbone cables shall be installed separately from horizontal cables.

C. Where backbone cables and horizontal cables are installed in a cable tray, backbone cables shall be installed first and bundled separately from the horizontal cables.

3.7 FIBER OPTIC BACKBONE CABLING

A. All fiber optic cabling shall be installed in “orange” colored innerduct. There shall be no splices allowed.

B. Fiber optic termination hardware shall be installed in the following manner:

1. Fiber slack shall be neatly coiled within the Light Interface Unit (LIU). No slack loops shall be allowed external to the LIU’s, unless otherwise noted.

2. Each cable shall be individually attached to the respective termination LIU by mechanical means. The cables strength member(s) shall be securely attached to the cable strain relief bracket in the LIU.
3. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the LIU.
4. Each cable shall be clearly labeled at the entrance to the LIU. Cables labeled within the bundle shall not be acceptable.
5. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

3.8 CABLE LABELING

A. Alpha-numeric numbering shall be developed by Installing Vendor, under the direction of the Owners IT Department. Label all equipment and cables in an identical fashion.

B. Patch Panel Labeling: Each terminal shall be identified and marked on the patch panel with the outlet port identification.

C. Outlet Port Labeling: Outlet labels for each port shall be identified and marked on the Outlet with the outlet port identification.

D. Backbone Labels: Labels shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of the each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and IDF Rooms.

E. Horizontal Cables: Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel.

3.9 TELECOMMUNICATION ROOMS

A. The Telecommunication Rooms (MDF and designated IDF's) shall house Racks, Patch Panels, Wire Management, UPS's, Punch Blocks, and required cable routing hardware. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6" to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide interlay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces.

B. Racks shall be installed in the following manner:

1. EACH Rack shall be securely attached to the floor and/or wall using the manufacturer's recommended mounting hardware.
2. EACH Rack shall be Grounded/Bonded to the TMGB/TGB with a minimum size of one (1) #6 copper green insulated conductor or larger due to distance requirements based on ANSI-J-STD-607-A.
3. Rack mount screws (#12-24) that are spare shall be bagged and left with the rack upon completion of the installation.

4. All rack mounted equipment shall be installed in a designated Rack Unit. Equipment shall NOT be installed in between Rack Units; this will NOT be considered acceptable.

C. Cable Tray: Configure as shown on the drawings. Provide Cable Tray as specified in Part 2 of this specification. Install the Cable Tray using the manufacturer's recommended mounting hardware, connectors, brackets, and fasteners.

3.10 TESTING OF CABLES

A. Notification shall be given a minimum of 14 days prior to any testing so that the testing may be witnessed by the Owner.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

C. Provide documentation of the following items of EACH Test Meter used:

1. Calibration certification from a third party shall be within two-years of testing (at the time that the test is performed).
2. Manufacturer of Test Meter.
3. Model Number of Test Meter.
4. Serial Number of Test Meter.

D. Copper Cables – Category 6 Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Vendor shall test:

1. Wire Map.
2. Length.
3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.

E. Copper Cables – Category 3 or 5e Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Vendor shall test:

1. Wire Map.
2. Length.
3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.

10. Delay Skew.

F. Fiber Optic Cables – Multi-Mode Inside Plant (ISP) and Outside Plant (OSP): Each of the fibers shall be tested from End-to-End. The Tests performed shall comply with ANSI/TIA-568-C.3 standards. The Installing Vendor shall test:

1. Polarity Testing
2. Length Measurement.
3. OLTS / Link Attenuation.
4. OTDR.
5. Two 2-meter patch cords shall be used for the actual test. The two jumper test shall be used to estimate the actual link loss of the installed cables plus the loss of the connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use.

G. Fiber Optic Cables – Multi-Mode Inside Plant (ISP): Each of the fibers shall be tested from End-to-End. The Tests performed shall comply with ANSI/TIA-568-C.3 standards.

H. Fiber Optic Cables – Single-Mode Inside Plant (ISP) and Outside Plant (OSP). Each of the fibers shall be tested from End-to-End. The Tests performed shall comply with ANSI/TIA-568-C.3 standards.

I. source of each error shall be determined, corrected, and the cable re-tested. All defective cables, connectors, connections, and related appurtenances shall be replaced and re-tested at no additional cost to the Owner.

J. Submit the Test Reports in PDF format.

K. See the O & M Manual / Asbuilt Drawings requirements in this specification and also in Section 270000 for additional requirements.

L. Acceptance of these test procedures is predicated on the Installing Vendor's use of the recommended products including, but not limited to; the specified cable type, patch panels, outlets, punch blocks, specified equipment identified in Part 2 and the installation standards of this specification. Adherence to these requirements shall be determined upon the completed installation and will be evaluated in the context of each of these factors.

3.11 FIRE RATED PENETRATIONS

A. Install per manufacturers recommendations.

B. Maintain all Code and AHJ requirements.

3.12 WARRANTY

A. Upon final installation, a certificate providing a "Performance and Application Warranty" shall be provided to the owner. This warranty shall be valid for a period of no less than 25 Years. The warranty shall be direct to the end user, from the manufacturer, supported through the installing and certified Installing Vendor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Vendor were to default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Vendors who are not certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid, will be rejected.

3.13 OPERATION & MAINTENANCE MANUALS (O&M'S)

A. Provide all Operation & Maintenance Manuals (O&M's) documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Provide hard copies of the Test Results of EACH Cable tested.

C. Provide the Test Results on CD in PDF format.

3.14 AS-BUILT DRAWINGS

A. Provide all As-Built documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

D. Provide (1) complete set of Telecommunication As-Built Drawings (each sheet shall be laminated) in the following locations:

E. The MDF Room.

F. See the requirements identified in "T-GMP" of this specification.

G. The Installing Vendor shall provide As-Built drawings to the Architect, which clearly indicates:

1. The floor plan of the building showing the As-Built location of Telecommunication Outlets and their associated Port Address(es), conduit runs, and terminal cabinets.
2. A list of EACH Telecommunication Outlet and the associated Port Address(es) shall clearly be identified according to system labeling scheme. Show all ports and punchdowns.
3. Provide (3) sets of complete As-Builts.

3.15 DEMONSTRATION AND TRAINING

A. Upon completion of the system installation, the installation representative shall conduct a system test for the Owner, Architect, Engineer, and Owner or their appointed representatives.

B. Upon completion of the installation, after test and demonstration, the Installing Vendor shall provide to the Architect a signed written statement substantiating the:

1. "System has been completely tested, demonstrated to the Owner's representative, and accepted by the appropriate authority."

END OF SECTION 272000

SECTION 274116 – TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUEMENTS

A. The work includes furnishing and installing a television distribution system complete and ready to use. The system shall include all amplifiers, power supplies, cable, outlets, attenuators, and all other parts necessary for the reception and distribution of selected cable company TV channels as well as owner-originated channels.

B. The contractor shall construct the system, following best engineering techniques, for continuous operation in accordance with applicable codes. The system shall meet the FCC requirements regarding low radiation of RF signal.

C. All equipment, including wiring, cabling, and outlets furnished and installed under these specifications, shall be guaranteed for a period of one year from the date of final acceptance thereof against all electrical or mechanical defects or failures except that which can be proved to have been caused by misuse. All service and parts shall be provided during the first year by the contractor or their designated agent.

1.2 SYSTEM OPERATION

A. The system shall provide TV reception, amplification, and distribution of all sub, mid, super, hyper and ultra band TV channels, including any free QAM HD channels that do not require a cable provider specific tuner/descrambler.

B. The system shall receive the television signals by master cable system, amplify these signals, and distribute them to all TV outlets to permit simple connection of EIA standard analog or digital television receivers or DVD/VCR combo units.

C. The system shall deliver at all outlets all monochrome and NTSC color television signals without introducing noticeable effect on intelligence and color fidelity. System picture quality shall be equal to that received from the cable company and other modulated channels.

D. The system and all equipment shall be designed and rated for 24-hours-a-day continuous operation.

1.3 QUALITY ASSURANCE

A. The contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including standard replacement parts. The contractor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period.

B. All television equipment shall be supplied and installed by a licensed and bonded contractor holding a valid Washington State Electrical Contractor's License and Administrator's Certificate as described in the Electricians and Electrical Installations Revised Code of Washington State. All work covered by this specification is to be performed by a holder of a current State of Washington Specialty Electrician for limited energy systems.

C. All components shall be of a single manufacturer, Blonder-Tongue or equal, as furnished and installed by Sound Electronics, Tacoma, Washington or as furnished and installed by Electrocom, Lynnwood, Washington.

D. Approval request to pre-qualify for bidding of equipment not as specified herein must be received by the architect not less than ten days prior to bid opening. Proposals shall include but shall not be limited to the following: complete technical data and such samples as required to indicate that the submitted components are equivalent to the specified equipment in all material aspects; the contractor will itemize on a separate enclosure any variation from the specification (refer to the section, paragraph, and item of the specification and clearly state the variation); a list of similar previous completed projects with the names and telephone numbers of the owners; number of years in the low voltage integration business; service staff and qualifications; documentation supporting that the contractor represents the products proposed; and the contractor's license number.

E. Alternative proposals which are approved for bidding purposes only will be published by addenda. Proposals not complying with the prior approval requirements and conditions set forth above will not be considered.

F. The Installing Vendor shall, at a minimum, provide and/or perform on-site installation assistance to the Contractor throughout the duration of the project.

G. Approvals: The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. UL Underwriters Laboratories Inc.
2. ULC Underwriters Laboratories Canada
3. Factory Mutual
4. FCC

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Data Sheets and other documentation:

1. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.
2. Provide data sheets for each item listed on the materials list.
3. Provide indicating arrows on data sheets that have multiple items on the data sheet.
4. Pre-Installation project kick-off meeting.
5. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.
6. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under “Coordination” identified elsewhere in this specification.

B. Shop Drawings shall include the following items:

1. Shop Drawings – Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with seven (7) copies of submittals for approval.
   a. Shop Drawing Requirements: The Installing Vendors Complete and Full Size set of Shop Drawings shall be issued in the following format:
      1) They shall be clear and legible.
      2) The same sheet size as the Contract Drawings (i.e. 30" x 42").
      3) A minimum of 1/8" text height shall be used for all text, symbol text, and subscript text.
      4) The Electrical Legend, Wire Legend, Load and Battery Calculations, Riser Diagram, Sequence of Operation info, Wiring Details, and Mounting Details shall precede the Site Plans and Floor Plans.
      5) Architectural information on the Contract Drawings, shall be included on the Installing Vendor Shop Drawing, including, but not limited to; Match Lines, Grid Lines, Grid Bubbles, Key Plan, and Enlarged Floor Plans.
      6) Electrical information on the Contract Drawings shall be included on the Installing Vendor Shop Drawing, including, but not limited to; all applicable General Notes and applicable Construction Notes for each of the Floor Plans. Where Enlarged Plans are shown on the Contract Drawings, include this in Installing Vendor Shop Drawings to show the room and ALL equipment within the room, to help facilitate and coordinate the installation of the Low Voltage equipment for all systems.
2. Legend Information: From Left to Right, provide the following information for EACH device:
   a. Use the symbol on the Legend of the contract drawings.
   b. List the manufacturer's name.
   c. List the manufacturer's model number.
3. Provide a logical description of the device.
   a. Provide the back box requirements and related information. At a minimum, this shall include;
      1) The height, width, and depth of each required back box for each symbol on the legend.
      2) If the device is a back box or comes with a back box (IE: control panel, power supply, enclosure, etc.) then provide the height, width, and depth of the dimensions.
      3) Indicate if this device back box is going to be installed flush, semi-flush, or surface mounted.
4. Provide a <u>Wire Legend</u> listing the cable manufacturer, model number, cable rating, size of conductors, quantity of conductors, and color of each conductor. Use the format in the Sample "Wire Legend", as it applies to each system (see the Sample at the end of this specification). Provide a cable identification naming scheme (as defined within these specifications).
   a. The Wire Legend shall include the Cable Manufacturer and Model Number for EACH of the following types of cables (as applicable to the project):
      1) Conduit/Raceway Cable
      2) Open Cabling
      3) Wet Rated Cable
      4) Aerial Rated Cable
      5) EACH cable and EACH cable type shall have a different letter designation.

5. Riser Diagram: Provide a System One-Line Riser Diagram that shows the entire system. List the following:
    a. List the head-end equipment and IP addressed devices. Show the connection to the "Cloud" WAN, where applicable.
        1) Show each location (the MDF and EACH designated IDF separately).
            a) Show each cable types, sizes, and quantities between the MDF and each designated IDF location.
            b) Show EACH device in the MDF and each designated IDF location (Control Panel, CPU, DVR, Server, Power Supply and Terminal Cabinet [where applicable]) for each applicable system, the room name that each major system component is located in, and show the connection to the headend equipment.
            c) Show all field devices with their respective room names and/or room numbers and connections to their associated equipment.
        2) Show all field devices with their respective address point (where applicable).
6. Detailed Wiring Information:
    a. Show each individual conductor color for all wiring on the point-to-point wiring diagrams for each device.
    b. Show complete scale drawings of equipment, devices, wiring diagrams, and terminations of:
        1) Each Control Panel, CPU, DVR, etc.
        2) Power Supply and/or amplifier
        3) Rack equipment (where applicable).
        4) EACH device type
        5) EACH Terminal Cabinet (where applicable)
7. Rack Layout (where applicable).
    a. Show the intended equipment layout within the Rack(s).
    b. Show blank filler plates in spaces where equipment is not installed.
    c. Indicate the rack unit size of each device or filler plate in the rack.
        1) If rack equipment is installed on the rear side of the rack, show rear view of the rack also.
8. Show floor plan layout of devices and the anticipated routing of cable runs in parallel with all structural framing in a neat and orderly fashion.
9. EACH device at EACH location shall be shown on EACH floor plan. The cabling for EACH device shall be shown from EACH device to the device that it shall be connected to. EACH cable(s) shown on the floor plan shall be identified as described in the "Wire Legend" portion listed within this specification.
    a. Floor Plans: Show all system related devices and all equipment that the system specific shop drawings will interface to, on each of the floor plans. Provide Cabling for each device and the related wire type (as shown on the "Wire Legend") shown for each of the device(s). Where multiple devices are on the same circuit or an addressable data cable is used, show all devices and their related cable(s).
10. All drawing submittals shall be a complete and full set of the system. If drawings are required to be re-submitted, a full and complete set must be re-submitted. Partial system drawing sets will be rejected and the Installing Vendor/Contractor shall reissue a full set of drawings. Any re-submittal(s) shall be provided at the Installing Vendor/Contractors expense.

11. The Installing Vendor/Contractor is responsible for assuring that the conduit size, wire quantity, wire size, and wire type is suitable for the equipment supplied. The Installing Vendor/Contractor shall review the proper installation method(s) for each type of device/equipment with the manufacturer's representative, and the AHJ, Prior to Rough-In.
12. Provide shop drawings that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes and connection wiring of entire system.

C. Contract drawings shall not be used as Shop Drawings.

D. The Shop Drawings shall be system specific. For example: only Fire Alarm equipment and connections to other equipment that will be interfaced to the Fire Alarm, shall be shown on the Fire Alarm drawings.

E. Floor plans for the project have been developed by the Engineer using AutoCAD™ software. These drawing files will be made available to the Installing Vendor/Contractor for development of Shop Drawings and/or As Builts for a fee of $20.00 per sheet.

PART 2 - EQUIPMENT

2.1 MATERIALS

A. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All Telecommunications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:

1. CMR General Purpose Communications Riser Cable.
2. CMP Plenum-rated Communications Cable.

B. And other cable ratings to comply with the National Electrical Code requirements for the installation.

C. Refer to PART 1 for any equipment that is not specifically defined.

2.2 COORDINATION

A. The Installing Vendor shall include each of the following items in their bid for this project.

2.3 LABELING

A. The alpha-numeric labeling shall be developed by the Installing Vendor, under the direction of the Owners IT Department at the Pre-Installation project kick-off meeting.

B. The Installing Vendor shall label all equipment and cables in an identical fashion of a sequential manner to the satisfaction of the Owner.

C. All label printing shall be machine generated using indelible ink ribbons or cartridges, and self-laminating labels shall be used on cable jackets appropriately sized to the outside diameter of the cable.

D. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, As-Built Drawings, and Test Results.

E. Outlet labels shall be the manufacturer's labels provided with the outlet assembly. Each outlet port label shall indicate the Telecommunication Room termination (the MDF or the designated IDF location).

2.4 OUTLETs

A. Provide Coaxial Cabling from EACH Cable Television Outlet port to the nearest MDF or designated IDF location.

1. Outlet.
   a. Each Outlet shall accommodate individual modular ports and each modular port shall be individually removed without affecting any other port within the outlet.
   b. Coordinate the selection of icon color and icon symbol type and/or labeling requirements with the Owner's IT department.
   c. Outlet label identification information shall be typed text. Hand written information will not be acceptable.
   d. The Installing Vendor shall match the color and finish of the devices specified in Section 262726. Modify the model number if a different color or finish is identified in Section 262726.
      1) 1-Port Telecommunication Outlets, where shown on the plans, shall be manufactured by CommScope: Model # M11SP-L, or approved equal. Provide quantities as required.
      2) Provide one "F" Connector for EACH outlet

B. Provide one 5" drop cord for EACH outlet.

2.5 BROADBAND LINE AMPLIFIERS

A. Broadband line amplifiers for VHF channels shall be provided as required to provide the specified outlet signal. Amplifiers shall be of solid-state design. The amplifiers shall have 32 dB minimum gain, 9 dB maximum noise figure, 75-ohm input and output. The amplifier shall be capable of sub-channel return path.

1. Model ACA-1000 with DSV multiplexer.

2.6 BROADBAND MAIN AMPLIFIER

A. The broadband main amplifier shall be provided for all TV channels specified. Each unit shall be of solid-state design, contain its own power supply, and have a manual gain control. The amplifier shall be capable of bi-directional operation.

B. The amplifier shall meet the following specifications: Gain 30 dB minimum for 152 channels, 8 dB gain control range. Bandpass shall be 47 to 1000 MHz, 75-ohm input and output.

1. Blonder Tongue Model RMDA-1000/BIDA-100A, furnish as required.

2.7 CHANNEL ELIMINATION FILTERS

A. Channel elimination filters shall be provided for the channels as required. Balancing of the signals shall be accomplished by simple screwdriver adjustment of the individual filter over a range of from 0 to 18 dB. The filter shall have a minimum rejection of at least 55 dB of the specified channel.

2.8 PASS BAND FILTER

A. Furnish a pass band filter to allow channels 2 through 86 to operate, while leaving 87 and up available for in-house origination.

2.9 MODULAR HEADEND SYSTEM EQUIPMENT

A. Provide a Modular Headend System consisting of a MIRC 12 slot Vertical Chassis with a MIPS-12C Power Supply. The chassis shall support all Blonder Tongue modular headend modules

B. Provide modular agile audio/video modulators for the channels required. The modulator shall have a video input with a level capability of 0.5 to 2 volts peak-to-peak, and an audio input 600 ohms unbalanced. A video gain control shall be provided for video input. Video response shall be +0.5 dB for 4.2 MHz bandwidth, audio response shall be +0.1 dB 50 to 15,000 Hz with pre-emphasis network. Audio distortion less than 1% 50 to 15,000 Hz. Video carrier output shall be 60 dBMV nominal. Model AMM-806. Provide Five

C. Provide a Sub Channel Block Converter to convert sub channels T-7 through T-13 to Viewable channels 7 through 13. Model MSBC Provide one

D. Provide a Demodulator to tune the output of the MSBC to Baseband Video for re-modulating to an in house channel. Model MIDM. Provide one.

E. Furnish MIBP blank panels for each unused slot.

F. Provide output couplers to combine the modulated channels. Model OC-8.

2.10 EQUIPMENT SHELVES

A. Equipment shelves will be supplied for each DVD player provided by the contractor. The quantity will depend on the number of owner generated channels. Each shelf will be 19” wide, 5-1/2” high, and 18” deep and include hold down brackets for non-rack mount equipment.

1. Lowell Model L-10-315.

2.11 HEAD-END RACK HOUSING

A. Provide and install a sectional wall cabinet for the amplifiers, filters, modulators, splitters, and head-end origination equipment. This cabinet is to be complete with 19" rack rails and blank fill panels. The rack shall provide 42" of vertical panel space.

1. Lowell Model L250-42. Provide quantities as required for mounting of all equipment.

2.12 DIGITAL READY LINE SPLITTERS

A. Line splitters shall be low radiation, digital ready types, and have a frequency response of 5 to 1000 MHz. The units shall be of the hybrid design with a 75-ohm match on input and outputs, and a VSWR of not more than 1.45 and –120 dB RFI shielding. The two-way line splitter shall have a signal loss of not more than 3.5 dB. The four-way splitter shall have a signal loss of not more than 7.2 dB, and the eight-way no more than 11.5.

1. Models DGS-2, DGS-4, and DGS-8.

B. All unused outputs on the splitter and end of runs shall be terminated with 75-ohm terminators.

C. Model PBT.

2.13 DIGITAL READY TAPS

A. Taps shall be low radiation, digital ready types, and have a frequency response of 5 to 1000 MHz. The units shall be of the hybrid design with a 75-ohm match on input and outputs, and a VSWR of not more than 1.45 and –120 dB RFI shielding. Insertion loss shall be frequency dependant, but not exceed 2.7 db. Available values shall be 8, 10, 12, 14, 16, 18, 20, & 24 dB.

1. Models DGT-2, DGT-4, and DGT-8.

B. All unused outputs on the splitter and end of runs shall be terminated with 75-ohm terminators.

C. Model PBT.

2.14 CATV HEADEND TUNERS

A. Owner shall provide HD capable CATV tuners to decrypt encrypted digital cable television channels.

2.15 HD QAM ENCODERS

A. Decrypted digital CATV channels shall be rebroadcasted into the building using HD QAM encoders. The device shall be capable of receiving (4) HDMI inputs to unencrypted digital cable channels (QAM). Channel output shall be selectable between frequencies 50 to 900 MHz with a typical output power of +25 dBmV adjustable in 5 dB increments.

B. In addition, an RSTP output stream shall be provided to allow future connection to an IP TV solution (not in this contract).

1. The HD QAM Encoder shall be manufactured by Thor Broadcast, Inc. Model H-4HDMI-QAM-IP. Provide one (1) in the CATV head-end.

PART 3 - INSTALLATION

3.1 DISTRIBUTION SYSTEM

A. System coaxial cable shall be low radiation CATV type. All components in the system shall connect to RG6, or RG11 cable as required to achieve the specified signal level.

B. Coaxial cables shall be run in continuous lengths except for terminations, and no splices shall be permitted in any conduit run. Cable shall be installed to avoid sharp bends or physical distortions.

C. All cables terminating at amplifiers or splitters shall be tagged as to function and destination.

D. All coaxial cables used in this system shall be a low radiation CATV cable, and have a nominal characteristic impedance of 75 ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall be sweep tested from 10 to 750 MHz.

3.2 PERFORMANCE AND TESTING

A. On completion of the installation of the system, the contractor supplying this equipment shall provide a qualified technician to perform the following tests:

1. The overall system shall be sweep tested with a spectrum analyzer from the head-end location to the last outlet in each distribution leg of the system.
2. The system shall deliver a minimum signal level of +10 dBMV/3000 mv plus or minus 5 DBmv across 75 ohms on each channel at each outlet.
3. A certification shall be made to the fact that no frequency drop-outs are present in the distribution system which would affect any of the VHF channels.
4. Using a return loss bridge, the contractor shall certify that the return loss of the system shall be a minimum of 26 dB down. VSWR shall not exceed 1.4:1.

3.3 AS-BUILT DOCUMENTATION

A. Operation and maintenance manuals and the as-built drawings shall conform to the requirements of Specification 260000.

END OF SECTION 274116

SECTION 274116.29 – BOARD ROOM AND COMMONS AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. Furnish and install a complete AV system as shown on the drawings and as specified herein.

B. Provide the control processor, DSP, switchers, scalers and another appearances as required for a complete and operating system.

C. Submit All equipment, including wiring, cabling, and outlets furnished and installed under these specifications, shall be guaranteed for a period of one year from the date of final acceptance thereof against all electrical or mechanical defects or failures except that which can be proved to have been caused by misuse.

D. All service and parts shall be provided during the first year by the contractor or their designated agent.

1.2 SYSTEM OPERATION

A. The AV system shall provide for the voice enhancement of the presenter via wireless microphone, and broadcast the audio via four (4) overhead speakers.

B. The AV system shall also provide for the playing of optical media (Blu-ray/DVDs), and projecting the video image on the screen via the LCD projector and television screen, and the audio over the four (4) overhead speakers.

C. The AV system presentation matrix switchers shall allow preset “scenes” for multiple input/output matrix routing scenarios, selectable via the AV System control panel.

D. The A/V System Control Panel shall control the input sources of the Projector, as well as the Output sources for the Blu-ray player and owner-provided CATV tuner. Volume control and mute will also be accomplished via the control panel.

E. At base-bid, the A/V System Control Panel (via the control processor) shall also be *capable* of controlling room lighting.

F. All wall plates, jacks, cable and accessories shall be provided as required for a fully functional system.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. All submittals and shop drawings shall meet the requirements of specification 270000.

B. Data Sheets and other documentation:

1. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.
   a. Provide data sheets for each item listed on the materials list.
   b. Provide indicating arrows on data sheets that have multiple items on the data sheet.
2. Provide ALL requested submittal documents in "Training Materials and Programming Survey" listed elsewhere in this specification. This includes, but is not limited items listed under "Interview the Owner":
   a. Provide a sample copy of the Training Syllabus.
   b. Provide a sample copy of the Step-by-Step Instructions.
3. Pre-Installation project kick-off meeting.
   a. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.
4. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under "Coordination" identified elsewhere in this specification.

C. Shop Drawings shall include the following items:

1. The shop drawings shall meet the requirements of specification 270000.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The System design, devices and/or wiring arrangement shown on the drawings represent that based on various equipment manufacturers. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor.

B. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications.

C. Any request for substitution shall be submitted by the contractor in writing so as to be received by the Architect **not later than (10) days prior to the bid due date**. Approval by the Engineer will be issued by addendum prior to the bid date.

D. Provide all equipment as defined in this specification and shown on the drawings.

E. Refer to PART 1 for any equipment that is not specifically defined.

2.2 PRESENTATION MATRIX SWITCHER AND RECEIVER

A. The presentation matrix switcher shall provide multiple HDMI and VGA/Audio sources and upscaling to an HDMI output to system projectors/televisions.

B. The presentation mixer shall have (4) HDMI inputs, (2) VGA (with analog audio input pairs), (2) HDMI outputs, and (2) analog audio outputs.

C. Three (3) Digital Twisted Pair input/outputs shall provide extension of video signals over CAT6.

D. The presentation matrix switcher shall have its HDMI output routed to the system HDMI extenders to the projector located on the floor plans. Audio output from the switcher shall connect to the main system DSP for additional processing.

E. The presentation matrix switcher shall be manufactured by Extron, model # IN1608.
1. Provide one (1) for the Board Room *only*.

2.3 VOICE ENHANCEMENT AMPLIFIER/RECEIVER/SPEAKERS

A. Provide the Listen Technologies LPT-S2-01 system that contains the following components:

1. (1) LPT-C6 ListenPoint Advanced Control Unit
2. (1) LPT-R12 ListenPoint Powered Room Module
3. (1) LPT-M1 ListenPoint Microphone/Media Interface Kit, with hand-held sleeve.
4. (4) LPT-A104 6 in. Ceiling Speaker
5. (4) LA-395-P-20 16 AWG Preassembled Plenum Speaker Cable
6. (1) LA-393-P-55 Cat-5e Preassembled Plenum Cable
7. (1) LPT-A107 Audio Cable Kit for Control Unit

B. Provide one (1) for the Board Room and one (1) for the Commons, for a total of two (2).

C. In addition to the base part number system components, provide the following additional devices:

1. One (1) LPT-M1 ListenPoint Microphone/Media Interface Kit, with hand-held sleeve, for the Board Room only.

2.4 CONTROL PANEL

A. The control panel shall be capable of changing the volume level and changing input sources for the presentation matrix switcher.

B. The control panel shall be the Extron TLP-350MV.

1. Provide one (1) for the Board Room only.

2.5 CONTROL PROCESSOR

A. The AV system’s components shall be managed by a central, IP protocol based control processor.

B. The control processor(s) shall provide RS23, infrared, and relay inputs and outputs for controlling TVs, switchers, Blu-ray/DVD Players and amplifiers.

C. The control processors shall be manufactured by Extron, model # IPL 250.

1. Provide one (1) for the Board Room only.

2.6 INPUT PANELS

A. Input panels shall be “decora” compatible and single/double gang.

B. Integral extender/receivers may also be provided as input panels (listed elsewhere in this specification)

2.7 LCD PROJECTOR MOUNTS

A. LCD projector mount shall be manufactured by Chief, model #RFPA series with extension columns and ceiling plate.

1. Provide one (1) for the Board Room only.

2.8 TELEVISION MOUNTS

A. LCD television mounts shall be manufactured by Chief, model #XSMU series.

1. Provide one (1) for the Board Room only.

2.9 LCD PROJECTOR

A. LCD projector shall be owner provided and contractor installed.

2.10 LCD TELEVISION

A. LCD Television shall be owner provided and contractor installed.

2.11 BLU-RAY PLAYER

A. The Blu-Ray player shall be of the single disk type fitted with a factory rack-mount frame. It shall be compatible with playing back the following media types: BD-ROM/BD-R/BD-RE, DVD-Video/DVD-R/DVD-RW, CD/CD-R/CD-RW/CD-DA.

B. It shall also be capable of playing back the following file formats: JPEG / MP3 / MKV files via USB.

C. Provide with 1 infrared remote control unit and repeater.

D. The Blu-Ray player shall be the Panasonic Blu-ray Player DMP-BD75 or most current equivalently featured device.

1. Provide one (1) for the Board Room only.

2.12 HDMI EXTENDER(S)

A. The HDMI extender shall extend HDMI signals from head-end audio/visual equipment up to the system projectors and LCD televisions.

B. The extender shall use CAT6 twisted pair cabling to carry 1080p resolution HDMI signals a minimum of 150ft.

C. Transmitters:

1. Transmitters shall include IR and RS232 output for control of display devices.
2. Double-gang decora style transmitters shall be manufactured by Extron, model # DTP HDMI 230 D Tx
   a. Provide three (3) for the Board Room *only*.

D. Receivers:

1. Double-gang decora style receivers shall be manufactured by Extron, model # DTP HDMI 230 D Rx
   a. Provide two (2) for the Board Room *only*.
2. Stand-alone style receivers shall be manufactured by Extron, model # DTP HDMI 230 Rx
   a. Provide one (1) for the Board Room *only*.

2.13 SURGE SUPRESSOR/POWER CONDITIONER

A. The sound system shall have a 1U rack-mountable surge suppression unit. It shall be capable of a 20 AMP load at 120 volts. Its UL 1449 Adjunct Classification Test result shall have zero failures at 1000 surges of 6000 volts, 3000 amps, B3 pulse. The measured suppressed voltage of this test shall be 170 volts with zero failures.

B. The surge suppressor will also have an EMI and RFI filter for power conditioning. It shall have the following cut off frequencies in "Normal" mode (50-ohm load): 40 dB @ 100 kHz; 50 dB @ 300 kHz; 50 dB @ 3MHz; 50 dB @ 30MHz.

C. The unit shall also be capable of remote turn-on with an applied voltage range of 5-30 volts DC.

D. The surge suppressor shall be manufactured by Surge-X, model # SX-1120-RT.

1. Provide one (1) for the Board Room only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install each system shown as indicated, in accordance with equipment manufacturer’s instructions, and with recognized industry practices.

B. Mount the projector on the wall mount per manufacturer's recommendations.

C. All low voltage and signal wiring shall be run exposed in the ceiling space.

D. Program the Switcher/Receiver per manufacturers recommended settings. All devices with RS-232 controls in the system shall be controlled by the Switcher/Receiver.

3.2 SYSTEM TESTING

A. The AV system testing shall conform with the requirements of specification 270000.

B. The Installing Vendor shall provide the Staff, walkie-talkies, test equipment, additional equipment, resources, and time necessary to support BCE Engineers to provide the Commissioning of this System. The Installing Vendor shall demonstrate to BCE Engineers the complete operation of each device, head end functionality, system configuration, and software functionality. The Installing Vendor shall also make adjustments to the equipment and changes to the program settings, as requested. This testing shall be typical of four (4) locations, selected by the Electrical Engineer.

3.3 ON-SITE TRAINING

A. On-site training shall follow a written training plan, prepared in advance. The training plan shall outline the topics to be covered, the publications to be used, and the training schedule.

B. Supply two (2) hours minimum of training for the Owner's staff in operating and maintenance of the television distribution system. Training time shall be extended as necessary to satisfy the Owner's Representative that all pertinent topics have been adequately covered.

C. The training shall be conducted after the operating and Maintenance Manuals for the Project are completed and available for use during the training session.

D. Maintain a training sign-in sheet, upon which participants in the training session, including the instructors, shall record their names. Training sign-in sheet shall be dated.

E. The training shall be conducted by a representative of the equipment manufacturer who is thoroughly familiar with the equipment and its features, and also with the installation on this Project. The training shall include instruction and field demonstration. As a minimum, the training shall cover, but not be limited to, the following topics:

F. General Overview of the system, including purpose and principle of operation.

1. System features, including expansion capability.
2. Interpretation of system outputs (indicators, displays, etc.).
3. Operation of system controls (gain controls, slope adjustment, etc.).
4. Recommended maintenance procedures and intervals.
5. Detailed trouble-shooting instructions.
6. Explanation of service agreement options.

G. At the conclusion of the training session, insert a copy of the training sign-in sheet into the Operating and Maintenance Manuals. Submit another copy of the training sign-in sheet to the Architect.

END OF SECTION 274116.29

SECTION 275113 - COMMUNICATION/INTERCOM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

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 015700 – Environmental Protection.

1.2 SCOPE & RELATED DOCUMENTS

A. The project Communication/Intercom System shall be an NEW installation of an Intercom System. The Installing Vendor shall provide new equipment at the project site and include the necessary programming for control functions of the new System.

B. The intent of this specification is to describe necessary equipment and software for a complete and properly operating, integrated intercom system with gate control.

C. Furnish and install a complete Communication/Intercom System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall include, but not be limited to: combination remote station, master station, power supply, relay circuit, conduit, junction boxes, fittings, wire, connections to devices, and all other necessary material for a completely reliable and fully functional system.

D. The system shall be of modular design to facilitate both expansion and service; microprocessor-based, FCC approved.

E. The Communication/Intercom System Installing Vendor shall furnish and install all materials, although some items may not be specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the functions listed herein in compliance with all the specified requirements.

F. Coordinate cable locations with Section 281300 Access Control System Installing Vendor.

G. The system shall meet ALL of the requirements listed in Section 270000 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

H. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 275113 includes, but is not limited to the sections identified in Section 281300.

1.3 SYSTEM OPERATION

A. An integrated Communication/Intercom System shall be provided as specified and as shown on the electrical drawings.

B. The communication/intercom system shall be of an open voice type with simplex communication. Capacity shall be one remote station and one master station, available as a packaged set (LEM-1DLS). A dual master system shall be available (two LEM-1DL/C masters plus door station and two transformers). Master station shall control communication, with hands free reply from the remote station. Direct dialing two-way communications between telephones and individual locations equipped with an IP-Based speaker.

C. Master station shall be equipped with a TALK button, OFF button for standby mode, and door release button. When TALK button is pressed, voice is transmitted to the remote station. Person at the remote station shall speak hands free. Door release button (key symbol) shall allow for activation of door strike or maglock. Door release button shall be supplied with "normally open" contacts, and shall be field-modifiable for "normally closed" contacts.

D. Door station shall be equipped with button to signal master station. Unit shall be weather resistant, made for outdoor installation.

E. Voice volume control on the master station shall control transmit and receive volume, and a call tone volume control shall be located beneath the operation plate. An incoming call shall be annunciated by a momentary electronic call tone. When using the dual master LEM-1DL/C stations, the "Occupied" LED shall light to indicate that the system is in use.

F. Master station shall wall mount on a 1-gang box or ring, or be placed directly on a desk or counter. Remote stations shall be available in the following configurations: (1) weather resistant door stations in surface or flush mount styles, mounted on or in standard 1-gang or 2-gang boxes, (Model LE-D,

G. LE-DL, or LE-DA); or (2) vandal proof weather resistant style (LS-NVP/B), mounted in a standard 3-gang masonry box, or with optional surface mount box (SBX-NVP).

H. Wiring shall be two conductors with an overall shield inside a single jacket. Wiring between LEM-1DL/C master stations shall be three conductors with an overall shield. Door strike shall be wired with a separately jacketed two conductor wire, non-shielded, from the master station(s) to the strike and power source for the strike.

I. Product shall be manufactured by Aiphone or approved equal. Manufacturer must have earned ISO 9001 certification for quality standards

J. Integration to other Low Voltage Systems:
   1. ACCESS CONTROL INTERFACE – Provide the necessary cabling from the Intercom System to EACH vehicle entry gate control location shown on the drawings. Connect and program as required. When the Communication/Intercom System gate open is activated the specific vehicle entry gate shall open. See Section 281300 and the Drawings for more information.

1.4 QUALITY ASSURANCE

A. The system, devices, and equipment, shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:
   1. National Fire Protection Association (NFPA) - USA:
      a. NFPA 70 National Electrical Code
      b. NFPA 101 Life Safety Code
   2. Meet or exceed Building Codes and Standards:
      a. Local Authority Having Jurisdiction (AHJ) Requirements
      b. State
         1) WAC 51-20 Washington Barrier Free Regulations
      c. National
         1) National Electrical Code (see NFPA 70)
         2) Americans with Disabilities Act
      d. International
         1) International Building Code
         2) International Electrical Code (see NFPA 70)
         3) International Fire Code

B. The Communication/Intercom System shall be supplied and installed by an authorized Manufacturer Certified/Authorized distributor. The Communication/Intercom System Installing Vendor shall have furnished and installed similar communication/intercom systems applications for no less than five years.

C. The Communication/Intercom System Installing Vendor shall have a local office staffed with Manufacturer Certified/Authorized Technician, full-time employees who are capable of performing testing, inspection, repair, and maintenance services for the life of the system.

D. This Communication/Intercom System Installing Vendor must have a minimum of 15 years' experience servicing systems, maintain a 24 hour emergency service program and shall be located within a 50-mile radius of the project site.

E. Service and Software Modifications:
   1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system upgrades or changes.
   2. For emergency service, response time of the technician to the site shall not exceed 4 hours. If the call is received by the Installing Vendor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.
   3. Provide all hardware and documentation necessary to modify the system on-site. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices.

1.5 SUBMITTALS/SHOP DRAWINGS

A. Refer to specification Section 270000 Low Voltage Systems General Requirements for the Shop Drawing and submittal requirements.

1. Pre-Installation project kick-off meeting.
   a. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.
   b. Submit the "System Device Naming Matrix" listed elsewhere in this specification, with the Data Sheet submittal.
2. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under "Coordination" identified elsewhere in this specification.
3. Data Sheets and other documentation:
   a. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.
   b. Provide data sheets for each item listed on the materials list.
   c. Provide indicating arrows on data sheets that have multiple items on the data sheet.
4. Provide ALL requested submittal documents in "Training Materials and Programming Survey" listed elsewhere in this specification. This includes, but is not limited items listed under "Interview the Owner":
   a. The "Section 275113 Communication/Intercom System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet".
   b. Provide a sample copy of the Step-by-Step Instructions.

B. Shop Drawings shall include the following items:
1. The System Riser Diagram shall show the MDF and EACH designated IDF separately.
   a. Show each system typical component connected at each location.

1.6 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.7 PROJECT CONDITIONS - ARCHITECTURAL PLANS

A. The Installing Vendor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. Provide all equipment as defined in this specification and shown on the drawings.

C. Refer to PART 1 for any equipment that is not specifically defined.

2.2 COORDINATION

A. The Installing Vendor shall include each of the following items in their bid for this project.

B. Refer to "Submittals" for additional coordination requirements.

C. Pre-Installation Project Kick-off Meeting. The Installing Vendor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner (somewhere within the District). This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Vendor shall be responsible for providing the following items.
   1. A sign in sheet (with the project name, Section number and title that the Installing Vendor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address).
   2. Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee, the Architect, and the Engineer.
   3. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:
      a. Discuss system configuration.
      b. Configuration settings.
      c. General coordination with staff.

D. Follow up documentation for the Pre-Installation Project Kick-Off Meeting. The purpose of this information is to illustrate to the Communication/Intercom System representative and the Owners that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Vendor
   1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

2.3 MATERIALS NOT INCLUDED (PROVIDED & INSTALLED BY OTHERS)

A. Telephone switching equipment and related appurtenances.

B. Telephones.

C. Switches, routers, network hubs, data concentrators and other similar active electronic equipment for data communications.

D. Computers, printers, facsimile machines, modems and other similar utilization equipment.

2.4 COMMUNICATIONS/INTERCOM SYSTEM MASTER CONTROL STATION (IMCS)

A. The Master control Station is an audio only communication and entry security system. The system is expandable to four (4) master stations. The master control station allows for communication with the outside gate and gate release control.

B. Standard features shall include:
   1. Built-in microphone for two-way hands free communication.
   2. Gate release (N/O contact).

3. Call tone and voice volume control.
4. AC 12-16V AC or DC 12-24V power.

C. Provide the appropriate desk top housing for each application.

D. Manufactured by Aiphone, Model # LEM-1DLC, or approved equal. Provide quantities as required.

2.5 COMMUNICATIONS/INTERCOM SYSTEM SUBSTATION (ISS)

A. The Communications/Intercom System Substation is a 2-gang stainless steel vandal proof and weather resistant substation designed for use with the Communications/Intercom Master Control Station.

B. Standard features shall include:
1. Built-in microphone for two-way hands free communication.
2. Mechanical SPST stainless steel switch used for the call button.
3. 12 gauge stainless steel faceplate.
4. 20 ohm, 2-1/2’ diameter, water and puncture resistant, 2.5oz. ceramic magnet speaker.
5. Power is supplied by the Communications/Intercom Master control Station.

C. Provide the appropriate surface mount housing for each application.

D. Manufactured by Aiphone, Model # LE-SS/A or approved equal. Provide quantities as required.

2.6 COMMUNICATION/INTERCOM SYSTEM SUBSTATION SURFACE MOUNT HOUSING.

A. The Communication/Intercom System Substation Surface Mount Housing is a stainless steel enclosure designed for mounting the Aiphone 2-gang substation. The enclosure is weather resistant and includes space inside for wiring.

B. Standard features shall include:
1. Mounts to a 1-gang box or ring, or mount directly to surface.
2. 16 gauge stainless steel

C. Manufactured by Aiphone, Model # SBX-2G, or approved equal. Provide quantities as required.

2.7 COMMUNICATION/INTERCOM SYSTEM POWER SUPPLY

A. The Communication/Intercom System Power Supply is an AC 12V Transformer Cass 2, compact, plug-in style power source used for the Communications/Intercom Master Control Station.

B. Manufactured by Aiphone, Model # PT-1210N.

C. Provide as required for operation of Communication/Intercom System.

2.8 SYSTEM CABLES

A. Provide cable type as recommended by the communication/intercom system manufacture.

B. Two Conductor Cable:
   1. Indoor/Outdoor: West Penn: Model# AQC224 (18/2s). or approved equal

PART 3 - EXECUTION

3.1 APPROVED EQUIPMENT AND PERMIT

A. No equipment shall be delivered to the jobsite until shop drawings have been reviewed and approved. An approved shop drawing set shall be continuously available at the jobsite during construction.

B. Obtain a permit as required from local AHJ prior to installation of equipment.

3.2 WIRING

A. All wiring shall be contained in steel raceways except as approved. Wiring insulation shall be one of the types required by NEC and shall be consistently color-coded throughout the system. Permanent wire markers shall be affixed to all conductors at terminations and splices.

B. Numbering system shall be consistent with shop drawings.

C. Install wiring and equipment in strict accordance with manufacturer's instructions. No wire other than the intercommunication system wire shall be permitted in conduit unless approved.

D. All cabling shall be spliced only in designated junction boxes, device boxes, or terminal cabinets. In-line splices in pull boxes are not permitted. Both ends of cable shall be marked utilizing `3M' wire markers.

E. Wiring shall be identified by room number, segregated, neatly laced, and terminated on telephone-type punch-on blocks.

F. Cable shall be laced together 18" O.C. and shall be supported from building structural members at not greater than 48" O.C.

G. All Cabling routed underground or under slab shall be rated for wet locations per the AHJ.

3.3 INTEGRATION TO OTHER LOW VOLTAGE SYSTEMS

A. See “System Operation” listed elsewhere in this specification for more information.

3.4 DEVICE LOCATIONS

A. Device locations may be changed within 15 feet without extra charge, if so directed by the Engineer prior to installation.

3.5 TESTING AND ADJUSTMENTS

A. All testing documentation shall conform to specification 270000.

B. Upon completion of the installation, all components and operational features shall be completely tested for proper operation and specification compliance. The owner reserves the right to witness any portion of the testing and adjustment process.

C. The communication/intercom system shall be adjusted to provide an adequate and constant level of return speech.

D. All station instruments shall be completely and clearly labeled. All labeling that is exposed to operator view shall be provided utilizing a typewriter or mylar tape type labeling machine to identify station numbers, function keys, speed dial buttons, pull out directories, etc., producing a neat and professional installation.

3.6 AS-BUILT DOCUMENTATION

A. Operation and maintenance manuals and the as-built drawings shall conform to the requirements of Specification 270000.

3.7 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period of 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully staffed office located within a 50-mile from the job site.

B. Contractor shall replace or repair defects in material of workmanship for a period of 12 months after the certification of final acceptance.

END OF SECTION 275113

SECTION 281300 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. The project Access Control System is an installation of a new Access Control System. The Installing Vendor shall provide new equipment at the project site and include the necessary programming for viewing reports, changing card holder information, changing card holder access capabilities, and control functions of the new Access Control System.

B. Furnish and install a complete Access Control System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall include, but not be limited to; Access Control Reader Interface(s), Input Board(s), Output Board(s), Power Supplies, Card Readers, Door Position Switches, Request to Exit motion sensors, Electric Locks, Electrified Exit Devices, Panic Buttons, Push Buttons, Intercom Stations, device Input supervision, control Relays, importing of Database(s), Configure, Program, conduit, junction boxes, fittings, wire, connections to devices, and all other necessary material for a completely reliable and fully functional system.

C. The system shall be of modular design to facilitate both expansion and service, providing an individual system for specific requirements of this project.

D. The system shall grant access to card holders with a valid card, monitor the status of open and closed doors, and activate relays. All relay outputs shall be programmable to change state via control-by-event equations, programmable inputs, and timed-events.

E. All activity of the Access Control System shall be recorded in an event history log. This history shall be able to be printed in a report format.

F. The system shall support industry standards for databases, networks, credential printers, and more, such as Microsoft™ SQL.

G. An important aspect of the construction process for this project is the Pre-Construction Kick Off Meeting, which shall take place PRIOR to Submittal of equipment data sheets. See “Submittals” and “Coordination” listed elsewhere within this specification.

H. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

I. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 28 13 00 includes, but is not limited to the sections identified in Section 270000 as well as Section 08 71 00 Finish Hardware.

1.2 SYSTEM OPERATION

A. Access Control System:

1. Overview:
   a. The Access Control System and related components shall control access and prevent unauthorized entrance to the building and selected areas from entrance during secure hours using Cards and Card Readers.
   b. Integrate with other systems as described within these specifications and as required.
   c. The system shall integrate various systems and devices, fully, completely, and seamlessly through the use of inputs, outputs, and software interfaces. The system shall serve as the hub for all system functions. The software shall allow System Operators to view specific information and status of devices and equipment.
   d. The modularity of the system shall allow the Owner to add or remove control functions, adapting to their needs as the system expands and as the operating requirements change.
   e. The system shall also be configured with remote workstations sharing system monitor and control tasks, if required. From Video to Alarm and printing equipment, industry standard protocols shall be used as the system framework.
   f. The software shall also combine all application information into a unified database, allowing for more informed operation and automatic system communication transfer between Subsystems, regardless of system drivers and/or protocols.
2. Central Configuration for System Monitoring and Control
   a. To support alarm management and monitoring, the system shall provide a wide range of display and control features.
   b. History Log
      1) The History Log shall monitor all incoming events. At a minimum, this shall provide the following information:
         a) Date/Time
         b) Device state
         c) Card Holder Name.
         d) Access denied/granted
         e) Door/Gate/Device location
   c. Reports
      1) The System Operator shall be able to search and generate reports from groups or individual persons, doors, locations, inputs, or outputs. The reports shall be captured in a standard document format. The report shall include, but not be limited to the following data:
         a) Date/time.
         b) Group name(s).
         c) User name(s).
         d) Door(s).
         e) Location(s).
         f) Input(s).
         g) Output(s).
   d. Display of Events
      1) The system shall support the real-time display of EACH event.
   e. Schedules and Timers
      1) The system shall provide timer and schedule functions to support:
      2) Time based control of programmable relays
      3) Time based automatic controls into any subsystem
      4) The timer shall support time frames per weekday, public holidays, and individual special days.

f. System Operator Generated Alarm
1) The system shall support a manual alarm trigger by a System Operator to allow alarm operation, for example, lock all doors.

B. Workstations and User Interface
1. Workstations shall be connected by standard IP network. Any computer on the network shall be usable as a workstation.
2. The system shall be expandable to support an unlimited number of integrated workstations.
3. The system shall provide a flexible and simple way to adapt to specific Owner requirements, such as different System Operator groups.

C. System Modularity
1. The system shall have a modular structure that provides specific project solutions. The system shall be expanded at a later date. Common expansion may include the number of System Operators, Subsystem connections, or monitored devices and/or equipment.

D. System Operators and Authorization Management
1. The system shall allow the creation of individual authorizations per System Operator or operator group. This includes:
2. Selectable displaying, monitoring, and control of locations, such as individual floor, building, or site permissions.
3. Selectable displaying, monitoring, and control of Subsystems, such as CCTV System, Intrusion Alarm Systems, Fire Alarm System, etc.
4. Selectable displaying, monitoring, and control of devices, such as cameras, readers, doors, or gates.

E. Subsystem and Device Programming
1. Subsystems and their peripheral devices shall be configurable in the system configuration tool.

F. Customizing the System
1. The system shall be adaptable and configurable to the project requirements, the expertise of the System Operator, and to the configuration of the workstations (resolution and number of monitors).
2. The system shall automatically detect from where a System Operator is logging in, and supplies the correct features, contents, and resolution for EACH appropriate workstation.
3. The system shall provide a toolbox containing all specific controls for display features, such as location tree, alarm queue, toolbar, and customizable action buttons for individual use.

G. Integration to other Low Voltage systems:
1. Intrusion Alarm System Interface – Provide the necessary cabling and one (1) Access Control System input to the Intrusion Alarm Control Panel (IACP). Connect and program as required. The Intrusion Alarm System shall toggle the relay each time the Intrusion Alarm System is "Armed" and "Dis-Armed". The Access Control System shall monitor the Armed/Dis-Armed status of the Intrusion Alarm System. See Section 281600 and/or the Drawings for more information.

1.3 QUALITY ASSURANCE

A. The Installing Vendor shall identify and designate two (2) Manufacturer Trained and Certified Installing Vendor Technicians for the duration of this project.
1. To be deemed a qualified Installing Vendor for this project, a minimum of (2) technicians shall hold the following Manufacturers Certifications PRIOR to issuing submittals for this project:
a. The Installing Vendor shall submit copies of the technicians Manufacturer Certification(s).

B. The Installing Vendor shall provide a Staff Commitment Letter in the Submittal and Shop Drawings submittal package, that states the following:
1. The Installing Vendor shall identify and designate two (2) Manufacturer Trained and Certified Installing Vendor Technicians for the duration of this project.
a. One of the Technicians shall be the designated LEAD TECHNICIAN.
1) This individual shall be responsible for no less than 80% of the technical portion of this project.
b. The other Technician shall be the designated BACK-UP TECHNICIAN, who may assist the Lead Technician with the project.
1) This individual shall be responsible for no greater than 20% of the technical portion of this project.
c. The Installing Vendor shall submit copies of the above designated technicians Manufacturer Certification(s).
d. Additional Installing Vendor field technicians may also work on the site, but only while one of the two designated technicians are on-site.
2. The Installing Vendor shall identify and designate a Project Manager whose responsibilities will include, but are not limited to:
a. The Primary Point of Contact between the Owner and the Installing Vendor.
1) This person can be the Lead Technician.
b. Scheduling of technicians to perform the work on the Owners premises.
c. Scheduling of any meetings.
1) All meetings shall be on the Owners premises.
d. Scheduling and coordination of any deliveries to the Owners premises.

C. The system, devices, and equipment, shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:
1. National Fire Protection Association (NFPA) - USA:
a. NFPA 70 National Electrical Code
b. NFPA 101 Life Safety Code

2. Underwriters Laboratories Inc. (UL) - USA:
   a. UL 294 Access Control Systems
   b. UL 1034 Burglary-Resistant Rated
   c. UL 1076 Proprietary Burglar Alarm Units and Systems
3. Meet or exceed Building Codes and Standards:
   a. Local Authority Having Jurisdiction (AHJ) Requirements
   b. State
      1) WAC 51-20 Washington Barrier Free Regulations
   c. National
      1) National Electrical Code (see NFPA 70)
      2) Americans with Disabilities Act
   d. International
      1) International Building Code
      2) International Electrical Code (see NFPA 70)
      3) International Fire Code

D. Approvals:
1. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   a. UL Underwriters Laboratories Inc.
   b. ULC Underwriters Laboratories Canada.
   c. Factory Mutual.
   d. FCC.

E. The Installing Vendor shall, at a minimum, provide and/or perform on-site installation assistance to the Contractor throughout the duration of the project, up to and including acceptance of the System as defined in Section 270000 “Testing & Complete System Functionality”.

F. Service and Software Modifications:
1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system software modifications, upgrades or changes.
2. For non-emergency service, response time of the technician to the site shall not exceed 4 hours. If the call is received by the Installing Vendor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.
3. Provide all hardware, software, programming tools and documentation necessary to modify the system on-site. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices. The system structure and software shall place no limit on the type or extent of software modifications on-site.

1.4 SUBMITTALS:

A. Refer to specification 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

B. Refer to “As-Built Drawings” for additional requirements.

C. Data Sheets Submittals and other documentation.
   1. Pre-Construction Kick Off Meeting:
      a. PRIOR to submitting any project Data Sheets, coordinate with the General Contractor as described in Section 27 00 00.
         1) Submit the Coordination Questions a minimum of 14 Days in advance of the meeting for Owner review for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.
      b. The Installing Vendor shall document the Meeting Minutes of the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.
      c. Provide the follow up documentation for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.
         1) The Installing Vendor shall make the necessary corrections or changes as discussed during this meeting and provide a revised formal Submittal through the normal construction channels.
         2) Be sure to include ALL responses by the Owner in the revised formal Submittal. This includes, but is not limited to:
            a) IP Address Equipment List.
   2. Installing Vendor/Manufacturer Agreement. Provide the following documentation of the Manufacturer of the equipment being installed:
      a. The Installing Vendor shall be an Authorized Partner that is trained and certified by the Manufacturer of the equipment being installed.
   3. Installing Vendor Staff Qualifications. Provide copies of the following information (Certification and Training documents):
      a. Provide a copy of no less than (2) separate technicians (from the Installing Vendors local office) Factory Certifications issued by the manufacturer of the equipment that is being installed.
   4. Provide The Installing Vendor Staff Commitment Letter as described in "Quality Assurance" listed elsewhere in this specification.
   5. Materials List:
      a. A complete materials list, which shall include; the quantity of each device, the manufacturer's name, model number, and a description of the equipment for each individual system component or device that will be provided. This list shall precede the data sheets.
      b. Equipment Data Sheets. Each System component or device data sheet shall have an indicating arrow next to each component or device that is being submitted.
      c. Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect.
   6. Provide ALL requested submittal documents in "Training Materials and Programming Survey" listed elsewhere in this specification. This includes, but is not limited items listed under "Interview the Owner":
      a. Generate the document titled "Section 281300 Access Control System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet" and submit for review.
      b. Provide a sample copy of the Training Syllabus.
      c. Provide a sample copy of the Step-by-Step Instructions.
   7. Provide preliminary Graphic Map screen shots. See Graphic Maps listed elsewhere within this specification.
   8. Submit the "System Device Naming Matrix" listed elsewhere in this specification, with the Data Sheet submittal.

D. Shop Drawing Submittals shall include the following items:
1. Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect.
2. Provide the follow up documentation for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.
a. The Installing Vendor shall make the necessary corrections or changes as discussed during this meeting and provide a Revised Submittal through the normal construction channels.
1) Be sure to include ALL responses by the Owner in the Revised Submittal.
3. Device Point-to-Point Wiring Diagrams:
a. Provide an Illustration of EACH Device that is being provided for this project.
1) Identify EACH conductor and the equipment type and termination point that it is intended to be connected to.
2) For equipment that is being connected to Integrate to another system, provide a brief description of the functional operation of the two different systems.
4. Device Mounting Details:
a. Provide an Illustration of EACH Device that is being provided for this project.
1) Identify the back box, conduit rough-in, and manufacturer recommended mounting method.
5. Door Hardware Illustrations and Wiring Diagrams:
a. Coordinate with the Electrical Contractor/General Contractor as required to obtain the following information that shall be included on the Shop Drawing submittal:
1) Provide a "typical" Illustration of EACH Electro-Mechanical Door Hardware device that the access control system will be connecting to.
2) Provide a "typical" Point-to-Point Wiring Diagram of EACH Electro-Mechanical Door Hardware device that the access control system will be connecting to.
a) Show a "typical" of EACH connection and termination to the Access Control Reader Interface (ACRI) and/or Access Control Panel.
6. The Riser Diagram shall show the following items:
a. Identify EACH Equipment location (the MDF and EACH designated IDF) separately.
1) Identify EACH cable type, size, and quantities between the MDF and EACH designated IDF location.
b. Identify EACH Device and the associated room number where it is located in the building. Use the designated door number on the Contract Drawings.
1) Identify the associated cable for EACH device (as described on the wire legend) routed to the Access Control Reader Interface (ACRI) and each cable routed from EACH ACRI to the MDF and EACH designated IDF location.
2) This includes, but is not limited to; Card Reader(s), Door Position Switches, Request to Exits, ACRI(s), ACPS(s), EDPS(s), Server(s), Workstation(s), and other system equipment.
7. Floor Plans shall show EACH Device type, style, and each individual cable required for EACH Device.
8. Shop Drawings shall be specific to the System that is specified in the Section.
a. Do NOT show other low voltage system equipment on the Shop Drawings, except where this system is integrated to other equipment and/or systems.
b. Provide EACH device Symbol and related description (as described on the Contract Drawings) on the Legend with the text that states "provided by others".

1) Intrusion Alarm System as described on the Floor Plans and Riser Diagrams.
2) Fire Alarm System integration as described on the Floor Plans and Riser Diagrams.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. See Section 272000 Data and Voice Infrastructure for additional equipment requirements.

C. The Access Control System design, devices and/or wiring arrangement shown on the drawings represent that based on equipment as manufactured by Paxton. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor.
1. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the contractor in writing so as to be received by the Architect not later than (10) days prior to the bid due date. Approval by the Engineer will be issued by addendum prior to the bid date.

D. Provide all equipment as defined in the specification(s) and shown on the drawings.

E. Refer to PART 1 for any equipment that is not specifically defined.

2.2 COORDINATION

A. Refer to “Submittals” for additional coordination requirements.

B. The Installing Vendor shall include in their bid; the time, staff, and materials that are necessary to perform the following services.

C. Provide the follow up documentation. Each of the items discussed during the Pre-Construction Kick Off Meeting shall be included in the Data Sheet Submittals and shown on the Shop Drawing Submittals.

D. Pre-Construction Kick Off Meeting. An important aspect of the construction process for this project is the Pre-Construction Kick-Off Meeting. The Installing Vendor shall allow as much time as necessary to accommodate each of the Owner preferences for; equipment layout, programming features, and each item identified within this specification. This meeting shall take place PRIOR to the Submittal of equipment Data Sheets and/or Shop Drawings.
1. The Installing Vendor Technician shall attend this MANDATORY meeting.
2. The Installing Vendor shall coordinate with the Electrical Contractor to confirm the date and time of this meeting.

3. See the paragraph titled "Coordination" in Section 27 00 00 Low Voltage Systems General Requirements for more information.
4. Coordination Questions shall be submitted a minimum of 14 Days in advance of the meeting for Owner review for the Pre-Construction Kick Off Meeting. This would include, but is not limited to;
    a. IP Address Equipment List.
    b. Rack / Equipment layout preferences.
    c. Automatic (pre-programmed) functions, such as; Lock/Unlock times of perimeter doors on a door by door basis.
    d. The Installing Vendor Other questions that would like clarification of.
5. The Installing Vendor shall bring to the Pre-Construction Kick Off Meeting 95% design engineered submittal documents, which shall be a complete Preliminary Submittal package.
    a. These items shall be reviewed during the course of the meeting. The intent is to identify incomplete or inaccurate information that was intended to be submitted. The Drawings, Material Lists, and/or Data Sheets will be marked up during this meeting.
    b. The Installing Vendor shall make the necessary corrections and provide a revised formal Submittal through the normal construction channels.
        1) Be sure to include ALL responses by the Owner in the revised formal Submittal.
    c. Provide a minimum of (3) Full-Size sets of 95% design engineered Shop Drawings. Insure that the drawings show the following items:
        1) A legend that identifies; each device, manufacturer, model number, description, rough-in of electrical back boxes and the related conduits.
        2) The proposed Rack / Equipment layout(s) for the MDF Room and each designated IDF location that will have Rack mounted equipment provided for this project.
        3) An Elevation View of the Wall Mount equipment for the MDF Room and each designated IDF location shall be provided. The proposed locations for EACH wall mount device (control panel(s), power supplies, and other equipment), proposed cable routing, wire management, 120vac conduits (including receptacles and junction boxes) shall be shown to scale. Provide dimensions of the equipment, the space required between the adjacent item and the overall dimensions of the anticipated wall space.
        4) Proposed route for cable installation (throughout the building).
        5) Riser Diagram. Insure the following items are shown:
            a) The MDF Room.
            b) Each individual designated IDF Room.
            c) Each type shall be shown between the MDF and each designated IDF location.
    d. Provide a minimum of (3) sets of 95% design engineered Material List.
        1) Provide the Data Sheets for each device and component on the Material List.
6. The items discussed at the Pre-Construction Kick Off Meeting shall include, but not be limited to:
    a. Coordinate with the Electrical Contractor and General Contractor to obtain the Door Hardware Illustrations and Wiring Diagrams, so that this information can be included on the Access Control System Shop Drawing submittal. See "Submittals" for more information.
    b. Coordination with other Trades.

c. Cable ID labeling.
d. Confirmation of the Outlet Connector Type.
e. Owner furnished equipment to be installed by the Installing Vendor.
f. Verification and approval by the Owners of the following items:
1) Proposed Rack / Equipment layout.
2) Proposed Rack locations and orientation within the MDF Room and EACH designated IDF location.
3) Proposed wall mounted equipment layout(s) for the MDF Room and each designated IDF location.
g. Automatic (pre-programmed) functions, such as;
1) Lock/Unlock times of perimeter doors on a door by door basis.
2) First Man In functional operation.
h. Integration to other systems. Discuss the intended operation.

E. Additional items to be discussed shall include, but not be limited to:
1. General questions about IT Department standards.
2. Access to locked doors within the building.
3. General coordination with staff.

F. Follow up documentation of the Pre-Construction Kick Off Meeting. The purpose of this information is to illustrate to the Owners IT Department that the information discussed during the Pre-Construction Kick Off Meeting was understood by the Installing Vendor. Provide the following information:
1. Make corrections to the Shop Drawings as marked up and discussed with the Owner and Engineer.
2. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals and/or Shop Drawing submittals.

2.3 NETWORK RELATED EQUIPMENT

A. Switch(s)
1. Utilize the Owners Ethernet Switch(s) at the MDF Room and EACH designated IDF location indicated on the drawings. The Owner shall provide the necessary switches for a functional LAN/WAN.
2. The Access Control System Installing Vendor shall program all other system equipment.

B. Data Infrastructure
1. Section 27 20 00 Data and Voice Infrastructure shall provide EACH of the following items at EACH location required:
a. Cat6 Cable Infrastructure.
b. Patch Panels.
c. Patch Cords.

2.4 SERVER(S) AND WORKSTATION(S)

A. Server(s).
1. Additional Server(s) are NOT required for this project.

B. Workstation(s).

1. Additional Workstation(s) are NOT required for this project.
2. Use the Workstation(s) that will be provided by the Owner.

2.5 SYSTEM SOFTWARE

A. Software.
1. Provide the most current version of software available by the Manufacturer. Paxton Net2 Pro Software is the basis of design.

B. Database – It will be the Installing Vendors responsibility to insure that the system is fully functional with the specified equipment.
1. The Database shall be programmed and accessed through the Owners LAN.
2. Import/Download the database to the ACP(s) and ACRI(s), as required.

C. General Functional Operation:
1. It will be the Installing Vendors responsibility to insure that the system is fully functional. Provide configuration and functional operation of EACH door as directed by the Owner.
2. Load and configure the software as required. This includes, but is not limited to;
   a. User Groups.
   b. Time Zones.
   c. Automated functions, such as; Door(s) automatically Lock and Unlock.
3. Bi-directional data transfer of card holder information and control functions, shall be accomplished via the Owners LAN/WAN.
4. Coordinate with the Owners Access Control System Representative, IT Department, and Human Resources Department and import the Database and related information fields as required.
5. Populate all database fields as directed by the Owner.
6. Coordinate with the Owners IT department as required.

D. The following functional capabilities are to be considered standard, without the need for add-on software. Not all of the system features are listed in this specification. This information shall be used as a summary of the requirements. This summary does not lessen the specified system Make, Model Number, and performance requirements in any way.
1. General Requirements:
   a. All databases will have the ability to ADD, DELETE, REPORT, VIEW and EDIT information.
   b. Provide storage of all system transactions in a retrievable file.
   c. Log all events by time and date.
   d. Provide ability for the Owner to make system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases at any time.
   e. Provide mode of system operation that stores system commands that were not accepted by the hardware.
   f. Provide a means for scheduled automatic backups of all Database system files and System Configuration files. A means to restore these files from a simple menu shall exist.

g. All commands and updates to the panels shall be verified and shall automatically retry if communications have failed.
h. Provide a system scheduler that shall automatically initiate a preprogrammed command event/action and also synchronize system to intelligent controller time.

2. Cardholder Database:
   a. Cardholder information shall include unique card number digits and optional Personal Identification Number.
   b. Allow multiple cards per cardholder.
   c. System Administrators shall have the ability to add custom fields in addition to or replacement of any standard fields on a minimum of thirty two (32) pages each of information for the cardholder, visitor, and visit forms and one page of information for assets.
   d. Provide special card options that include, but are not limited to:
      1) Time zone reference, which defines valid time.
      2) Temporary User, which provides a specified activation date and expiration date (spanning years).
      3) Provide ability to store digital images of cardholder or other digital images such as property or family members. Up to nine (9) such images shall be associated with the cardholder.
   e. Upon editing card information, the updated information shall be sent automatically to the appropriate access control panel(s) and access control reader interface(s), when hardwired, with no other user intervention. If the scheduler is used, then card updates shall be sent based on scheduling.
3. Access Levels:
   a. Provide the ability to define specific times of access.
   b. Provide the ability to define specific readers to specific locations.
   c. Provide a template of a defined access level detail, where changes can be made to the template and saved as a new access level detail.
4. Alarm Monitoring – Alarms Only View:
   a. Execute alarm notification in all modes of operation.
   b. Provide a display of the most current transactions in real time.
   c. Provide a “Panel Not Responding” alarm if communication to a panel is lost.
5. System Operator Database:
   a. The software shall allow the assignment of System Operator levels to define the system components that each System Operator has access to view, operate, change or delete.
   b. Define the accounts to which the System Operator has access.
   c. Provide the ability to log System Operator actions in the history files.
6. Reports:
   a. Provide reporting capability for printing of selected system transactions from the disk files by specific time and date selection, range from time and date to time and date, or from start time to end time each day of the selected date range.
   b. Provide feature to generate a history report for a card(s) state. A card state shall be defined as Normal, Trace, Not Found, Anti-Passback Violation, PIN Violation, Time Zone Violation, Site Code Violation, or Expired card. Additional search criteria shall include cardholders that meet up to at least 3-note field restriction and filter the report with defined reader location(s).

c. Provide feature to generate a history report for System Operator(s) activities. The report shall include time, date, operator name the device associated with the action and the type of action performed by the operator.
d. Provide complete database reporting of all data programmed into the system data files.

7. Time Zones:
a. Time zone definitions shall include Starting time, Ending time, Days of the week, and Holiday override.
b. Time shall be definable in 24-hour (military) time.
c. The maximum time zones that can be defined in a system shall be unlimited.

2.6 ACCESS CONTROL PANEL (ACP)

A. The Paxton Access Control System and related Software are the basis of design.

B. Provide the most current version of panel and firmware available by the Manufacturer.

C. The following functional capabilities are to be considered standard, without the need for add-on software or hardware. Not all of the system features are listed in this specification. This information shall be used as a summary of the requirements. This summary does not lessen the specified system Make, Model Number, and performance requirements in any way.

D. The Access Control Panel (ACP) shall include an on-board LAN/WAN communication module and shall link the Access Control System software to all other Subsystems. The system field devices (Access Control Reader Interfaces [ACRI], Readers, Door Position Switches, etc.) shall connect to the ACP and/or ACRI(s). EACH ACP and EACH ACRI shall provide full distributed processing of access control, alarm monitoring operations, emergency school lock-down, and reader led control (to indicate when the door is locked/unlocked).

E. Access levels, hardware configurations, and programmed control functions assigned at the administration workstation or database server shall be downloaded to EACH ACP and EACH ACRI, which shall store the information and control functions.

F. EACH ACP and EACH ACRI shall be wall mounted and installed in enclosures located as shown on the drawings.

G. The Access Control Panel (ACP) shall contain the following features:
1. Communications: The following communication formats shall be supported:
a. RS-485 to EACH of the ACRI(s).
b. Ethernet at 10/100Mbps (10/100BASE-T, RJ45).
1) The Installing Vendor/Contractor shall provide the following for the LAN/WAN Interface:
a) Furnish all necessary wiring, RJ45 jacks, modular harness's, and patch cords as required for connection to the designated LAN/WAN. Provide programming, final testing, and use the communication protocol as necessary so that all information is reported the Server and workstations, as required.
b) Coordinate with the Owners IT Department as required, to insure proper communication over the LAN/WAN.

2) All access granted/denied decisions shall be made at the ACP to provide fast response to card reader transactions.
3) Memory for the ACP shall be Flash-based and shall be completely non-volatile. If power to an ACP is lost, upon restoration of power the unit shall retain all information contained in the unit at the time of the power loss including cardholder database, system configuration, event transaction history, etc.

2. Memory:
   a. Real time program updates, and overall host communications shall utilize flash memory.
   b. Shall be configured for up to 50,000 cardholders and 2,728 event buffer.
3. Light emitting diodes (LED) shall indicate status of components and communication links.
4. Readers: The controller shall support the following:
   a. Up to two (2) card readers, two (2) door position switches, two (2) Request to Exit devices, two (2) electro-mechanical locking devices, one (1) auxiliary input device, and two (2) auxiliary relay output devices.
5. Electrical Power:
   a. Primary input power shall be 24v/40va.
6. Paxton: Provide Model # Net2 plus part number 682-813-US. Provide quantities as required to service the number of Readers and other devices shown on the drawings, detail sheets, and listed in this specification.

2.7 ACCESS CONTROL PANEL INTERFACE (ACPI)

A. The Access Control Panel Interface (ACPI) shall contain the following features:
1. Communications: The following communications format shall be supported:
   a. Ethernet at 10/100Mbps (10/100BASE-T, RJ45).
      1) The Installing Vendor/Contractor shall provide the following for the LAN/WAN Interface:
         a) Furnish all necessary wiring, RJ45 jacks, modular harness's, and patch cords as required for connection to the designated LAN/WAN. Provide programming, final testing, and use the communication protocol as necessary so that all information is reported the Server and workstations, as required.
         b) Coordinate with the Owners IT Department as required, to insure proper communication over the LAN/WAN.
2. The Access Control Panel Interface (ACPI) shall support the following
   a. Up to four (4) 2-state dry contact inputs, four (4) Form "C" relay Outputs and PCB only.
3. Electrical Power:
   a. Primary input power shall be 24v/40va.
4. Paxton: Provide Model # Net2 I/O Board part number 682-710-US. Provide quantities as required to service the number of Readers and other devices shown on the drawings, detail sheets, and listed in this specification

2.8 POWER SUPPLIES

A. Power Supplies of various types shall be used to provide power to system related equipment, as required, providing a fully functional system.

B. Access Control Power Supply (ACPS):
1. The power supply shall be capable of supplying 12v (1.5a) and 24v (500a).
2. At a minimum, provide (1) ACPS at EACH ACP and ACPI location shown on the drawings and/or as required for a fully functional system. If additional ACPS's are needed, provide the quantities as required for a fully functional system, while maintaining the design requirements that are defined elsewhere in these specifications.
3. The power supply shall include battery backup. Contact manufacture for battery recommendation.
4. Paxton: Model# 857-381-US.

C. Electrified Exit Device Power Supply (EDPS):
1. See "Field Devices" listed elsewhere in this specification.

2.9 BATTERY BACKUP FOR COMPLETE SYSTEM OPERATION

A. Battery back up power shall be an integral part of the Access Control system.

B. Provide and install gel-cell, maintenance free batteries, as required. Provide battery back up power for the entire Access Control system to provide a minimum of (1) hour of standby operation. Batteries shall be sized to provide at least 20% spare capacity.
1. Provide quantities as required for maintaining or exceeding the submittal calculation requirements listed elsewhere in Section 270000 "Submittals and Shop Drawings".

C. Each Power Supply shall have automatic switch over to stand-by batteries when AC power fails. The power supply/charger shall be an integral portion of the control panel and/or power supply and be capable of charging fully discharged system batteries to 100% in 8 hours.

D. All batteries shall be placed inside a metal enclosure that is approved by the manufacturer.

E. Each battery shall have the date of installation written on the battery with a permanent marker. The date shall be legible and clearly written in 1" numbers and be visible when the enclosure door is open.

2.10 FIELD DEVICES

A. Review the Access Control System Riser Diagram for Card Reader related equipment that is NOT shown on the drawings, but shall be provided and installed for this project.

B. Card Readers and Credentials: Provide one (1) Card Reader at EACH location shown on the drawings. Card readers shall connect to the ACP, for a fully functional system, as required.
1. Card Readers shall meet the following minimum requirements:
   a. Provide Card Reader(s) that are compatible with the ACP(s).
   b. Private labeled Readers are not permitted.
   c. Readers shall be weather resistant.
   d. When a card is presented to the reader, the beeper shall sound.
   e. The LED's shall be controlled individually by the host system.
      1) Reader LED's shall change color when the door is unlocked.
   f. Reader color shall be specified by the Architect.

1) PRIOR to ordering, obtain written approval of the color selection.
g. Manufacturer's 5 year warranty.
2. Surface mount –Proximity metal HID reader satin chrome:
a. Read range distance up to 4", as listed on the manufacturer's data sheet.
b. Surface mount to a single-gang electrical box.
c. Paxton: Model# 390-757-US. Provide quantities, as shown on the drawings.
3. Mullion Mount – Proximitly P50M HID Reader:
a. Read range distance up to 3", as listed on the manufacturer's data sheet.
b. Surface mount onto metal surfaces, such as door mullions or storefront applications, where indicated on the drawings.
c. Paxton: Model#345-220-US. Provide quantities, as shown on the drawings.
4. Credentials:
a. Credentials shall meet the following minimum requirements:
1) Provide Credentials that are compatible with the Card Readers, ACP(s).
2) A unique Credential identification number shall be encoded on each Credential.
b. Cards:
1) Provide 200 Cards.
a) Net2 proximity ISO cards, no magstripe.
c. Keyfobs:
1) Provide 40 Keyfobs.
a) Net2 proximity keyfobs.
d. Card, Keyfob programmer:
1) Provide 1 Desktop programmer.
a) Net2 desktop reader USB
b) Paxton: model# 514-326-US.

C. Request To Exit (REX): Provide Dual Technology REX with Built-In Sounder.
1. Provide REX(s) at EACH Reader location, as shown on the drawings.
a. For EACH single door location, provide one (1) REX.
b. For EACH double door location, provide two (2) REX's.
c. Provide manufactures recommended mounting plates as required.
2. GE: Model # RCR-REX-W.

D. Door Position Switches (DPS's):
1. Coordinate with the Intrusion Alarm System Installing Vendor. See the Electrical Legend and Riser Diagram for more information.
a. A DPDT Door Position Switch shall be provided for the following systems to use;
1) Access Control System.
2) Intrusion Alarm System.

E. Auxiliary Relays (AUXR):
1. Where called for on the plans, specifications, or where required, provide the necessary quantities of auxiliary relays, as required.
2. For outdoor applications.
a. Space Age Electronics: Model# SSU-PAM-1.
3. For indoor applications.
a. Space Age Electronics: Model# SSU-PAM-1, SSU-MR-101 Series, or SSU-MR-201 Series.

F. Electrified Exit Device Power Supplies (EDPS):
1. Elector-Mechanical locks shall be powered by and/or be compatible with the system Power Supplies. The following items provided by the Division 8 Door Hardware supplier, shall include, but not be limited to:
a. Electric Locks and/or Electrified Exit Devices.
b. Electrified Exit Device Power Supply (EDPS).

2.11 FLEXIBILITY IN SYSTEM DESIGN LAYOUT

A. Where indicated on the drawings, the Installing Vendor shall have the flexibility in their design to provide system equipment at any of the MDF and designated IDF locations. Do not install equipment in other locations, unless noted otherwise.

B. Provide all quantities of equipment as specified, while maintaining the "Spare Capacity" requirements listed elsewhere within this specification.

C. Coordinate the exact location of field devices with the Architect, prior to installation.

2.12 SYSTEM CABLES, CONNECTORS, AND PATCH CORDS

A. See PART 3 of this specification and Section 270000 for additional requirements.

B. Include the "Spare Capacity" requirements listed elsewhere within this specification, for the calculations and sizing requirements of the cables and/or conductors.

C. ALL cables and conductors shall be the same size and color throughout EACH cable run. Such as from EACH field device to the terminals on the ACP, ACRI, and Power Supply.

D. Cables/Conductors: The minimum allowable size conductors are specified below. Use larger conductors and/or additional conductors, as required. Prior to Bidding, consult with the system Manufacturer that the following cable types are acceptable. It shall be the Installing Vendors responsibility to provide and install Manufacturer approved cables. Use the Manufacturers equivalent cable requirements, to meet all code requirements [such as "Wet Rated" or "Aerial Rated" cable] for the appropriate devices.
1. CAT6 cable(s):
a. Refer to Section 272000.
b. The outer jack of the data cable color is specified in Section 272000.
2. Readers:
a. Non-Plenum: West Penn 3021 (18/6oas), or approved equal.
1) Provide additional conductors for Reader control of LED's as specified, as required.
b. Plenum: West Penn 253186B (18/6oas), or approved equal.
1) Provide additional conductors for Reader control of LED's as specified, as required.
3. Door Position Switches (DPS's):
a. Non-Plenum: West Penn 221 (22/2ns), or approved equal.
b. Plenum: West Penn 25221B (22/2ns), or approved equal.

4. Request To Exit's (REX's):
   a. Non-Plenum: West Penn 241 (22/4ns), or approved equal.
   b. Plenum: West Penn 25241B (22/4ns), or approved equal.
5. Electro-Mechanical Locks:
   a. Non-Plenum: West Penn 224 (18/2ns), or approved equal.
   b. Plenum: West Penn 25224B (18/2ns), or approved equal.
6. Electrified Exit Devices:
   a. Non-Plenum: West Penn HA210 (10/2 ns), or approved equal.
   b. Plenum: West Penn 25210 (10/2 ns), or approved equal.

E. Connectors/Terminations: Use the manufacturer approved wire strippers and crimping tool as required.
1. CAT6 cable(s):
   a. Refer to Section 272000.
2. Maintain all cable and system requirements.

F. Patch Cords: Size EACH cable length to provide ease of maintenance, while not leaving excessive slack.
1. CAT6 cable(s):
   a. Refer to Section 272000.
2. Maintain all cable requirements.

2.13 TRAINING MATERIALS AND PROGRAMMING SURVEY

A. The Installing Vendor shall include in the Pricing of their Bid, the time and materials necessary to generate and create the following Documentation, provide the staff and necessary equipment as required to provide the following services, as described below.

B. EACH of the documents shall have the following:
1. List the Name or Title of the document, the Section Number, and Section Title. This shall be bold and centered at the top.
2. Header of document:
   a. The Project Name and the current date.
3. Footer of document:
   a. Use multiple pages as required, but identify each page by having the footer state "Page 1 of X", "Page 2 of X", etc.

C. Interview the Owner for no less than a minimum of two (2) 4-Hour sessions. Allow for additional time if required, at no additional cost to the Owner. The Installing Vendor shall be present for this meeting. The purpose of this Interview is to verbally discuss all of the feature sets of the system. The dialog shall describe the benefits for implementing each of the systems features, thus allowing the Owner to make an informed decision on the how they can maximize the functional operation of their system.
1. Prior to starting the Interview process with the Owner, have EACH attendee fill out a "Sign In Sheet" listing EACH attendee's name, department they work in, and their phone number.
2. Provide a detailed list of software features on a document titled "Section 281300 Access Control System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet". This

shall be provided in the "Submittal and Shop Drawings" with the Section 270000 submittal. This shall be used as the basis of discussion for the Interview process.

a. For EACH separate software feature, provide a row with an ascending number indicating the "Item #" (on the far left side of the page).
b. Next to the Item #, provide a Yes, No, and N/A column. This shall be checked off by the Installing Vendor during the course of the Interview, to determine which options the Owner would like to have programmed.
c. On each row, provide a brief description of the feature set.
d. On the far right of each row, provide adequate space to write comments.

3. All parties shall review the drawings and discuss the intended functions of EACH device. This will allow all parties to have a complete understanding of EACH system devices purpose and the performance requirements of the system that was identified during the Interview process.
4. At the conclusion of the Interview with the Owner, prior to leaving the premises, the Installing Vendor shall do the following:
   a. Review with the Owner, by verbally recapping EACH of the feature sets listed on the "Section 281300 Access Control System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet" and reiterating this with a Yes (the Owner wants this feature) or No (the Owner does not want this feature). Make any corrections as required.
   b. Provide no less than three (3) copies of the completely filled out, "Section 281300 Access Control System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet" to the Architect.
5. For Bidding Purposes, the Installing Vendor shall be expected to program the system to Industry Standards, based on a project of this size, scope, typical functionality for this market segment, and as described throughout this specification.
   a. Review the testing requirements specified elsewhere within this specification for additional information.

D. Within five (5) business days of the conclusion of the Interview, provide the following documents to the Architect for review:

E. The updated Interview Document with a new title of "Section 281300 Access Control System – Owner Requested Systems Programming Sheet". This shall have the Yes, No, and N/A columns electronically filled out to demonstrate what will and will not be programmed. Include at the conclusion of this document, the following;
1. The date(s) of the Interview with the Owner.
2. The address, building name, room name, and room number of the location that the Interview took place at.
3. Provide copies of the sign in sheet(s).

F. A Training Syllabus titled "Section 281300 Access Control System – Training Syllabus", based on the features that the Owner has selected to be programmed into their system.

G. Training Manuals for the Site Staff:
1. At The 1st Training Session, Prior To Starting, Provide A Quantity Of Up To Ten (10) Training Manuals To The Site Staff.
2. The training manual shall be specific to the site (i.e. binder spine, binder cover insert, and the binder's internal documents).
3. Each of the training manuals shall be in a 3-ring "D" style binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with

an insert clearly typed with the following label "Section 281300 Access Control System – (Site Name Here) Training Manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. Under the title of the spine, the following information shall also be included on the front sheet of the binder; the site name and site address, the project name and project address, the current date, the installing vendors name, address, contact name and phone. Each binder shall include the following;

a. Use color coded numbered tabs to separate each item defined below and for each device that was installed. Provide these items in the following order.
    1) Provide an 8½" x 11" clear heavy plastic sheet in front of a table of contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.
    2) "Section 281300 Access Control System – (Site Name Here) Training Syllabus".
    3) Provide the power point presentation actual screen shots of typical functions that are specifically intended to demonstrate the aspects of the owner's new system. These shall be step-by-step instructions of the most common features that are used on the software. This includes , but is not limited to;
        a) How to add, change, and delete card holders.
        b) How to temporarily unlock a door (approximately five seconds).
        c) How to temporarily open a gate.
        d) Demonstrate how Events/Alarms come into the workstation.
        e) Demonstrate how to acknowledge Events/Alarms.
        f) Demonstrate various Searches and Report functions to the Owner.
    4) Include color copies of each slide in the power point presentation. Provide a maximum of three (3) legible slides per page, with lines beside each slide to write notes.
    5) The manufacturer's software users manual(s).
    6) Include color copies of each slide in the power point presentation. Provide a maximum of three (3) legible slides per page, with lines beside each slide to write notes.

2.14 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 - EXECUTION

3.1 GENERAL

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. See Section 272000 Data and Voice Infrastructure for additional cable and installation requirements.

C. Prior to rough-in, coordinate with the Architect for the exact location(s).

D. Install all equipment, devices, and cabling, per the manufacturer's recommendation.

3.2 INSTALLATION

A. Each cable run shall continuous, without any splices, from the device to the terminal strip on the ACRI(s), ACP(s), and Power Supplies. Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. Setup, connect, and configure the Servers/Workstations/Monitors per the manufacturer's recommendations to operate as intended. Load, configure, and test the software for a fully functional system.

3.3 INTEGRATION TO OTHER LOW VOLTAGE SYSTEMS

A. See "System Operation" listed elsewhere in this specification for more information.

B. See the Drawings and Section 281600 for more information.

3.4 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Mount enclosures as specified in Section 270000.

B. Prior to Bidding, the Installing Vendor(s) shall confirm and coordinate the actual quantities and locations of the power requirements with the electrical contractor see "Power Supplies" and "Flexibility in System Design Layout" listed elsewhere in this specification. At a minimum, provide 120vac wiring and connections to the ACP(s) and all power supplies, as required for a fully functional system.

C. Prior to rough-in, coordinate with the Architect for the exact location(s).

D. Install EACH of the devices and/or equipment per the manufacturer's recommendation.

E. Access Control Panel (ACP's):
   1. Install EACH ACP:
      a. On the hinge side of the door, and approximately 5'-0" from the door on parallel or perpendicular walls, to accommodate servicing this unit without blocking the doorway.
      b. Approximately 6" above the accessible ceiling (where applicable) or at 8'-0" above the finished floor, unless otherwise noted.

F. Access Control Panel Interface (ACPI)
   1. Install ACPI in MDF adjacent to Fire Alarm Control Panel.
   2. Coordinate installation with Fire Alarm System Installer.

G. Card Readers:
   1. Install EACH Card Reader:
      a. Flush to the wall surface.
         1) Surface mounted boxes are unacceptable.

2) At 44" on center.

2. For Electric Strike(s), install per the manufacturers recommendation.

H. Request To Exits (REX's):
1. Prior to rough-in:
a. Verify exact location with the Architect.
b. Mount in the middle of the door frame or header, as recommended by the manufacturer.
c. Verify the functional operation of the REX will not be hindered by other equipment. Such as exit signs.
2. Install manufactures recommended mounting plates, as required.
3. Install and make all adjustments to EACH REX, per the manufacturer's recommendation.

I. Door Position Switches shall be installed on the latch side of the door, NOT the hinge side. At the upper portion of the door, near the top of the door (surface mount), on the top of the door (recessed mount), and 4" to 6" from the edge of the door (unless approved by the Architect). Install per manufacturers recommendations. After installation the door shall be able to close properly without rubbing on the door position switch.
1. Provide the appropriate style of Door Position Switch and application appropriate magnet for each type of door.
2. Recessed Mount Door Position Switches:
a. The Door Position Switch shall be provided and installed by the Intrusion Alarm Installing Vendor. Coordinate with the Installing Vendor for cable terminations, as required.
3. Surface Mount Door Position Switches:
a. Install per the manufacturers recommendation. Conceal all cabling within the walls and/or ceiling, as required.
4. Hollow Metal Door with Grout Filled Frame(s) and/or Concrete/CMU Wall Applications:
a. Heavy Duty Surface Mount Door Position Switches: for these types of applications, secure the device to the frame and/or wall using a minimum depth of 1.25 inch of screw in the wall penetration. Plastic insert anchors are NOT acceptable. Either one of the following methods is acceptable or approved equal;
b. Lead anchors.
c. Concrete sleeve anchors.
d. Secure the armored cable every 4" with U-shaped two-hole steel clamps that are secured on both sides of the clamp, sized to be a snug fit on the armored cable, until it enters the junction box. Secure at the junction box with a screw type clamp as it enters the junction box.
5. Roll-Up Door Applications:
a. The door position switch(s) shall be installed in a manner to be the least obtrusive in the door opening. Consult with the Architect for actual location, prior to mounting.
b. Secure the device to the floor and/or wall using a minimum depth of 1.25 inch of screw in the floor or wall penetration. Plastic insert anchors are NOT acceptable. Either one of the following methods is acceptable or approved equal;
1) Lead anchors.
2) Concrete sleeve anchors.
c. Secure the armored cable every 4" with U-shaped two-hole steel clamps that are secured on both sides of the clamp, sized to be a snug fit on the armored cable, until it enters the junction box. Secure at the junction box with a screw type clamp as it enters the junction box.

J. Access Control Power Supplies (ACPS):
1. Electric Lock Power Supplies (ACPS) shall power the Electro-Mechanical Door Hardware and other system related equipment.
2. Mounting of ACPS's, wiring, and terminations of ALL Elector-Mechanical locks shall be by the Installing Vendor/Contractor.
a. Locate the ACPS's as required, unless noted otherwise.

K. Electrified Exit Device Power Supply (EDPS):
1. Electrified Exit Device Power Supply (EDPS) shall power the Electrified Exit Devices (ED). The following items shall be provided by the Division 8 Door Hardware supplier.
a. Electric Locks and/or Electrified Exit Devices.
b. Electrified Exit Device Power Supply (EDPS).
2. Mounting of EDPS's, wiring, and terminations of ALL Elector-Mechanical locks shall be by the Installing Vendor/Contractor.
a. Locate the EDPS's directly above the ACP, unless noted otherwise.
b. Mount approximately 6" above the accessible ceiling (where applicable) or at 9'-0" above the finished floor, unless otherwise noted.

3.5 DATA CABLES AND OUTLET LOCATIONS

A. See Section 272000 Data and Voice Infrastructure for additional information. Connect the ACP(s) to the LAN/WAN as required.

3.6 PROGRAMMING AND CONFIGURATION

A. Program the Database as described in "System Software" listed elsewhere in this specification.

B. Time and Date Synchronization.
1. Each of the ACRI(s), EACH of the ACP(s), and the Access Control Server(s) shall be synchronized for the Time and Date to be exactly the same (where applicable).
2. The "Access Control System" shall be synchronized to other designated systems, such as the CCTV System, for the Time and Date to be exactly the same (where applicable).

C. The Installing Vendor shall program the system as defined in the documents that were completed during the "Interview the Owner", as described throughout this specification, and as required for a fully functional system.
1. The Owner shall program the Owners staff.

D. The Installing Vendor shall program the Configuration Files of the system to be automatically backed up onto the Designated Server. These back ups shall occur once per week. Coordinate with the Owners IT Department, as required. This includes, but is not limited to:
1. EACH of the Configuration Files of EACH ACP.
2. EACH Site Workstation.

3.7 TESTING

A. See Section 270000 Low Voltage Systems General Requirements for "Test Forms" and "Testing & Complete System Functionality", and "Test Forms" listed elsewhere in this specification for more information.

B. See Section 272000 Data and Voice Infrastructure for additional Testing requirements.

C. The Installing Vendor shall provide the staff and necessary equipment to meet or exceed the testing requirements, as required.

3.8 TRAINING

A. Training for Site Staff:
   1. The training sessions shall be held at the project Site.
      a. Provide Training for up to ten (10) Site Staff.
      b. Provide a total of two (2) separate training sessions for the Owners personnel. Schedule both training sessions with the Owner, providing a minimum of 14 days advance notice, and offer a minimum of three dates to choose from.
   2. The Site Training Session(s) shall only take place AFTER the Owners Administrative Staff have had their first training session.
   3. The 1st Training Session shall consist of:
      a. Providing the printed Training Manuals to EACH attendee, as described elsewhere in this specification in "Training Materials and Programming Survey".
      b. Being conducted by one of the designated Installing Vendor technicians. The training shall be a minimum of one (1) 4-Hour session that shall be held on the same day, and provide a thorough and in depth full feature training session. Provide additional training time as required, to answer EACH of the staff's questions, at no additional cost to the Owner. This training shall address EACH of the software features that meet the Owners requirements identified on the documents that were filled out during the "Interview with the Owner". This includes, but is not limited to:
         1) The "Section 281300 Access Control System – Owner Requested Systems Programming Sheet".
         2) The Manufacturers Programming Worksheets.
      c. Using an Installing Vendors laptop and projector, connect to the Owners WAN and demonstrate each of these features and functions.
         1) At the Owners option, the Installing Vendor may be allowed to provide the Training Session on the Owners Workstation.
      d. The 2nd Training Session shall consist of:
         1) A refresher training session shall be held approximately 30 days after the first training session. The training session shall be a minimum of two (2) hours that may be conducted by one of the Installing Vendors designated technicians that attended the first training session. Provide additional training time as required, to answer EACH of the staff's questions, at no additional cost to the Owner.
         2) Using an Installing Vendors laptop and projector, connect to the Owners WAN and demonstrate each of the features and functions that the Owner's staff would like clarification on.

a) No less than five (5) business days in advance of this meeting, the Installing Vendor shall request from the Owner, EACH of the items that the Owner would like clarification on.
b) The documents that were filled out during the "Interview with the Owner" shall be used as the reference document.
c) At the Owners option, the Installing Vendor may be allowed to provide the Training Session on the Owners Workstation.

e. Following the 2nd training session, the Installing Vendor shall include additional programming to accommodate system functionality changes, based on the requirements of the Owner.
1) Provide up to one (1) hours of system programming changes.

3.9 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.
1. Provide an "Equipment Information Sheet", in the O & M manuals. At a minimum, from left to right, provide the following information;
a. Each row shall have an "Item #".
b. Manufacturers Name.
c. Equipment Device Type (such as Workstation, Control Panel, etc).
d. Location (such as MDF room 103, or area of building).
e. IP Address.
f. Software Name.
g. Software Version that is installed on the device.
h. List the "Highest Level" configurable password for EACH device.
i. List "EACH System Operator" password.
j. List all other password settings for EACH device.

D. Provide ALL CD(s)/DVD(s) of installation software, legally required software licenses, and the associated documentation to reinstall all portions of the software that is running on the new and/or existing Server/Workstations.
1. Separate ALL information by Server, and EACH individual Workstation, into large plastic Ziploc bags that are clearly identified with a PC generated label. The information on the label shall include, but is not limited to:
a. Project Name.
b. Date.
c. PC location (building name, room name, and room number).
d. List the contents of EACH bag.
2. Include a "Proof of Delivery Form" that includes, but is not limited to;
a. Documentation:
1) The quantities of EACH Binder.

2) The Binder Spine Name.

b. Software:

1) List EACH bag for EACH PC and lists the contents of EACH bag.

END OF SECTION

SECTION 281600 - INTRUSION ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. Provide new addressable Intrusion Alarm System including, but not limited to; motion sensors, door position switches, duress buttons, monitoring points, keypads, power supplies at all locations as shown on the plans and/or as indicated in these specifications. The keypad(s) as indicated on the drawings will be used to arm and disarm the system.

B. Furnish and install a complete, addressable point, partitioned Intrusion Alarm System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall use programmable, multiplex, initiating device circuits with individual point identification, device supervision, primary and standby power. Include control panel(s), automatic detection devices, sirens, flashing lights, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a completely reliable and fully functional system.

C. An important aspect of the construction process for this project is the **Pre-Construction Kick Off Meeting**, which shall take place PRIOR to Submittal of equipment data sheets. See "Submittals" and "Coordination" listed elsewhere within this specification.

D. The system shall meet ALL of the requirements listed in Section 270000 Low Voltage Systems General Requirements PART 3 "Testing & Complete System Functionality", prior to "Substantial Completion".

E. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 281600 Intrusion Alarm System includes, but is not limited to the sections identified in Section 270000.

1.2 SYSTEM OPERATION

A. The system shall be armed, disarmed, reset, monitored and altered by the use of an LCD Keypad and shall be capable of supporting up to eight (8) keypads. All points of identification shall clearly indicate the device type, room name, and room number. The system shall provide "fail safe arming" preventing arming of the system if a zone has been violated. It shall indicate which device is not ready for arming at the remote keypad(s).

B. Point identification of devices and their respective locations, shall be displayed at the keypad, reported to the remote monitoring agency.

C. Actuation of any monitored device shall cause the following to occur:

1. Display device name, type, location within the building, and alarm device unique addressable point nomenclature at the LCD keypad.

2. Activate the built-in digital communicator, seize the protected premises telephone line and automatically report the alarm point/device to the remote monitoring agency.

D. General System Operation:

1. The building shall be divided into the partitioned zones as indicated on the drawings and/or these specifications. A partition is defined as an area of protection, provided with its own keypad and group of sensors, connected to the main building system, whose operation in totally independent from a different section of the building or structure. Operation is similar to that of a completely separate control panel, keypad, or system.

E. Integration To Other Low Voltage Systems:

1. Access Control System Interface – Provide the necessary cabling and (1) relay output from the Intrusion Alarm Control Panel (IACP) to the Access Control System. Connect and program as required. The Intrusion Alarm System shall toggle the relay each time the Intrusion Alarm System is "Armed" and "Dis-Armed". The Access Control System shall monitor the Armed/Dis-Armed status of the Intrusion Alarm System. See Section 281300 and the Drawings for more information.
2. Light Control Panel(s):
   a. Interior Lights. The Intrusion Alarm shall turn on the Interior Lights when the system is in Alarm.
   b. Site Lighting (around the perimeter of the building and the parking lot lights). The Intrusion Alarm shall turn on the Site Lighting when the system is in Alarm.
3. Intercom System:
   a. Provide connection to the Intercom System to activate an Announcement (.wav file).
      1) Sound the Exterior Intercom Speakers.
      2) Sound the Interior Intercom Speakers.

1.3 QUALITY ASSURANCE

A. The system, devices, and equipment, shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:

1. National Fire Protection Association (NFPA) - USA:
   a. NFPA 70 National Electrical Code
   b. NFPA 71 Central Station Signaling Systems-Protected
   c. Premises Unit
   d. NFPA 72 National Fire Alarm Code
   e. NFPA 101 Life Safety Code
2. Underwriters Laboratories Inc. (UL) - USA:
   a. UL 365 Police Station Burglar Alarm Units and Systems
   b. UL 464 Audible Signal Appliances
   c. UL 609 Local Burglar Alarm Units and Systems
   d. UL 864 Control Units for Fire Protective Signaling Systems

e. UL 1076 Control Units for Burglar Alarm Proprietary
f. Protective Signaling Systems
g. UL 1610 Central Station Burglar Alarm Units
h. UL 1635 Digital Alarm Communicator System Units

3. Meet or exceed Building Codes and Standards:
   a. Local Authority Having Jurisdiction (AHJ) Requirements
   b. State
      1) WAC 51-20 Washington Barrier Free Regulations
   c. National
      1) National Electrical Code (see NFPA 70)
      2) Americans with Disabilities Act
   d. International
      1) International Building Code
      2) International Mechanical Code
      3) International Electrical Code (see NFPA 70)
      4) International Fire Code

B. Approvals:

1. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   a. UL Underwriters Laboratories Inc.
   b. ULC Underwriters Laboratories Canada.
   c. Factory Mutual.
2. The Intrusion Alarm Control Panel shall meet UL Standard 864 and UL Standard 1076.

C. The Installing Vendor shall, at a minimum, provide and/or perform on-site installation assistance to the Contractor throughout the duration of the project, up to and including acceptance of the System as defined in Section 270000 “Testing and Complete System Functionality”.

D. Service And Software Modifications:

1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system software modifications, upgrades or changes.
2. For non-emergency service, response time of the technician to the site shall not exceed 4 hours. If the call is received by the Installing Vendor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.
3. Provide all hardware, software, programming tools and documentation necessary to modify the system on-site. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices. The system structure and software shall place no limit on the type or extent of software modifications on-site.

1.4 SUBMITTALS

A. Refer to specification 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

B. Refer to "As-Built Drawings" for additional requirements.

C. Data Sheets Submittals and other documentation.

1. Installing Vendor Staff Qualifications. Provide copies of the following information (Certification and Training documents):
   a. The Installing Vendor field staff installers (a minimum of 2) Installation certifications issued by the manufacturer of the equipment that is being installed.
2. Installing Vendor/Manufacturer Agreement. Provide the following documentation of the Manufacturer of the equipment being installed:
   a. The Installing Vendor shall be an Authorized Partner that is trained and certified by the Manufacturer of the equipment being installed.
3. Materials List:
   a. A complete materials list, which shall include; the quantity of each device, the manufacturer's name, model number, and a description of the equipment for each individual system component or device that will be provided. This list shall precede the data sheets.
   b. Equipment Data Sheets. Each System component or device data sheet shall have an indicating arrow next to each component or device that is being submitted.
   c. Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect.
4. Provide ALL requested submittal documents in "Training Materials and Programming Survey" listed elsewhere in this specification. This includes, but is not limited items listed under "Interview the Owner":
   a. Provide a sample copy of the Training Syllabus.
   b. Provide a sample copy of the Step-by-Step Instructions.

D. Shop Drawing Submittals shall include the following items:

1. Prior to ordering or installation of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect.
   a. The Installing Vendor shall make the necessary corrections or changes as and provide a Revised Submittal through the normal construction channels.
      1) Be sure to include ALL responses by the Owner in the Revised Submittal.
2. Device Point-to-Point Wiring Diagrams:
   a. Provide an Illustration of EACH Device that is being provided for this project.
      1) Identify EACH conductor and the equipment type and termination point that it is intended to be connected to.
      2) For equipment that is being connected to Integrate to another system, provide a brief description of the functional operation of the two different systems.
3. Device Mounting Details:
   a. Provide an Illustration of EACH Device that is being provided for this project.
      1) Identify the back box, conduit rough-in, and manufacturer recommended mounting method.
4. The Riser Diagram shall show the following items:
   a. Identify EACH Equipment location (the MDF and EACH designated IDF) separately.
      1) Identify EACH cable type, size, and quantities between the MDF and EACH designated IDF location.

b. Identify EACH device and the associated room number where it is located in the building. Use the designated room number or door number on the Contract Drawings.
   1) Identify the associated cable for EACH device (as described on the wire legend) routed to the MDF and EACH designated IDF location.

5. Rack and/or Equipment Layout.
   a. Show the intended equipment layout within EACH of the Rack(s) and/or Cabinets.
   b. Indicate the rack unit size of each device or filler plate in the rack.
   c. Show blank filler plates in spaces where equipment is not installed.
   d. If rack equipment is installed on the rear side of the rack, show rear view of the rack also.
   e. Show the equipment layout as it is intended to be installed.
6. An Elevation View of the Wall Mount equipment for the MDF Room and each designated IDF location shall be provided.
   a. The proposed locations for EACH wall mount device (control panel(s), power supplies, and other equipment), proposed cable routing, wire management, 120vac conduits (including receptacles and junction boxes).
   b. All equipment shall be shown to scale.
   c. Provide dimensions of the equipment, the space required between the adjacent item and the overall dimensions of the anticipated wall space.
7. Floor Plans shall show each Outlet type, style, and each individual cable required for EACH Device.
8. Shop Drawings shall be specific to the System that is specified in the Section.
   a. Do NOT show other low voltage system equipment on the Shop Drawings, except where this system is integrated to other equipment and/or systems.
   b. Provide EACH device Symbol and related description (as described on the Contract Drawings) on the Legend with the text that states “provided by others”.
      1) Access Control System integration as described on the Floor Plans and Riser Diagrams.
      2) Fire Alarm System integration as described on the Floor Plans and Riser Diagrams.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Section 270000 Low Voltage Systems General Requirements for additional requirements.

B. Bosch manufactures the products that are used for the basis of design for this specification.

C. The System design, devices and/or wiring arrangement shown on the drawings represent that based on various equipment manufacturers. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor.

1. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the contractor in writing so as to be received by the Architect not later than (10) days prior to the bid due date. Approval by the Engineer will be issued by addendum prior to the bid date.

D. Provide all equipment as defined in the specification(s) and shown on the drawings.

E. Refer to PART 1 for any equipment that is not specifically defined.

2.2 COORDINATION

A. Refer to “Submittals” for additional coordination requirements.

B. The Installing Vendor shall include in their bid; the time, staff, and materials that are necessary to perform the following services.

C. Provide the follow up documentation.

2.3 INTRUSION ALARM CONTROL PANEL (IACP)

A. Approved Intrusion Alarm Control Panel (IACP) Manufacturers

1. Bosch: Model # D9412GV4.

B. Provide one (1) Intrusion Alarm Control Panel (IACP) and communicator as shown on the drawings. EACH IACP shall be a microprocessor based control panel. All eight master zones shall be individually programmable to support 246 individually annunciated points of protection through the addition of a two wire, multiplex zone expansion system (ZONEX). Points of protection are annunciated with custom text at the Remote LCD Keypad.

1. This installation shall use addressable modules for EACH device and shall display a unique point identification label on the LCD Keypad.
2. The IACP shall be listed by UL for Power Limited Circuits and the central processor control panel that controls all functions of the system shall be an integral UL listed commercial fire and burglary digital communicator.
3. The control panel metal enclosure shall be lockable with a key.

C. The system shall include the following features as minimum:

1. Standard Features:
   a. Eight programmable zones.

b. 12 VDC, 2 amp alarm power with three separate outputs.
c. 12 VDC, 1 amp auxiliary power with two separate outputs.
d. Built-in digital communicator with phone line monitor.
e. Battery charging circuit.
f. Battery voltage supervision.
g. Automatic reset circuit protectors.
h. Onboard warning buzzer and diagnostic LED's.
i. Lightning and RFI protection.
j. Power limited external circuits.
k. Auto-answer modem
l. Real time clock and test timer

2. Programmable Features:
   a. Modem 3A2(tm) Central station reporting format.
   b. Two telephone numbers.
   c. Automatic test reports.
   d. Individual zone responses.
   e. Custom annunciator text.
   f. Alarm test mode.
   g. Audible alarm output, steady or pulsed.
   h. Silence option by zone.
   i. Automatic silencing.
3. Zone Expansion (Zonex):
   a. 246 points of protection
   b. Two wire multiplex communication
4. Event Logger:
   a. 500 event memory
   b. Remote event retrieval
   c. Log opening/closing by user
   d. Log alarms, troubles, and restorals

D. IACP Components And Related Equipment:

1. Provide quantities as required. Depending on system requirements, this may include but is not limited to the following items:
2. Transformer Enclosure for the Intrusion Alarm Control Panel (IACP) shown on the drawings.
   a. Bosch: Model # D8004.
3. Dual Phone line Switcher:
   a. Furnish all necessary wiring, RJ31X jacks, modular harness(s), and cabling, as required for connection to Owner furnished telephone lines. Provide programming, final testing using the communication protocol as necessary so that this information is reported to the remote monitoring agency. Coordinate with Owner, as required.
   b. Bosch: Model # D928.
4. Multiplex Zone Expansion module:
   a. Bosch: Model # D8125MUX.
5. Alarm Status Relay:
   a. Bosch: Model # D811.

1) Section 281300 Access Control System shall monitor the Alarm Status of the Intrusion Alarm System. Provide connections and programming as required.

6. Powered loop interface module:
   a. Bosch: Model # D125B.
7. Dual Battery Harness:
   a. Bosch: Model # D122.
8. Enclosure:
   a. Bosch: Model # D8103.
9. Lock and Keys for Enclosure:
   a. Bosch: Model # D101.
10. Mounting Skirt:
    a. Bosch: Model # D9002-5.
11. Tamper Switch:
    a. Bosch: Model # D110.
12. Adapter:
    a. Bosch: Model # MP203.
13. LAN/WAN Interface:
    a. Furnish all necessary wiring, RJ45 jacks, modular harness(s), and cabling, as required for connection to the Owners existing WAN. Provide Two (2) Ethernet Communication Boards for the IACP shown on the Drawings. Programming, final testing, and using the communication protocol as necessary so that all IACP information is reported simultaneously to the remote monitoring agency and the Owners Server and/or workstations.
    b. Coordinate with the Owners IT Department for the issuing of the Static IP address(s) and insuring proper communication over the LAN/WAN.
    c. Bosch: Model # B420.

2.4 INTRUSION ALARM POWER SUPPLY (IAPS)

A. The Intrusion Alarm Control Panel shall NOT be used to power any low voltage device, except for nominal voltage on the addressable data circuits.

B. Use an Intrusion Alarm Power Supply(s) (IAPS's) as required for serving all Intrusion Alarm devices that consume 12vdc or 24vdc power. The power supply shall be U.L. listed, have sixteen (16) Class 2 Rated PTC Power Limited outputs and a key locking enclosure. The IACP shall have automatic switch over to stand-by batteries when AC power fails, and have AC fail supervision which is a Form "C" contact closure upon loss of power. Connect as required, one (1) addressable module to monitor AC power for EACH IAPS that is provided for this system. The power supply shall be capable of supplying 4.0 Amps or 6.0 Amps.

C. At a minimum, provide one (1) IAPS at EACH location shown on the drawings. If additional IAPS's are needed, provide the quantities as required for a fully functional system, while maintaining the design requirements that are defined elsewhere in these specifications.

D. Altronix: Model # AL400ULXPD16CB or AL600ULXPD16CB. Provide sizes and quantities, as required.

2.5 SURGE SUPPRESSION

A. Provide (1) dedicated TVSS at EACH 120vac hard wired connection point.

B. Provide manufacturer and model number as specified in Section 264300.

2.6 BATTERY BACKUP FOR COMPLETE SYSTEM OPERATION

A. Battery back up power shall be an integral part of the Intrusion Alarm system.

B. Provide and install gel-cell, maintenance free batteries, as required. Provide battery back up power for the entire Access Control system to provide one (1) hour of standby operation. Batteries shall be sized to provide at least 20% spare capacity.

C. Provide quantities as required for maintaining or exceeding the submittal calculation requirements listed elsewhere in Section 270000 “Submittals and Shop Drawings”.

D. EACH Power Supply shall have automatic switch over to stand-by batteries when AC power fails. The power supply/charger shall be an integral portion of the control panel and/or power supply and be capable of charging fully discharged system batteries to 100% in 8 hours.

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. The date shall be legible and clearly written in 1” numbers and be visible when the enclosure door is open.

2.7 KEYPAD FOR REMOTE OPERATION

A. Provide one (1) LCD Keypad, adjacent to the IACP and at EACH location shown on the drawings. The Keypad(s) shall have the following features:

1. An illuminated, backlit keypad.
2. Multi-line alphanumeric English language LCD display.
3. A built-in sounder that emits several distinct warning tones.
4. Remote control or relays.
5. User-programmable pass codes.
6. System diagnostic tests.

B. Bosch: Model # D1260b:
Provide quantities shown on the drawings.

2.8 FIELD DEVICES

A. Provide one (1) addressable module and/or addressable input for EACH Intrusion Alarm device and related equipment as shown on the drawings.

B. Addressable Module(s):

1. Use the addressable module that when the system is laid out, it follows a logical sequence, unless otherwise noted elsewhere in the drawings or specifications. Provide the following quantities as required. Depending on system requirements, this may include but is not limited to:
2. MUX Mini Single Input, Single Point identification module. This is the Owners "Standard" addressable module. This is the ONLY type of addressable module that shall be used for this project.
    a. Bosch: Model # DS7457i.

C. Door Position Switches (DPS's):

1. Coordinate with the Division 8 Door Hardware supplier, prior to bidding or ordering any equipment. Provide the appropriate style of Door Position Switch and application appropriate magnet for each type of door. Each switch shall be UL listed and 100% Manufacturer tested prior to installation.
2. Provide DPS(s) at EACH exterior door location.
    a. For EACH single door locations, provide (1) DPS.
    b. For EACH double door locations, provide (2) DPS's.
3. Recessed Mount:
    a. Recessed Mount: GRI; Model # 199-12WG.
4. Roll-up Doors:
    a. Each switch shall be provided with the magnet, for the roll-up doors application and all necessary mounting brackets as recommended by the manufacturer. Provide all necessary mounting brackets and fasteners, as recommended by the manufacturer.
    b. GE (formerly Sentrol): Model #2202AU-L.

D. Motion Detectors:

1. All motion detectors shall utilize Tri-Tech features and be UL listed. Provide one (1) Motion Sensor at EACH location as shown on the drawings.
2. Wall Mount: The Motion Sensor shall offer wall or corner mounting.
    a. Bosch: Model # ISC-PDL1-W18G.
    b. Accessories for the Motion Sensor:
        1) Provide (1) Gimbal-mount bracket for EACH Motion Sensor.
        2) Bosch: Model # B328.
3. Ceiling Mount: The Motion Sensor shall offer the detection pattern applicable to area served.
    a. Bosch: Model # DS9370.

2.9 MULTIPLEX PROGRAMMER

A. Provide a total of (1) Multiplex Programmer for the purpose of programming the MUX protocol addressable points.

B. Turn over to the Architect prior to any Training and no less than ten (10) business days prior to project completion.

C. This unit shall be new, unopened, and delivered with the factory seal intact on the box that the programmer comes in.

D. Bosch: Model # D5060

2.10 SPARE CAPACITY

A. Spare capacity to add additional devices in the future shall be an integral part of the system design.

B. Within the Building and other Structures:
   1. Low Voltage Power – Regardless of where the low voltage circuit is in the building, each individual cable run shall not exceed 80% of the Amp Draw load capacity of each run.
   2. Addressable Devices – The system design should be able to add no less than Twenty (20) additional addressable devices for EACH of the following sections;
      a. Each area or wing of the building.
      b. Each floor shall be divided into two equal areas
         1) For projects with more than one floor (or level), then each floor (or level) shall also be divided into two equal areas.

2.11 FLEXIBILITY IN SYSTEM DESIGN LAYOUT

A. Where indicated on the drawings, the Installing Vendor shall have the flexibility in their design to provide system equipment at any of the MDF and designated IDF locations. Do not install equipment in other locations, unless noted otherwise.

B. Provide all quantities of equipment as specified, while maintaining the “Spare Capacity” requirements listed elsewhere within this specification.

C. Coordinate the exact location of field devices with the Architect, prior to installation.

2.12 SYSTEM CABLES, CONNECTORS, AND PATCH CORDS

A. See PART 3 of this specification and Section 270000 for additional requirements.

B. ALL cables and conductors shall be the same size and color throughout EACH cable run. Such as from EACH field device to the terminals on the IACP and Power Supply.
   1. The color of the overall cable jackets shall be green. If this color is not available, provide a permanent colored marking in green on the cable for every 10’-0” of cable for the duration of the cable run.

C. Cables/Conductors: The minimum allowable size conductors are specified below. Use larger conductors and/or additional conductors, as required. Prior to Bidding, consult with the system Manufacturer that the following cable types are acceptable. It shall be the Installing Vendors responsibility to provide and install Manufacturer approved cables. Use the Manufacturers equivalent cable requirements, to meet all code requirements [such as "Wet Rated" or "Aerial Rated" cable] for the appropriate devices.

1. CAT6 cable(s):
   a. Refer to Section 272000.
2. CAT3 cable(s):
   a. Refer to Section 272000.
3. D8125 MUX Addressable Data Protocol field devices:
   a. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.
   b. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.
4. Serial Data Bus (SDI) Data Protocol for LCD Keypads:
   a. The length of the cable run shall not exceed 1,000 feet.
   b. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.
   c. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.
5. Non-addressable initiating field devices shall have the addressable module installed at the device.
6. Motion Sensors (MS):
   a. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.
   b. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.
7. Door Position Switches (DPS's):
   a. Non-Plenum: West Penn: Model# 221 (22/2ns), or approved equal.
   b. Plenum: West Penn: Model# 25221B (22/2ns), or approved equal.

D. Connectors/Terminations: Use the manufacturer approved wire strippers and crimping tool as required.

1. CAT6 cable(s):
   a. Refer to Section 272000.
2. CAT3 cable(s):
   a. Refer to Section 272000.
3. Maintain all cable and system requirements.

E. Patch Cords: Size EACH cable length to provide ease of maintenance, while not leaving excessive slack.

1. CAT6 cable(s):
   a. Refer to Section 272000.
2. CAT3 cable(s):
   a. Refer to Section 272000.
3. Maintain all cable requirements.

2.13 TEST FORM

A. See Section 270000 Low Voltage Systems General Requirements for "Test Forms" and "Testing & Complete System Functionality", and "Testing" listed elsewhere in this specification for more information.

B. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below. From left to right, list the information for EACH software feature set and for EACH device.

1. Provide a Pass, Fail, and N/A column. This shall be checked off during the course of the Testing process, to determine a "Pass" or "Fail".
2. To obtain a 100% Passing Test EACH row shall have; a "Pass", all answers shall be yes, and shall NOT have any negative comments.
3. List the name (i.e.: Motion Sensor, Door Position Switch, etc.).
4. List the Serial Number for EACH device.
5. List the device ID number.
6. List the Device model number.
7. List the Device Location (for example; South Wing Side Door, MDF Room XXX, etc.).
8. The Test Forms shall have the following categories;
    a. Equipment and Devices;
        1) Use the information on the System Device Naming Matrix as the basis for this form.
        2) Provide a separate row for EACH item/equipment/device test listed below.
    b. Submit this information with the Submittals and Shop Drawings in 11' x 17' format, or smaller.
9. The Test Forms shall include EACH of the items identified in "Test Forms" and the following tests listed below, but shall not be limited to the following;
    a. Equipment and Device Testing:
        1) For Data Cable(s): Refer to Section 272000.
        2) Motion Sensors:
            a) Has EACH Motion Sensor detection pattern been "walk tested" for the appropriate room or area location?
            b) Is the "look down" sensor enabled?
        3) Raceway, Cabling, and Terminations:
            a) General:
            b) Is EACH of the cable type(s) provided/installed as specified?
            c) Are EACH of the cable runs installed without any splices?
            d) Do all cables maintain their minimum bend radius?
            e) Is EACH cable labeled as specified?
            f) Have EACH of the cable runs been combed and are tangle free?
            g) Systems Plywood Backboard(s):
            h) Is the Service Loop located above or near EACH of the Systems Plywood Backboard(s) as specified?
            i) Is the cabling installed in a neat and organized manner?
            j) Is the equipment installed in the correct location, which leaves plenty of room for expansion, as specified (i.e.: NOT in the middle of the backboard).
            k) Are the approved wire fasteners and wire ties installed?
            l) Terminations:

m) Are EACH of the approved connectors provided and installed as specified?
n) Are EACH of the cables terminated as specified?
o) Intrusion Alarms Control Panel (IACP):
p) Is the IACP installed correctly?
q) Are the cables combed and dressed neatly?
r) Power Supplies:
s) Is EACH of the system Power Supplies installed correctly?
t) Is EACH of the system Power Supplies functioning correctly after removal of the primary AC power?
u) Does the IACP log in the event history, the loss of primary AC power for EACH Power Supply as specified?

2.14 ADDITIONAL INTRUSION ALARM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 - EXECUTION

3.1 GENERAL

A. See Section 270000 Low Voltage Systems General Requirements for additional information.

B. See Section 272000 Data and Voice Infrastructure for additional cable and installation requirements.

C. Prior to rough-in, coordinate with the Architect for the exact location(s).

D. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

E. Coordinate with the Owner for final program settings.

3.2 INSTALLATION

A. Setup, connect, and configure the system per the manufacturer's recommendations to operate as intended. Load, configure, and test the software for a fully functional system.

B. T-Tapping of Addressable device conductors is acceptable, when all of the manufacturer's requirements for the MUX protocol are fulfilled.
1. T-Tapping of Notification device conductors is NOT acceptable.

3.3 INTEGRATION TO OTHER LOW VOLTAGE SYSTEMS

A. See "System Operation" listed elsewhere in this specification for more information.

3.4 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Prior to rough-in, coordinate with the Architect for the exact location(s). Install all devices and/or equipment per the manufacturer's recommendation.

B. The IACP shall be mounted at 60" from the finished floor to the top of the enclosure, and shall be level.

C. Prior to Bidding, coordinate with the Installing Vendor(s), for actual quantities and locations of power requirements (see "Intrusion Alarm Power Supply" and "Flexibility in System Design Layout" in PART 2 of this specification). At a minimum, provide 120vac wiring and connections to EACH the IACP Transformer Enclosure for the IAPS as shown on the drawings and as required for a fully functional system, while maintaining all of the design requirements described elsewhere within these specifications. This shall include the following;

1. Install the Transformer Enclosure (with duplex 120vac outlet located inside the enclosure) at the following location(s);
    a. Provide and Install one (1) Transformer Enclosure above the IACP location shown on the drawings.
    b. The bottom of each Transformer Enclosure shall be a minimum of 6" inches above the accessible ceiling tiles (where applicable) or 8'-0" above the finished floor, directly above the Intrusion Alarm Control Panel.
    c. Provide one (1) ¾ inch conduit between the Transformer Enclosure to the Intrusion Alarm Control Panel, for the purpose of running a power cable from the plug-in transformer (within the Transformer Enclosure) down into the IACP.

D. The Keypad(s) shall be mounted at 48" from the finished floor to the top of the Keypad, and shall be level.

E. Motion Sensors:

1. Ceilings Mount – Install per manufacturer's recommendations.
2. Wall Mount motion sensors shall be mounted:
    a. Install per manufacturer's recommendations and at 8'-0" above the finished floor, unless approved by the Architect.
    b. Provide (1) 4-square junction box with a single-gang reducing ring and (1) 1" conduit up to the accessible ceiling space for EACH motion sensor.
    c. Locate on a perimeter wall. The detection pattern shall NOT face toward exterior windows.
    d. Sensor shall be switch selected to provide a 25'-0" x 32'-0" protection pattern.
    e. Enable the bottom "look down" sensor.
    f. Enable the anti-masking feature.
    g. The following hard wired contacts shall be monitored:
        1) Alarm contact closure shall be monitored by an addressable point.
        2) The Trouble contact closure shall NOT be monitored.
        3) The Tamper switch contact closure shall NOT be monitored.
    h. Prior to rough-in, consult with the manufacturer. Upon their suggestion, install the Gimbal-mount bracket where required for proper detection.

i. Adjust each sensor as required per the manufacturer's recommendations for each area and location. Walk test each device to confirm the detection pattern area is set correctly.
j. When all adjustments have been completed, leave the detection LED's in the active mode. The Owner wants to view the LED's at all times.

3.5 ADDRESSABLE MODULE INSTALLATION

A. Single Input Addressable Point Module(s) shall be used for EACH device as outlined below.

B. Motion Sensors:

1. The addressable input module shall be installed inside the motion sensor or installed inside the Motion Sensor Junction Box, and monitor the "Alarm" contact.

C. Provide a device cable from each of the following non-addressable field device to an Addressable Module Junction Box;

1. Loss of Primary Power:
   a. For Loss of Primary Power, wire the IAPS's relay output to a separate single addressable input.
2. Freezer Alarm (where applicable).
   a. For Freezer, wire EACH Freezer Alarm relay output to a separate single addressable input.

D. The Addressable Module Junction Box(s) shall consist of the Addressable Module being installed in a 4-square junction box (with a blank cover) 6" to 12" above the accessible ceiling.

1. For doors, install the junction box on the hinge side of the door, and approximately 5'-0" from the door on parallel or perpendicular walls, to accommodate servicing this unit without blocking the doorway. From the junction box, wire the door contacts as recommended by the manufacturer.
2. For other devices that are out in the open, or require the addressable module to be installed in a location other than at the device, install the addressable module in a logical location on the nearest wall that is a minimum of 5'-0" from the nearest doorway. Indicate on the As-builts where the junction box is for each device.
3. Conceal all wiring within the walls and/or ceiling, as required.

3.6 PROGRAMMING AND CONFIGURATION

A. The Installing Vendor shall program the system as coordinated with the Owner, as described throughout this specification, and as required for a fully functional system.

B. The Installing Vendor shall program the Configuration Files of the system to be automatically backed up onto the Owners Designated Server. These back ups shall occur once per week. Coordinate with the Owners IT Department, as required.

C. The partitioning of the system, shall be programmed as follows;

1. As shown on the Drawings.
2. As coordinated with the Owner.

D. For Bidding Purposes, the Installing Vendor shall be expected to program the system to Industry Standards, based on a project of this size, scope, typical functionality for this market segment, and as described throughout this specification.

1. Review the testing requirements specified elsewhere within this specification for additional information.

3.7 TESTING

A. See Section 270000 Low Voltage Systems General Requirements for “Test Forms” and “Testing & Complete System Functionality”, and “Test Forms” listed elsewhere in this specification for more information.

B. The Installing Vendor shall provide the staff and necessary equipment to meet or exceed the testing requirements.

C. The Installing Vendor shall provide the Staff, walkie-talkies, test equipment, additional equipment, resources, and time necessary to support the Owner to provide the Commissioning of this Systems. The installing Vendor shall demonstrate to the Owner the complete operation of each device, head end functionality, system configuration, and software functionality. The Installing Vendor shall also make adjustments to the equipment and changes to the program settings, as requested.

3.8 TRAINING

A. Training For Site Staff:

1. The training sessions shall be held at the project site.
   a. Provide Training for up to ten (10) Site Staff.
   b. Provide a total of two (2) separate training sessions for the Owners personnel. Schedule both training sessions with the Owner, providing a minimum of 14 days advance notice, and offer a minimum of three dates to choose from.
2. The Site Training Session(s) shall only take place AFTER the Owners Administrative Staff have had their first training session.
3. The Training Session shall consist of:
   a. Providing the printed Training Manuals to EACH attendee.
   b. Being conducted by one of the designated Installing Vendor technicians. The training shall be a minimum of one (1) 2-Hour session that shall be held on the same day, and provide a thorough and in depth full feature training session. Provide additional training time as required, to answer EACH of the staff’s questions, at no additional cost to the Owner. This training shall address the Owners requirements identified on the documents.

3.9 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 270000 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.

1. Provide an “Equipment Information Sheet”, in the O & M manuals. At a minimum, from left to right, provide the following information;
    a. Manufacturers Name.
    b. Equipment Device Type (such as Workstation, Control Panel, etc).
    c. Location (such as MDF room 103, or area of building).
    d. IP Address.
    e. Software Name.
    f. Software Version that is installed on the device.
    g. List the “Highest Level” configurable password for EACH device.
    h. List “EACH System Operator” password.
    i. List all other password settings for EACH device.

END OF SECTION 281600

SECTION 283100 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. Conform to General Conditions, Supplementary Conditions and Division 01.

B. Furnish and install a complete analog, addressable Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. The system shall include, but not be limited to; control panel(s), peripherals, power supplies, alarm initiating and indicating devices, conduit, junction boxes, fittings, wire, connections to devices, and all other necessary material for a completely reliable and fully functional system. All units shall be located in accordance with the plans. The system shall be of modular design to facilitate both expansion and service and shall be microprocessor based. The system shall operate as a low voltage, non-coded, class "B" Fire Alarm System.

C. To silence and reset the system, the Fire Alarm Control Panel (FACP) and Remote Control Annunciator Panel(s) (RCAP)’s will be used, as indicated on the drawings. The Fire Alarm System shall be installed, fully functional, tested and accepted by the AHJ, prior to acceptance from the Engineer.

D. The new Fire Alarm System shall meet all requirements of the Authority Having Jurisdiction (AHJ).

E. The Fire Alarm Control Panel (FACP) shall supervise the integrity of all circuits. The entire Fire Alarm system shall be provided with functional ability to automatically charge standby batteries and to maintain system operation, during power outages for the duration of time, as specified elsewhere in the “Battery Backup for Complete System Operation” portion of this specification.

F. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

G. Division 26 Basic Materials and Methods Section applies to work specified in this section.

1.2 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed as a product of the SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial or pending listings shall not be acceptable.

B. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC Article 760. All circuits must be marked in accordance with NEC Article 760-23.

C. All fire alarm equipment shall be of a single supplier and installed by an authorized factory distributor, located within 50 miles of the project, to ensure proper component application, system uniformity and the availability of prompt, emergency service by factory trained technicians.

D. These specifications are based on equipment manufactured by Notifier. Substitutions of the specified equipment and/or supplier will be considered providing that sufficient documentation is provided to the Engineer which certifies that the equipment and/or supplier qualification meets the requirements of this specification. Any request for substitutions shall be submitted by the Contractor in writing so as to be received by the Architect not later than ten (10) days prior to the date set for the bid opening. Approval by the Engineer will be issued by addendum prior to the bid date.

E. Wiring arrangement shown on the drawings represents that required for the Notifier system. Suppliers interested in furnishing substitute systems shall furnish to the Engineer a Riser Diagram showing size, number, type and arrangement for all interconnecting wiring with the request, for prior approval to bid. This Riser shall also be furnished to each interested bidding contractor during the bidding period.

F. The system subcontractor for this Fire Alarm System shall be currently listed and approved by Underwriters Laboratories, Inc. Certificate Service for Protective Signaling Services--Local, Auxiliary, Remote Station and Proprietary Signal System Listing Program. Proof of this listing shall be included with all prior approval requests. At the request of the Engineer, an UL certificate specific to this installation shall be furnished by the Fire Alarm System Sub-Contractor. The U.L. certificate shall be issued only by Fire Alarm System Sub-Contractor. Certificates issued by any company not directly associated with the installation of this project will be rejected.

G. U.L. Approved system:

1. Notifier NFS2-640; By Sound Electronics; (253) 472-2955

H. The equipment and installation shall comply with the current applicable provisions of the following standards:

1. National Electric Code, article 760.
2. National Fire Protection Standards:
   a. NFPA 71 Central Station Signaling Systems-Protected Premises Unit.
   b. NFPA 72 National Fire Alarm Code
   c. ADA Americans with Disabilities Act
   d. WAC 51-20 Washington Barrier Free Regulations

I. All requirements of the Local Authority Having Jurisdiction.

J. If any conflicts occur between government adopted codes/rules and the drawings, the codes are to govern.

K. The system and all components shall be listed by Underwriters Laboratories, Inc. for use in fire protective signaling systems under the following standards as applicable:

UL 38 Manually Actuated Signaling Boxes.

UL 268	Smoke Detectors for Fire Protective Signaling UL 17 Smoke Detectors, Single and Multiple Station
UL 268A	Smoke Detectors for Duct Applications.
UL 346	Waterflow Indicators for Fire Protective Signaling Systems.
UL 464	Audible Signaling Appliances.
UL 864	Control Units for Fire Protective Signaling System.
UL 1481	Power Supplies for Fire Protective Signaling.
UL 1638	Visual Signaling Appliances.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Prior to installation of any equipment, the Contractor shall provide the Engineer with 7 copies of submittals for approval.

B. Submittals shall include floor plans with fire alarm equipment, point to point wiring diagrams, zoning, battery calculations, one-line risers, equipment specification sheets and graphic annunciator details/artwork.

C. The Contractor is responsible for assuring that the conduit size and wire quantity, size, and type is suitable for the equipment supplied. The Contractor shall review the proper installation of each type of device with the manufacturer’s representative.

D. Contractor shall submit floor plan shop drawings and complete equipment submittals (3) copies to each Fire Code Enforcing Authority as required, for approval, and pay all required review fees.

E. The shop drawings shall include a letter signed by either a NICET Level III certified designer or a registered professional engineer, currently employed by the system sub-contractor, responsible for the design depicted in the submittals and shop drawings. The letter shall state that the shop drawings conform to NFPA, NEC, and local codes as adopted by the local authority having jurisdiction or shall list items of non-conformance.

F. Provide shop drawings that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes and connection wiring of entire fire alarm and detection system. Include layout wiring and riser diagrams

G. Floor plans for the project have been developed by the engineer using AutoCAD (tm) 2007 software. These drawing files will be made available to the contractor for development of shop drawings and/or "As Builts" for a fee of $20.00 per sheet.

1.4 SERVICE

A. The equipment manufacturer representative shall have a local office staffed with trained, full-time employees who are capable of performing testing, inspection, repair maintenance services, and inventory parts for the life of the fire alarm system.

B. This organization must have a minimum of fifteen (15) years of experience servicing fire alarm systems and shall respond to service calls within 48 hours during or after the warranty period.

C. Prior to completion of the installation, the manufacturers representative shall provide a preventative maintenance agreement, which shall at the Owners option, become effective at the end of the 12 month warranty period.

D. Upon completion of the project, the system subcontractor shall provide to the owner, an agreement for the purpose of providing off-site monitoring services.

1.5 CONTROL PANEL REQUIREMENTS

A. The control panel shall provide the following capacities:

1. Intelligent/Addressable loops: 2
2. Intelligent detectors or modules: 636
3. 6 amps for notification circuits
4. Network ready for future installation of NAM232 module.

1.6 GENERAL OPERATION

A. Upon actuation of any initiating device (manual stations, automatic detectors, etc.) all alarm indicating units (horns, visual alarm lamps, etc.) shall operate continuously until such time as the manual station or automatic detector is restored to normal and the fire alarm control unit 'silenced'. Alarm signals shall be annunciated by point and zone at the control panel.

B. As per plans, the following additional functions shall be performed in the event of an alarm:

1. Alarms shall be annunciated at a remote annunciator.
2. Alarms shall trip the municipal system, and/or remote central station system.
3. Magnetic door holders shall release self-closing fire and smoke doors (where applicable).
4. All air handling systems of 2000 CFM or larger shall be shutdown.
5. Strobe units shall be controlled independently from audible units. Upon system silence, strobe units will continue to flash until system reset is provided.

C. 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 signaling devices will be de-energized. Should an alarm be initiated in a subsequent zone after an alarm has been acknowledged, the alarm signals shall be re-energized. The control panel shall be restored to normal by operation of a reset switch after the initiating device has been restored to normal.

1.7 SYSTEM FUNCTIONAL OPERATION

A. The system shall operate as a low voltage, Intelligent, point identification fire management system. The fire detection control system shall monitor Intelligent (Analog) and Addressable (Digital) devices, point identify the alarm location and transmit a signal to the monitoring agency.

B. The fire alarm control panel shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate and facilitate expansion, building parameter changes or changes as required by local codes. All software operation shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

C. System Alarm Detection and Reporting: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1. The System Alarm LED shall flash.
2. A local Piezo-Electric signal in the control panel shall sound.
3. The 80-character LCD display shall indicate all information associated with the Fire Alarm condition, including: type of alarm point, its location within the protected premises, and the time and date of that activation.
4. If any of the available optional serially connected equipment is being used, then each of the connected peripherals will display/print the information associated with the Fire Alarm Control Panel condition, including the time/date stamping of the change of status event.

D. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (Alarm Indicating Appliances and/or relays) shall be activated. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition will have display priority.

E. System Trouble Detection: When a trouble condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The System Trouble LED shall flash.
2. A local Piezo electric signal in the control panel shall sound.
3. The 80-character LCD display shall indicate all information associated with the Fire Alarm trouble condition, including: type of trouble point, its location within the protected premises, and the time and date of that activation.
4. If any of the available optional serially connected equipment is being used, then each of the connected peripherals will display/print the information associated with the Fire Alarm Control Panel condition, including the time/date stamping of the change of status event.
5. If applicable, all system output programs assigned via control-byevent equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Indicating Appliances and/or relays) shall be activated.
    a. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition will have display priority.

F. System Common Control Switch Operation:

1. Acknowledge (ACK/STEP) Switch. Activation of the 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 LED from flashing mode to steady-ON mode. 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.
   a. In this case, the local Piezo sounder shall not silence, and the Alarm/Trouble LEDs shall not transfer to their steady-on mode, thus signaling to the operator that more Alarm/Trouble conditions are present in the system.
   b. Alarm conditions shall always have display priority before Trouble conditions. Depression of the Acknowledge switch shall also cause a corresponding (time-stamped) message to be displayed on all system peripheral equipment (if used).
   c. Occurrence of any new Alarm or Trouble conditions in the system shall cause the Control Panel to resound the Local Piezo sounder and repeat the Alarm or Trouble sequences.
2. Signal Silence Switch: 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. The selection of indicating circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.
3. Alarm Activate (Drill) Switch: The Alarm Activation Switch shall activate all local system LED's, light each segment of the liquid crystal display and display the panel software revision for service personnel.
4. System Reset Switch: 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.
   a. 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.
5. Lamp Test Switch: Activation of the Lamp Test Switch shall sequentially turn on all LED indicators, System Liquid Crystal Display and Local Piezo-Electric signal, and then automatically return the Fire Alarm Control Panel to the previous condition.

1.8 FIELD PROGRAMMING

A. The system shall be programmable, configurable, and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits. All programming shall be accomplished through the standard common control panel keyboard or through the use of the CRT-2 keyboard. All field defined programs shall be stored in non-volatile memory.

B. The programming function shall be enabled with a special 5-digit password that may be defined specifically for the system when it is installed.

C. This password may be changed to a new value at any time by systems's Sub-Contractor. In the event that the system's sub-contractor may define a password and then lose or forget it, the system shall be designed so that the valid password may be determined by special procedures available through the system manufacturer.

D. The system shall provide means for automatic programming of its operation to conform with certain N.F.P.A. Standards through internal software. The following N.F.P.A. operations are to be available through this means:

1. NFPA 72: National Fire Alarm Code

1.9 SYSTEM OPERATIONS

A. Smoke Detector Sensitivity Adjust: 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 CRT-2.

1. Sensitivity range shall be within the allowed UL window, and shall be a HIGH/MEDIUM/LOW selection.

B. Alarm Verification: Each of the Intelligent/Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The Alarm Verification Function shall be from 5-50 seconds and each detector shall be able to be enabled/disabled during the field programming of the system, or anytime after system turn-on. The Alarm Verification shall not require any additional hardware to be added to the Fire Alarm Control Panel.

C. System Reports: The system will be able to generate and print a summary of all of the Detectors, Modules, Pull Stations, and Zones, which are currently active in the System. This printout will require password protection to prevent unauthorized user access, and will automatically print the system report using "soft" (single push) keys. No computer expertise will be required to initiate the System Report sequence.

1. The following parameters will be printed for all installed system points whenever a "System Report" is requested:
    a. Point Status Report: Upon command from a password-authorized operator of the system, a report will 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.

D. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer, which will be capable of storing up to 400 system output/input/control activations. Each of these activations will be stored and time and date stamped with the actual time of the activation, until a password authorized operator requests that the contents be either displayed, or printed. The contents of the History Buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed. History Buffer Reports (whether Displayed or Printed), will be instantly distinguishable from all other displayed or printed system reports through the use of a semicolon in the time/date stamp of the data.

E. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each Intelligent System Detector and shall analyze the detector responses over a period of time. 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 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. 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.

PART 2 - PRODUCTS

2.1 GENERAL

A. The fire alarm system design is based on equipment as manufactured by Notifier. Any changes resulting from differences between the specified product and substitute manufacturers shall be the responsibility of the contractor as specified under the General Conditions, "Substitutions".

2.2 CENTRAL PROCESSING UNIT MODULE

A. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the System Common Control Annunciator by the Central Processing Unit.

B. 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. Such control-by-event programs shall be held in non-volatile programmable memory (NVRAM), and shall not be lost even if system primary and secondary power failure occurs.

C. The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-Of-Day and date shall not be lost if system primary and secondary power supplies fail. The Central Processing Unit shall provide a single Form C General Alarm Contact, and a single Form C General Trouble Contact, rated at 5A (30VDC), minimum.

2.3 DISPLAY INTERFACE ASSEMBLY

A. The System Display shall be the system common control/annunciator, and shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters. The Display Interface Assembly shall contain, and display as required, the custom alphanumeric labels for all Intelligent Detectors and Addressable Modules. Such label information shall be stored in programmable nonvolatile memory (NVRAM).

B. The System Display shall provide an 80-character alphanumeric Liquid Crystal Display (LCD). It shall also provide 8 Light - Emitting-Diodes (LEDs), which will indicate the status of the following system parameters:

1. AC POWER

2. FIRE ALARM
3. PRE ALARM WARNING
4. SECURITY ALARM
5. SUPERVISORY SIGNAL
6. SYSTEM TROUBLE
7. DISABLED POINTS
8. ALARM SILENCED

C. The System Display shall include the following operator control switches:

1. ACKNOWLEDGE - RESET
2. SIGNAL SILENCE - RESET
3. LAMP TEST

2.4 SYSTEM POWER SUPPLY

A. The Main Power Supply for the Fire Alarm Control Panel/Transponders shall be integral to the control panel itself, and shall provide all control panel and peripheral device power needs, as well as 3 amperes of regulated 24 VDC power for Audio-Visual alarm indicating devices. Provisions will be made to allow the Audio-Visual power to be increased as required by adding modular expansion Audio-Visual power supplies. All power supplies shall be designed to meet UL and NFPA requirements for power- limited operation on all indicating and initiating circuits.

B. Positive-temperature-coefficient thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs.

C. Input power shall be 120 VAC, 60 HZ. The power supply shall provide an integral Dual-Rate Battery Charger for use with batteries up to 18 AH. This integral Battery Charger will automatically inhibit the deep discharge of the system standby batteries, and shall be protected against the accidental reverse polarity connection of the standby batteries.

D. The Main Power Supply may also be used with external battery and charger systems.

E. The Main Power Supply shall continuously monitor all field wires for Earth Ground conditions, and shall have the following LED indications:

F. Negative Ground Fault LED - Positive Ground Fault LED

G. Battery Fail LED - AC Power Fail LED

2.5 AUDIO VISUAL POWER SUPPLY

A. The Audio Visual Power Supply for the Fire Alarm Control Panel/Transponders shall be integral to the control panel itself, and shall provide 6 amperes of unregulated 24 VDC power for Audio-Visual alarm indicating devices. Provisions will be made to allow the AudioVisual power to be increased as required by the addition of more Audio/Visual power supplies. All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external circuits.

B. Positive-temperature-coefficient thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs.

C. Input power shall be 120 VAC, 60 HZ. The power supply shall be capable of being backed up with a standby battery, or may be used with external battery and charger systems. Battery arrangement may be configured in the field. All standby power connections shall be supervised.

2.6 FIRE ALARM POWER SUPPLY(S) (FAPS)

A. The Fire Alarm Power Supply(s) for the Fire Alarm System shall provide 6 amperes of VDC power for Audio-Visual alarm Notification devices. Provisions will be made to allow the Audio-Visual power to be increased, by the addition of more Fire Alarm Power Supplies (FAPS)'s as required. All FAPS's shall be designed to meet UL and NFPA requirements for power-limited operation on all external circuits.

B. Manufactured by Honeywell, Model #HPF24S6, or Notifier, Model #FCPS-24S6. Provide quantities as required.

2.7 REMOTE ANNUNCIATOR PANEL (RCAP)

A. For the purpose of providing a remote system status display, an LCD annunciator shall be provided in locations as indicated on the drawings.

B. Features Include:

1. 80 character LCD display
2. Control switches for System Acknowledge, Signal Silence, and System reset.
3. On-line/Power LED
4. Local Piezo sounder with Alarm/Trouble switch for audible indication of alarm and trouble conditions.

C. Provide flush or surface mounted, in location as indicated on the drawings.

D. The RCAP shall be programmed to clearly indicate the Address and location of any automatic or manual initiating device and control or monitor module.

E. Where indicated in outdoor locations, provide a weatherproof, heated enclosure.

F. FDU-80

2.8 BATTERY BACKUP FOR COMPLETE SYSTEM OPERATION

A. Battery backup power shall be an integral part of the Fire Alarm System.

B. **Prior to bidding, it shall be the Installing Vendors responsibility** to confirm that the proposed fire alarm system will meet or exceed the local Authority Having Jurisdiction (AHJ) requirements for battery backup power. At a minimum, provide battery backup power for the entire Fire Alarm system to provide 24 hours of standby operation, and a minimum of 5 minutes of alarm operation. Batteries shall be sized to provide at least 20% spare capacity.

C. Provide and install gel-cell, maintenance free batteries for the FACP and EACH FAPS that is provided. Provide quantities as required for maintaining or exceeding the submittal calculation requirements listed elsewhere in Section 27 00 00 “Submittals and Shop Drawings”.

D. The FACP and EACH FAPS shall have automatic switch over to stand-by batteries when AC power fails. The power supply/charger shall be an integral portion of the control panel and/or power supply and be capable of charging fully discharged system batteries to 100% in 8 hours.

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. The date shall be legible and clearly written in one-inch numbers and be visible when the enclosure door is open.

2.9 FIELD DEVICES

A. Intelligent and Addressable Photoelectric Smoke Detectors: The intelligent photoelectric detectors shall be intelligent and addressable, and shall connect with two wires to one of the fire alarm control panel signaling line circuit loops. The detectors shall use the photoelectric principle to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

1. The detectors shall be ceiling mount and shall include a twist-lock base.
2. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel. The detectors shall provide address-setting means on the detector head using rotary decimal switches. The detectors shall also store an internal identifying code, which the control panel shall use to identify the type of detector.
3. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of detector LEDs shall be controlled through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. The detector sensitivity shall be set through the fire alarm control panel, and shall be adjustable in the field through the field programming of the system.
5. FSP-751

B. Duct Smoke Detectors: Duct Detectors shall be addressable, intelligent, 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air duct(s), with properly sized air sampling tubes. Where duct detectors are utilized for smoke control, four wire operation is required. Provide with addressable photoelectric detector as specified elsewhere.

1. FSD-751P

C. Monitor Modules: Monitor modules shall be provided to connect one supervised IDC zone of conventional alarm indicating devices (any N.O. dry contact devices, including 4-wire smoke detector(s)), to one of the fire alarm control panel signaling line circuit (SLC) loops.

1. The monitor module shall mount in a 4-inch square, 2-1/8" deep electrical box, to a surface mounted back box, or directly into the fire alarm control panel.
2. The IDC zone may be wired for Style D or Style B operation. The monitor module shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code, which the fire alarm control panel shall use to identify the type of device. An LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. Notifier: Model FMM-1

D. Control Module: The control module shall be used to connect a conventional indicating appliance circuit of 24 VDC compatible polarized audiovisual indicating appliances to one of the SLC loops. The control module shall mount in a standard 4-inch square, 2-1/8" deep electrical box. The control module may also be wired as a dry contact (form C) relay. Power for the relay coil shall be provided by the SLC loop to reduce wiring connection requirements.

1. Audio-visual power shall be provided by a separate loop from the main control panel or from supervised remote power supplies.
2. Notifier: Model FCM-1

E. Isolator Module: The isolator module may be used to isolate wire-to-wire short circuit on an SLC loop in order to limit the number of other modules or detectors that are incapacitated by the short circuit fault. If a wire-to-wire short occurs, the isolator shall automatically open circuit the SLC loop. When the short is corrected, the isolators shall automatically reconnect the isolated section of the SLC loop.

1. Provide isolation modules at logical junctions corresponding to architectural wings or sections of the building or campus.
2. At minimum, an isolation module shall be provided for every 50 SLC sloop devices. Should multiple, remote power supplies be required, a minimum of one isolation module shall be provided for devices served by each remote power supply.
3. Notifier: Model ISO-X

F. Addressable Manual Stations: Addressable manual stations shall be provided to connect one addressable, supervised manual station to one of the fire alarm control panel signaling line circuit (SLC) loops. The manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch. Manual fire alarm stations shall be double action type with a key operated test-reset lock, and shall be designated so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

1. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key. The word FIRE shall appear on the front of the stations in raised letters.
2. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single gang box. The manual stations shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code, which the control panel shall use to identify the type of device.
3. An LED shall be provided which shall flash under normal conditions, indicating that the manual station is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. The station shall provide a key reset. The key shall be the same as used for the fire control panel.
   a. Notifier: Model NBG-12LX
4. All addressable manual fire alarm stations shall be surface mounted to a back box. This back box will be color coordinated with the front panel of the manual fire alarm station, and shall not allow any corner of the manual fire alarm station to protrude.
   a. Notifier: Model SB-10
5. A mounting plate will be provided to allow the installation of an isolator/control/monitor module directly in the fire alarm control panel back box.
   a. Notifier: Model MOD-1
6. Provide covers for all manual pull stations. Cover shall be Lexan with integral horn.
   a. Notifier: Model STI-1130 w/spacer

G. Horn/Strobe (High Intensity): Combination horn/strobe unit shall be 24 VDC, red, and compatible with the control panel. The horn shall have field selectable sounds, a minimum of 100 DB at 10 feet, screw terminals and can operate independent of the strobe. The strobe shall be xenon flash tube type rated at a minimum of 75 candela and meet or exceed the requirements of the Americans With Disabilities Act (ADA).

1. Combination units shall be suitable for surface mountings on a matching back box or semi-flush mounting on a standard 4" square box.
   a. Notifier: SpectrAlert Series

H. Ceiling Mounted Horn/Strobe: Ceiling mount horn/strobe shall be 24 VDC, red, and compatible with the control panel. Strobes shall be xenon flash tube type rated at 75 candela minimum and meet or exceed ADA requirements.

I. Weatherproof Horn/Strobe: Weatherproof horn/strobe shall be 24 VDC, red, and compatible with the control panel and rated for outdoor use. Wheelock MT-24-WM-VFR with IOB-R weatherproof back box.

J. Strobe Only: Strobes shall be 24 VDC, red, and compatible with the control panel. Strobes shall be zenon flash tube type rated at 75 candela minimum and meet or exceed ADA requirements.

K. Waterflow/Tamper/Pressure switches and Post Indicator Valve: Unless indicated otherwise on the electrical drawings, sprinkler waterflow, tamper, and low pressure switches shall be furnished under Division 21 and connected under Division 26. Coordinate location and wiring requirements with Mechanical Contractor.

2.10 UNIVERSAL DIGITAL ALARM COMMUNICATOR TRANSMITTER (UDACT)

A. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

B. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

C. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.

D. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.

E. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.

F. Communication shall include vital system status such as:

1. Independent Zone (Alarm, trouble, non-alarm, supervisory)
2. Independent Addressable Device Status
3. AC (Mains) Power Loss
4. Low Battery and Earth Fault
5. System Off Normal
6. 12 and 24 Hour Test Signal
7. Abnormal Test Signal (per UL requirements)
8. EIA-485 Communications Failure
9. Phone Line Failure

G. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

2.11 SPRINKLER SUPERVISORY DEVICES

A. Sprinkler supervisory devices shall be connected to the fire alarm system such that the movement of a valve from the normal (open or closed) position shall sound a supervisory trouble signal. The devices shall be provided by the Sprinkler Contractor and the monitor module and switch wired by the electrical contractor.

2.12 TRANSIENT AND SURGE PROTECTION

A. If not provided as an integral part of the system power supply, an external, 120 VAC transient and surge shall be provided for protection of all components of the system. Protector shall be UL listed under sections 1449, 1283 and 497A, have a minimum energy handling of 70 Joules on line to line, line to neutral and line to ground spikes. Response time shall be 5 nanoseconds or less and shall begin at 140 VAC.

2.13 WIRE GUARDS

A. Where designated on the drawings, provide wire guards to protect the device from damage. Wire guards mount directly to the device, and not affect the performance of the device.

2.14 SPRINKLER SYSTEM BELL CONNECTION

A. Provide connection to the Sprinkler System Bell, provided by the Sprinkler Contractor. Bell shall connect to the FACP. Provide 24VDC that shall be activated by one or more of the sprinkler system flow or pressure switches.

PART 3 - EXECUTION

3.1 APPROVED EQUIPMENT AND PERMIT

A. No equipment shall be delivered to the job site until shop drawings have been reviewed and AHJ approved. A reviewed and AHJ approved shop drawing set shall be continuously available at the job site during construction.

B. Obtain a permit as required from local AHJ prior to installation of equipment.

3.2 WIRING

A. All wiring shall be contained in metal raceways. Wiring insulation shall be one of the types required by NEC 725-16 and shall be consistently color coded throughout the system.

B. Permanent wire markers shall be affixed to all conductors at terminations and splices. Numbering system shall be consistent with shop drawings.

C. All terminations shall be T & B "Sta-Kon" (or equivalent) self insulated, flanged or forked tongue lugs where connected at screw type terminals. Wiring in main control cabinet shall be neatly arranged and bundled with wire ties (or equivalent).

D. Install wiring equipment in strict accordance with manufacturer's instructions. No wire other than the detector circuit shall be permitted in conduit feeding detectors unless approved.

E. Minimum wire size for 120 VAC wiring shall be #12 THHN.

F. Minimum wire size for initiating alarm circuit, i.e., pull stations, heat and smoke detectors, shall be minimum #16 twisted shielded pair FPL rated.

G. Minimum wire size for speaker and indicating circuits, i.e., horns, strobes, shall be minimum #16 shielded, twisted FPL rated cable. Indicating circuits shall be sized in accordance with manufacturer recommended voltage drop requirements, minimum size #14 AWG.

H. Provide separate raceway or shielded cable as required or recommended by system manufacturer to prevent the introduction of noise into the system.

I. All junction boxes for fire alarm shall be red and labeled in minimum ¼" letters: FIRE ALARM.

J. Connections to the communicator will be made by the Fire Alarm Vendor, in the presence of the Electrical Contractor, 1-week prior to the final acceptance test with the AHJ.

K. All circuits shall be identified in accordance with table 3.02L with labels to include wire type, quantity and circuit number. Wire code shall match AHJ approved shop drawings wire code. Labels must be provided at the FACP and all junction boxes. Labels shall be produced using an electronic labeler.

Table 3.02 L

Example: C2HX3
C = Signal Circuit Wire
2 = Signal circuit number
H = Annunciator wire
X = Addressable initiating device circuit wire
3 = Addressable initiating device circuit number

3.3 AUXILIARY CONTROLS

A. Conductors and power supplies of sufficient size shall be installed to minimize voltage drop consistent with the proper operation of all devices. Destructible link smoke dampers shall not be connected to the fire alarm system. Fan shutdown control circuits and smoke removal circuit electrically supervised (subject to NFPA 72 requirements) and may by incorporated into the fire alarm raceway system, except that limited energy circuits shall be routed separately from line voltage circuits as required by code (NEC article 725).

3.4 AIR DUCT HEAT AND SMOKE DETECTORS

A. Install in accordance with manufacturer's recommendations.

3.5 ADDITIONAL FIELD DEVICES AND INSTALLATION LABOR

A. In order to minimize the schedule and cost impact of implementing minor changes during the course of construction, the following list of material and installation labor shall be included in this scope of work. The contractor shall include in his bid the listed materials, labor that is based on existing jobsite conditions and established construction standards, and all fees associated with documenting and executing these changes. The locations of additional field devices shall be as directed by the Engineer or Architect.

B. The material included but is not limited to:

QTY	ITEM
4	Photo Electric Smoke Detector/Bases
2	Heat Detectors
2	Manual Pull Stations
4	Horn/Strobe Units
2	Magnetic Hold Opens
20	Device Boxes
20	4S J-boxes with blank covers
500 LF	½" EMT with 4-#14 THHN wire (includes couplers, straps, connectors, etc.)
40 Hrs.	Labor for Journeyman Electrician
1 Lot	Miscellaneous fees, tools, material, handling, O H & P

3.6 OPERATION AND MAINTENANCE MANUALS

A. Provide Owner with three (3) sets of detailed operations and maintenance manuals in a hard bound binder prior to completion of the job and formal training. Manuals shall include thorough testing procedures and recommended testing frequency for each item.

B. The manuals shall include a complete materials list of the fire alarm system including the addresses and phone numbers of local sources of replacement parts.

3.7 FAN/DAMPER CONTROL CIRCUITS

A. Provide a single form "C" isolated contact output and wiring from the new fire alarm system to the EMCS system. Provide all necessary connections, programming and testing for the shutdown of affected mechanical equipment.

B. A second isolated contact shall be provided for automatic closure of combination smoke and fire dampers. Upon activation of a general alarm or zone alarm in an area, which the dampers are located, dampers shall automatically close. Power supply for damper actuators is provided by others. Prior to closure of dampers, mechanical equipment shall be disabled.

C. Coordinate with temperature controls or EMCS contractor.

3.8 AUTOMATIC SMOKE VENTS

A. In locations as indicated on the drawings, provide connection between fire alarm system and automatic smoke vents. The smoke vent and automatic release mechanism is provided by others and connected under this division. The release mechanism shall be normally de-energized and energized only under a zonal fire condition. Unless indicated to be otherwise, solenoid release mechanism shall be 24 Volts DC. Coordinate voltage requirements with general contractor. Provide manual override control station, if required by fire marshal.

3.9 AUTOMATIC DETECTORS

A. Locate detectors not less than two (2) feet from a supply or exhaust ventilation grille.

3.10 DEVICE LOCATIONS

A. Device locations may be changed within 15 feet without extra charge, if so desired by the Engineer, before installation.

3.11 AS-BUILT DOCUMENTATION

A. Three sets of as-built drawings shall be provided by the Electrical Contractor to the Architect which clearly indicates:

1. Actual routing of all raceways.
2. Actual cable type, numbers, and routing.
3. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.
4. Actual room number and programming addressed assigned for all components in the system.

B. The Contractor shall include in the maintenance manuals the following as a minimum:

1. Reduced copy (11”x17”) of record drawings.
2. Cuts on all equipment and components.
3. Complete wiring diagram of system including internal workings of main panel and annunciators.
4. Acceptance test certification.

C. Following the completion of final system programming, the systems contractor shall provide to the Engineer, a hard copy printout of the final system program software or "point status report". A hard copy of the "system report" which documents the status of all active devices in the system shall also be provided.

D. Note: The room numbering system depicted in all graphics and referenced in data bases generated by the system contractor shall match that of the final signage and room identification system adopted by the Owner, unless specifically approved in writing otherwise, by the Engineer.

3.12 MOUNTING HEIGHTS

A. Detectors in ceiling.

B. Manual Stations with operating handle at 48” above floor.

C. Horn/Strobes - 80" above finished floor or 6" below ceiling, whichever is lower.

D. Strobe Only – 80” above finished floor or 6” below ceiling, whichever is lower.

3.13 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period on 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully staffed office located within a reasonable distance from the job site. Contractor shall replace or repair defects in material or workmanship for a period of 12 months after the certification of final acceptance.

3.14 TEST AND DEMONSTRATION

A. Upon completion on the system installation, manufacturer’s representative shall conduct a system test for the Owner, Architect, Engineer, and Authority Having Jurisdiction (Fire Marshal) or their appointed representatives. This test shall be conducted by a factory trained equipment manufacturers representative and verify to those present satisfactory operation of the system.

B. After completion of the test/demonstration, the manufacturer's representative shall obtain written approval on an accepted form from the AHJ that the system is approved and shall submit copy of same along with a letter containing the following statement:

C. "The undersigned, having been engaged as the Electrical Contractor for the **BUILDING OWNER** confirms that the fire alarm equipment was installed in accordance with the plans and specifications, and in accordance with the wiring diagrams and directions provided to us by the manufacturer, and that all wire installed is approved for "Power Limited" fire alarm use under Article 760 of the National Electrical Code. It has been completely tested and demonstrated to the Owner's representative, and accepted by the Code Enforcing Authority Having Jurisdiction."

3.15 INSTRUCTION

A. The manufacturer's representative shall conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner. O & M manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.

3.16 SPARE PARTS

A. The following list of material shall be delivered to the Owner upon completion of the final testing and system certifications:

QTY	ITEM
3	Photoelectric Smoke Detector
3	Photoelectric Smoke Detector Bases
3	Addressable Manual Stations
3	Heat Detectors
1	Duct Detector with Detector Head
2	Control Modules
2	Monitor Modules
3	Horn/Strobes

B. All material shall match those components utilized in the system. Provide signed proof of delivery to the Owner with close out documentation.

END OF SECTION 283100

SECTION 311100 – CLEARING AND GRUBBING

1.1 SUMMARY

A. This Section includes:
1. Location of existing utilities.
2. Protection of existing vegetation and utilities not scheduled for removal.
3. Clearing and grubbing of stumps, vegetation, debris, rubbish, and site improvements, and stripping of organic material.
4. Protection of adjacent property, structures, benchmarks, and monuments.
5. Removal and legal disposal off site of material resulting from these operations.

B. Related Sections:
1. Section 31 20 00 Earthmoving
2. Section 31 25 00 Erosion and Sedimentation Control

1.2 REFERENCES

A. Reference the following standards:
1. The current WSDOT Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT).
2. Geotechnical Engineering Report dated November 8, 2013 by Landau Associates.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

1.4 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.4 EXISTING CONDITIONS

A. Coordinate with utility companies and verify that all appropriate services have been disconnected. Contractor shall pay all fees and costs associated with utility disconnects, capping, line and meter removals.

B. Do not shut off or cap utilities without prior notice. Site utilities shall remain in service unless otherwise indicated. Coordinate work with Division 1 requirements.

C. Construct temporary erosion and sedimentation control and maintain as required.

D. Maintain street drains and sewers open for free drainage.

E. Objectionable Noises: Conform with Owner's requirements regarding Noise Control.

F. Maintain vehicular and pedestrian traffic routes:
1. Ensure minimum interference with roads, streets, alleys, sidewalks, and adjacent facilities.
2. Do not close or obstruct streets, fire lanes, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

G. Contractor is responsible for the verification of all utility locations. A minimum of five working days in advance of construction, use a private utility locate service to verify location and elevation of existing utilities within the areas shown on the plans to allow for coordination and mitigation of conflicts without down time.

1.5 DIMENSION AND LAYOUTS

A. Comply with all applicable Federal, State and Local codes and safety regulations. If there are any conflicts among referenced standards, the more stringent requirements shall govern.

B. Obtain necessary permits, including but not limited to:
1. All permits required due to Contractor's Method of Operation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain required permits and permission from local governing authorities and Owner prior to commencing work.

B. Verify that site improvement removal may safely and appropriately begin.

3.2 EROSION CONTROL

A. Refer to Erosion Control Plan and Section 31 25 00.

B. Install and maintain TESC measures in accordance with the plans.

3.3 CLEARING

A. All trees, brush, logs, upturned stumps, roots of downed trees, rubbish and debris shall be removed and disposed of. Clear all areas to permit installation of new construction.

B. Do no clearing within those areas specified to remain undisturbed.

3.4 GRUBBING

A. Grub all areas to be graded, except as noted below.

B. Do no grubbing within areas that the Architect and/or Drawings specify to remain undisturbed.

C. Grubbing shall be to the depth necessary to remove all stumps, large roots, buried logs and other objectionable material.

3.5 STRIPPING

A. Strip all areas to be graded, except as noted below.

B. Remove all sod and grass before stripping topsoil. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. See referenced geotechnical report for recommendations for stripping depth.

3.6 SITE IMPROVEMENT REMOVALS

A. Adjacent improvements and natural conditions to remain that are damaged by the Contractor during the work shall be replaced and restored in kind at no additional cost to the Owner.

B. Sprinkle excavated material and access roads with water as necessary to limit dust to the lowest practicable level. Do not use water to such an extent as to cause flooding, contaminated runoff, or icing.

C. All utility piping and structures not designated for removal are to remain until new services are tested and in operation and shall be protected during construction unless indicated otherwise. Damage to existing utilities, which are to remain, shall be repaired immediately at the Contractor's expense.

D. In the event the Contractor encounters utility lines not shown on the site plan or otherwise indicated to be saved, removed, or abandoned, the location of such lines shall be marked in the field and the Owner notified immediately.

E. Sawcut, remove, recycle and dispose of slabs, pavement and other obstructions in areas to be improved or as required to construct new improvements. Materials not designated for reuse shall be broken up, loaded, and legally disposed of or legally recycled by the Contractor. Care shall be taken removing items in place. All concrete walk removals shall be sawcut at the next adjacent joint. Adjacent materials designated to remain that are damaged by the Contractor during the work shall be replaced in kind at no additional cost to the Owner.

3.7 DRAINAGE AND FILL

A. Keep natural drainage ways open for drainage at all times. Provide erosion control facilities as required according to the plan to prevent sediment transport either downstream or offsite. At no time shall more than one foot of sediment be allowed to accumulate within a ditch or swale. At no time shall sediment be allowed to accumulate within a catch basin that is a height of 60% of the sump or within 6 inches of the outlet pipe, whichever is greater. All catch basins and

conveyance ditches shall be cleaned prior to paving. Mud/sediment build-up shall be removed, and the cleaning operation shall not flush sediment-laden water into the downstream system.

B. Fill open pits and holes caused by the work with imported structural fill, unless further excavation or earthwork is indicated. Fill shall be placed and compacted per the requirements of Section 31 20 00 Earthmoving. Open pits and holes shall be kept free of standing water.

3.8 UTILITY SYSTEMS

A. Locate, identify, disconnect, and remove, seal or cap off utilities as indicated on the plans.

B. Arrange to shut off indicated utilities with utility companies.

C. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted by the Owner and then only after arranging to provide temporary utility services.

D. Remove and dispose of existing structures and pipes as indicated on plan. Plug or cap all pipes to remain unless designated otherwise on plans.

E. Abandonment of existing catch basins, inlets and other utility structures: Two-feet below finished grade.

F. Cap or plug pipes shall be in accordance with WSDOT Section 7.

3.9 DISPOSAL OF MATERIALS

A. Remove the refuse from site preparation, including trash and debris, and legally dispose of it off Owner's property at no additional cost to the Owner. Refuse shall either be recycled or disposed of in a manner consistent with all government regulations. In no case shall refuse material be left on the project site, shoved onto abutting private properties, or be buried in embankments or trenches on the project site. Maintain hauling routes clean and free of any debris resulting from work of this Section.

END OF SECTION 311100

SECTION 312000 – EARTH MOVING

1.1 SUMMARY

A. This Section includes:
1. Accomplishing indicated and required stripping, excavation, filling, compaction, sub-grade preparation, rough and finish grading, and the like.
2. Excavate and backfill trenches as necessary for water, storm drain, foundation drain, sanitary sewer installation and other work as shown on drawings.
3. Removing materials from the site which are either
   a. unsuitable for use, or;
   b. are in excess of that required.
4. Importing additional required materials.
5. Coordinating earthwork operations with other work of the project.
6. Dewatering requirements including providing, operating, maintaining and removing temporary dewatering systems for controlling surface water in the construction area.
7. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
8. Excavating and backfilling for buildings and structures.
9. Drainage course for concrete slabs-on-grade.
10. Subbase course for concrete walks and pavements.
11. Subbase course and base course for asphalt paving.
12. Excavating and backfilling for utility trenches.

B. Related Sections:
1. Section 31 11 00 Clearing and Grubbing
2. Section 31 25 00 Erosion and Sedimentation Control
3. Section 32 11 00 Base Courses
4. Section 33 10 00 Water Utilities
5. Section 33 36 00 Utility Septic Tanks
6. Section 33 40 00 Storm Drainage Utilities

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting a slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Contracting Office Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Contracting Office Representative. Unauthorized excavation, as well as remedial work directed by Contracting Office Representative, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 REFERENCES

A. Reference the following standards:
   1. The current WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT).
   2. ASTM D-1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort .
   3. Uniform Federal Accessibility Standards (UFAS).
   4. Geotechnical Engineering Report dated November 8, 2013 by Landau Associates.

1.4 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

B. Regulatory Requirements:
   1. See referenced Codes, ordinances and the like.
   2. Obtain all permits.

C. A qualified Soils Engineer shall be employed by the Owner to perform all required tests of fill and of soil compaction, and for supervision of the earthwork. Contractor shall notify the Soils Engineer prior to completion of each lift and phase of the work in order to permit him to make

tests as required. Samples of all fill materials proposed for use shall be delivered to him at least five days prior to the time that such materials are expected to be placed in the work. No materials shall be placed until receipt of written approval of samples and all materials used shall be the same as those in the samples submitted. The Soils Engineer shall be considered the Architect's/Owner's representative on the job during earthwork operations. Any fill which in his opinion does not meet the specification requirements shall be removed or otherwise corrected as he directs.

D. Conform to requirements of the Geotechnical Report referenced in these specifications.

1.5 SUBMITTALS

A. Submit samples of all imported materials to be used seven days in advance of use. Samples shall consist of sieve analysis of material gradation.

1.6 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before be-ginning earth moving operations.

C. Do not commence earth moving operations until Erosion and Sedimentation Control measures are in place as specified in the plans and as specified in Section 31 25 00.

1.7 DIMENSION AND LAYOUTS

A. Comply with all applicable Federal, State and Local codes and safety regulations. If there are any conflicts among referenced standards, the more stringent requirements shall govern.

B. Obtain necessary permits, including but not limited to:
1. All permits required due to Contractor's Method of Operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil Materials:
1. Topsoil: Reusable excavated or imported, friable loam; free of subsoil, roots, grass, excessive amount of weeds, large stone, and foreign matter.
2. Subsoil: Imported or excavated materials, graded free of lumps larger than 6 inches, rocks larger than 3 inches, and debris.

B. Earth Fill Materials: Furnish the following materials for fills and backfills where indicated or where specified.
1. Imported Structural Fill: Structural fill shall consist of a granular soil free of organics, debris, or other deleterious material. Structural fill during wet weather conditions shall meet following gradation requirements: Imported well graded sand and gravel with less

than 5 percent fines. Conform to "Aggregate for Gravel Base, Class A or B" in accordance with Section 9-03.12(1) of the WSDOT Standard Specification with gradation.

2. Select Granular Fill: Fill placed beneath structure foundations and ground slabs. Materials shall consist of imported, well graded sand and gravel or rushed rock with less than 5 percent fines based on the minus ¾ fraction. "Gravel Borrow" in accordance with Section 9-03.14(1) of the WSDOT Standard Specification is a suitable source provided that less than 5 percent by weight of the materials passes the US No 200 sieve based on the minus 3/4 inch fraction.
3. Gravel Backfill for Walls: Free draining sand and gravel conforming to Section 9-03.12(2) of the WSDOT Standard Specification.
4. Backfill for Floor Support: Conform to referenced Soils Report.
5. Gravel Backfill for Pipe Bedding: Rigid pipe bedding shall be in accordance with the Section 7-08.3(1)C and Section 9-03.12(3) of the WSDOT Standard Specification.
6. Backfill for Utility Trenches; Utility trench backfill shall be in accordance with Section 7-08.3(1) A of the WSDOT Standard Specification.
7. Patching for Utility Trenches: Utility trenches shall be patched in accordance with the trench restoration detail shown on the plans for all utility trenches on site.
8. Furnish additional off site material as may be required for completion of work.
9. Excavated materials for use as fill: The suitability of excavated site soils for compacted backfill will depend on gradation and moisture content of soil when placed. In general, use excavated on-site material except as specified above. Excavated materials shall meet the following requirements:
   a. be tested and approved for use.
   b. be free from organic and deleterious matter.
   c. be maintained at moisture content suitable for compaction.
   d. no silty soils permitted.
   e. no demolition debris permitted
   f. Soil shall contain not more than 5% fines passing a No. 200 sieve.

C. Stockpile site material to be used as fill material where permitted by Owner.

D. Stockpile any topsoil material to be reused where agreed upon.

E. Fill Under Sidewalks: 2 inches CSTC meeting the requirements of Section 9.03.9(3) of the WSDOT Standard Specifications.

F. Concrete: Lean concrete shall be utilized as structural fill when required by unsuitable soil conditions.

2.2 DEWATERING

A. Dewatering includes lowering the water table for the purposes of reducing seepage which would otherwise emerge from the slopes or bottom of the excavation, increasing the stability of excavated slopes, preventing loss of material from beneath the slopes or bottom of the excavation, reducing hydrostatic heads and seepage forces, and preventing rupture or heaving of the bottom of an excavation. Provide necessary pipe, pumps, and filter material suitable for conditions of construction.

B. Disposal of dewatering water shall be to an approved location and water shall be free of silts and fines. Settlement of dewatering water may be required prior to disposal. Contractor to provide water disposal plan to Architect prior to commencing with dewatering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Locate and carefully maintain all bench marks, monuments, control markers and other reference points; if disturbed or destroyed, replace as directed at no cost to Owner.

B. Permits and Inspections: Obtain all permits and required inspections; pay all fees. Maintain property in as good condition as possible. At completion, leave in as good condition as before work started.

C. Protection:
1. Utilities
   a. The Contractor shall protect from damage private and public utilities. Contractor shall, before excavation begins, call the Utilities Underground Location Center 1-800-424-5555. Contractor shall pay all costs associated with location of existing utilities; including costs for private locate service to determine connection points and crossings.
   b. Notify owners of underground facilities at least two full business days prior to commencing any excavation. Provide schedule of excavation to all owners of underground facilities in accordance with RCW 19.122.
   c. The Contractor shall, at its own expense, make excavations and borings ahead of the work, as necessary, to determine the exact location of utilities, service stubs, and underground structures.
   d. All existing utilities to remain shall be protected and maintained by the Contractor and shall not be disturbed, disconnected or damaged during work. The Contractor shall be responsible for all expenses arising from damaged utilities/structures except for unforeseen underground items.
2. Site Improvements
   a. The Contractor shall protect from damage all pavement, curbs, sidewalks, paved areas, and other improvements to remain.
   b. Contractor shall be responsible for replacement if damage occurs to improvements to remain.
3. Access: Contractor shall provide full access to adjacent driveways, fire hydrants, street crossings, sidewalks, and other points as designated by the Owner.

3.2 SITE GRADING

A. General: Required contours and elevations are indicated and noted on Drawings; should indicated figures conflict with actual conditions, notify Owner and await his directions before proceeding.

B. Grading:
1. Shape surface of site to grades and contours as noted (as applicable).
2. Strip topsoil in areas to be graded and those to be excavated and stockpile on site where directed and remove excess subsoil and topsoil not being reused from site.
3. Remove debris and rocks, which will interfere with reusable topsoil and lawn maintenance.
4. Control grading around building areas and building excavations at all times to prevent flow of water into excavated areas.
5. At paving and other site improvements, shape subgrades to lines, grades, and cross sections indicated; remove and replace soft or otherwise unsatisfactory material; excavate rock encountered to a depth of 6" below finish subgrade elevations; bring low areas up to required elevations with suitable structural fill materials.

3.3 APPROVAL OF SUBGRADE

A. Notify the Owner when excavations have reached required subgrade.

B. Proof-roll all prepared subgrade areas with a fully loaded dump truck in the presence of the Owner.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.

C. When the Owner determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted foundation material as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner at no cost to the Owner.

3.4 EXCAVATION

A. General: Do all excavation work for building and other work shown on the drawings, to lines and elevations required for the work.

B. Removal of Obstructions: Remove rocks, boulders, and other obstructions.

C. Depth of Excavation:
1. Ground Slab: Excavate to subgrade required to provide for a 6 inch minimum depth of permanent drainage material and vapor barrier as detailed on the drawings. See drawings for variations in drainage material depth.
2. Footing/Foundation Excavation: Excavate to depths indicated on the drawings.
3. Slope banks to angle of repose or less, until shored.
4. Excavation shall not undermine any foundation.

D. Excess Excavation: If through error, excavation is to levels lower than shown, and is in compacted fill, re-compact to required compaction percentages at Contractor's expense. Where excess excavation is in undisturbed soil, fill with lean concrete or deepen footing, at Contractor's expense.

E. Do not excavate wet topsoil or subsoil. Do not excavate wet topsoil or subsoil without approval of General Contractor. Coordinate all wet conditions work stoppages beforehand with general contractor.

F. Dewatering Excavation: Maintain excavation in dry condition as required, free from frost.

G. Trench Excavations:
1. Excavate trenches to depths required and widths as necessary; make sides as nearly vertical as practicable. Brace and shore per governing agency requirements. Grade and smooth trench bottoms for uniform support of utility lines. Excavate to depths allowing for bedding.
2. Excavation Near Mature Trees: Preserve and protect existing trees at the site which are designated to remain and those adjacent to the site. Any fines levied by the Owner for tree damage or destruction shall be the responsibility of the Contractor.

H. Catch basins, manholes, inlets, and similar utility structures: Excavate to furnish a minimum of 12 inches between sides of excavation and outer surfaces of structure. Take care to excavate to exact depths required; fill over excavation with compacted gravel borrow. If the material at the bottom of excavations becomes unstable or muddy due to weather conditions, the Contractor shall excavate all unsuitable material below grade and replace the unstable material with gravel borrow.

I. Excavation Safety Systems
1. Provide all trench excavation in excess of 4 feet in depth with a safety system conforming to the referenced standards and requirements.
2. All excavation not requiring trench safety systems shall also meet the WISHA safety standards.

J. Utility Trench Excavation
1. Trenching shall include all excavation of every description and of whatever materials encountered to the depth indicated on the Drawings or in the Project Manual.
2. Grade and smooth bottoms of trenches to furnish uniform bearing and support for utility lines; remove rocks and similar material causing point bearings.
3. Form bell holes and depressions for joints after grading of bottom limit such depressions to lengths, depths, and widths required for particular type of joint.
4. Excavate to depths allowing for bedding.

3.5 FILLING AND BACKFILLING

A. General: Fill to elevations or grades indicated or required. Remove debris and decayable matter from all areas before filling. Protect shored walls from damage during filling operations. Verify foundation walls are braced to support surcharge forces imposed by placed fill materials near optimum (+/- 2%) moisture content to permit compaction to specified density. Fill over excavated areas under structure bearing surfaces in accordance with geotechnical report.
1. Backfill areas to contours and elevations as shown on plans and in accordance with the Soils Report. Use unfrozen and unsaturated materials.
2. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
3. Place and compact fill materials in continuous layers not exceeding 6 inches loose depth.
4. Employ a placement method so not to disturb or damage foundations, foundation perimeter drainage, foundation damp-proofing, foundation waterproofing and protective cover, or utilities in trenches.
5. Maintain optimum moisture content of backfill materials to attain required compaction density. Certification of proper placement shall be provided by Soils Engineer.

6. Backfill against supported foundation walls. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
7. Slope grade away from building minimum of 2%, unless noted otherwise.

B. Backfill: Place fills and backfills in lifts, before compaction, not to exceed 6 inches for hand operated mechanical compactors and not to exceed 10 inches for heavy equipment compactors. Place fill and backfill as soon as practicable to allow time for thorough settlement at time of completion of the Work.
1. Under Interior Concrete Slabs: Provide 6 inch minimum layer of free draining material and leave ready for compaction and installation of vapor barrier.
2. Bedding for Utility Lines: Properly place material in trenches. Do not disturb sides of trenches. Place and compact and shape material to conform to the barrel of the pipe to ensure continuous firm bedding for full length of pipe. Backfill trenches in lifts as specified above.
3. Topsoil: Distribute evenly around site as required.

C. Bedding and Backfilling for Utility Lines
1. Bedding shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete.
2. Bell holes shall be excavated as required to ensure uniform support along the pipe barrel. Bedding disturbed by pipe movement or by removal of shoring or movement of a trench shield or box shall be reconsolidated prior to backfill. Special care shall be taken to provide adequate bedding support at wye or tee connections and adjacent to manholes or other Structures, so as to avoid bending or shearing stresses at these critical points.
3. In backfilling the trench, the Contractor shall take all necessary precautions to protect the pipe from any damage or shifting. The Contractor shall backfill from the side of the trench to a uniform depth of 2 feet above the crown of the pipe before starting compaction.
4. During all phases of the backfilling operations and testing as outlined herein, the Contractor shall protect the pipe installation, provide for the maintenance of traffic as may be necessary, and provide for the safety of property and pedestrians.
5. Pipe trenches shall be backfilled as soon as possible after the pipe installation. Backfilling of trenches in the vicinity of catch basins, manholes, or other appurtenances will not be permitted until the cement in the masonry has become thoroughly hardened. Walking on the pipe shall not be allowed until at least 1 foot of earth has been placed upon it.
6. Trench backfill shall be spread in layers and be compacted by mechanical tampers of the impact type approved by the Owner's Soils Engineer. The backfill Material shall be placed in successive layers with the first layer not to exceed 2 feet above the pipe, and the following layers not exceeding 12 inches in loose thickness, with each layer being compacted to the density specified herein. Backfill shall also be in accordance with the pipe manufacturer's recommendations.
7. If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench and recompact using heavier compaction Equipment or more passes. This process shall be repeated until the Contractor has established a procedure that provides the required field density. The Contractor will then be permitted to proceed with backfilling and compacting the remainder of the pipeline under the approved compaction procedure. In the event routine field densities taken during the course of construction show the specified compaction is not being obtained because of changes in

soil types or for any other reason as determined by the Owner's Soils Engineer, the Contractor will be required to reestablish the compaction procedure. In no case will excavation and pipe installation operations be allowed to proceed until the specified compaction is attained. Water setting will not be allowed as a method for compaction of backfill. Backfill shall also be in accordance with the pipe manufacturer's recommendations.

8. All bedding and trench backfill of utility lines in the County Right-of-Way shall be in accordance with the County Standards.

D. Embankment Construction:

1. The Contractor shall place earth embankments in horizontal layers of uniform thickness. These layers shall run full width from the top to the bottom of the embankment. Slopes shall be compacted to the required density as part of embankment compaction.
2. During grading operations, the Contractor shall shape the surfaces of embankments and excavations to uniform cross-sections and eliminate all ruts and low places that could hold water.
3. Embankments shall be constructed in accordance with the requirements for fill placement in the Geotechnical Report.

3.6 COMPACTION

A. General: Place fills in uniform lifts, depending on equipment used for compaction, see paragraph 3.5 B, this Section. Compact with approved vibratory compactors, or other approved rollers, or equipment necessary to obtain specified density.

B. Compact areas occupied by building and paving to attain 95% minimum of maximum dry density in accordance with ASTM D-1557.

C. Compact other areas at attain 90%, as indicated in soils report, minimum of maximum dry density, in accordance with ASTM D-1557.

D. Moisture Content of Fill Material: Material shall be at near optimum moisture content (within +/-2%) when compacted. Take appropriate means to obtain moisture content.

E. Areas designated for stormwater infiltration shall not be compacted to preserve infiltrative capability of soils.

3.7 EXCESS OR SHORTAGE OF EARTH MATERIALS

A. Remove all excavated material, except as required for fill onsite, at Contractor's expense. Legally dispose of off site. Keep streets free from spillage of excavated material and debris by power sweepers or other approved methods.

B. Stockpile excavated materials classified as satisfactory soil material where directed, until required for on-site fill. Place, grade and shape stockpiles for proper drainage and then cover to prevent water infiltration.

C. If shortage, provide suitable materials as needed to complete work.

3.8 FINISH GRADING

A. Finish grade to +/-0.10 foot.

B. Finish grades flush with adjacent surface unless otherwise indicated.
   1. Finish grades will be inspected and approved by Architect.
   2. Place topsoil in areas where seeding, sodding and planting is scheduled.
   3. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of sub-grade.
   4. Remove large stones, roots, grass, weeds, debris, and foreign material while spreading.
   5. Roll placed topsoil.
   6. Leave stockpile area and site clean and raked, ready to receive landscaping.

C. Protect and maintain finished surfaces. Allow no heavy objects, to be moved over finish grade surfaces. At no cost to Owner, repair any ruts or holes in finished surfaces, and any obstructions to positive drainage. Repair areas showing settlement.

3.9 FIELD QUALITY CONTROL

A. Conduct inspections to verify conformance with Specifications and Drawings.

B. Provide equipment to roll compact site areas as advised by the project geotechnical or field engineer. Roll compact such areas as requested by general contractor.

3.10 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace material to depth directed by the Owner; reshape and re-compact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible at no additional cost to the Owner.

3.11 PROTECTION FROM WEATHER

A. The Contractor shall protect excavated sub-grade, stockpiled soils and excavations from damage due to weather, surface runoff or other source of water that may render the soil unworkable or unusable for filling and compaction on the site.

B. The Contractor shall furnish, install, maintain, replace, operate and remove any and all facilities necessary to keep excavations, stockpiled materials, exposed sub-grades and surrounding working surfaces free from water, surface runoff, mud or deterioration during construction.

1. The Contractor shall provide plastic sheeting, tarpaulins, rock armoring and protection, or other methods to protect exposed sub-grades and stockpiled material from deterioration or damage from water or construction traffic.
2. The Contractor shall dewater all excavations and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or menace to the public. The Contractor shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all emergencies, including power outage and flooding, and shall have available at all times competent workers for the continuous and successful operation of the dewatering systems. Systems shall be operated so as to accomplish dewatering as necessary to perform and protect the work.
3. It is understood that the Contractor shall, throughout the course of construction which will be occurring during normally wet weather conditions, adequately protect, stabilize or armor all site areas. The Contractor agrees that the measures required to work in wet weather conditions are usual and ordinary, and are reflected in the bid and plan of operation. It is understood that additional compensation will not be granted to the Contractor for impacts due to construction in typical wet weather conditions.

3.12 CLEANING

A. Cleaning: Leave premises clean and free of residue of work of this Section.

END OF SECTION 312000

SECTION 312500 – EROSION AND SEDIMENTATION CONTROLS

1.1 SUMMARY

A. This work shall consist of temporary erosion and sediment control measures, as shown on the temporary erosion control and sediment (TESC) plan and per the stormwater pollution prevention plan (SWPPP). This work is intended to provide prevention of erosion and control of sediment within the limits of the project and to minimize damage to the Work and adjacent property in accordance the Department of Ecology NPDES permit if applicable. The Contractor is responsible for installation, maintenance, and revisions to the erosion and sediment control measures as site conditions change. Contractor is also responsible for all requirements of the DOE General Stormwater permit including providing a Certified Erosion and Sediment Control Lead (CESCL), performing required monitoring, and preparing and submitted Discharge Monitoring Reports (DMR).

B. Related Sections:
   1. Section 31 11 00 Clearing and Grubbing
   2. Section 21 20 00 Earthmoving

1.2 REFERENCES

A. Reference the following standards:
   1. Department of Ecology (DOE) Stormwater Management Manual for Western Washington Volume II Construction Stormwater Pollution Prevention.
   2. Erosion Control (TESC) and Demolition Plan.
   3. Stormwater Pollution Prevention Plan (SWPPP).
   4. Geotechnical Engineering Report dated November 8, 2013 by Landau Associates.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

1.4 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials.

PART 2 - PRODUCTS

Erosion and sediment control products are numerous and varied. The following is a listing of expected products that will be used based on the TESC plan. If erosion control and sediment control needs change during construction, the Contractor may propose alternative measures and products. All alternative products must be approved by the Owner prior to implementation.

2.1 FILTER FABRIC FENCE

A. Approved filter fabrics are Mirafi 140, or approved equivalent.

2.2 HYDROSEED

A. Seed mix for erosion and sediment control shall be certified seed composed of a 40-40-10-10 mixture of perennial rye, creeping red fescue, white clover, and highland bentgrass respectively.

B. Fertilizer shall be 10-20-20 (N-P-K) with 50% of nitrogen derived from slow release urea form. Fertilize shall be used according to the suppliers recommendations. Amounts should be minimized.

C. Wood fiber mulch shall be a specially processed cellulose fiber, such as Conwed or Silva Fiber (or approved equivalent) containing no growth or germination-inhibiting factors. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content. Mulch shall be chemically inert, and non-toxic to plants, humans, and animals.

D. Tackifier shall be ERO-BOND or approved equal. Emulsion designed to retain moisture and heat in the soil.

2.3 INLET PROTECTION

A. Inlet protection catch basin inserts shall be “StreamGuard for Sediment” or approved equal.

2.4 CONSTRUCTION ENTRANCE

A. The construction entrance shall be 4” to 8” quarry spalls per WSDOT Standard Specification 9-13.6..

PART 3 - EXECUTION

3.1 GENERAL

A. Maintain, upgrade and/or relocate existing temporary erosion and sedimentation control measures as necessary.
   1. Contractor to follow the intent of the Department of Ecology NPDES Construction General Stormwater Permit, shall provide a CESCL, and will perform required monitoring and reporting.

2. The implementation of the Erosion and Sediment Control plans and the construction, maintenance, replacement, and upgrading of these facilities is the responsibility of the Contractor until all construction is approved. The Temporary Erosion and Sediment Control (TESC) facilities shown on the plan must be constructed in conjunction with all clearing and grading activities, and in such a manner as to ensure that sediment-laden water does not enter the drainage system or violate applicable water standards.
3. The TESC facilities shown are the minimum requirements for anticipated site conditions. During the construction period, the erosion control facilities shall be upgraded (e.g. sumps, construction of ditches and silt fences, etc.) as needed. Contractor shall pay for all costs associated with the construction, maintenance, upgrading, relocation and removal of the erosion control system throughout project duration.
4. Access Roads: Provide wheel-cleaning stations to clean wheels and undercarriage of trucks before leaving site, as necessary to prevent dirt from being carried onto public roads. If roads are fouled, they must be cleaned immediately in conformance with Owner, and WSDOT requirements, as indicated on the plans and all governing requirements and regulations.
5. Provide catch basin protection for catch basins in and adjacent to work area. Provide catch basin protection for new catch basins and area drains following installation, until site paving is completed.

B. Provide additional temporary erosion and sedimentation control measures as required by plans, notes, details and specifications.

3.2 FILTER FABRIC FENCE

A. The filter fabric fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water, without soil, to pass through the fence.

B. Install per plan.

3.3 DRAINAGE COLLECTION

A. Contractor shall install and put into service those sections of the proposed storm drain system necessary to collect TESC outflows.

B. Additional collection structures shall be installed as necessitated by construction activities to ensure that sediment laden water does not enter the natural or public drainage system.

C. Clean storm drain system of all debris following removal of TESC facilities and following permanent stabilization of site.

3.4 HYDROSEEDING

A. The Contractor shall submit to the owner certificates of inspection of seed by state or federal authorities and copies of delivery invoices or other proof of quantities of mulch and fertilizer.

B. Seeding shall not be done during windy conditions (excess of 5mph) or when climate or ground conditions would hinder placement or proper growth.

C. Soil Preparation

1. All seedbeds shall be a minimum depth of one inch. Seedbeds shall be reviewed by the Architect prior to seeding.
2. After soil has been scarified, apply seed by hydroseeding method. Prepare and apply slurry at the rate and proportion specified below.

Seed Mix	200 lbs./acre
10-10-6 Fertilizer	650 lbs./acre
10-10-7 Wood Fiber Mulch	1,500 lbs./acre
10-10-8 Water	As necessary
10-10-9 Tackifier	40 lbs./acre on slopes 2:1 or greater

3. Seeding by hydraulic method shall consist of furnishing and placing a slurry made of seed, fertilizer, cellulose wood fiber, tackifier (if needed), and water.
4. The cellulose wood fiber shall be added to the water slurry in the hydraulic seeder after the proportionate amounts of seed and fertilizer have been added. The slurry mixture shall then be combined and applied in such a manner that the rate of application will result in an even distribution of materials.

3.5 CONSTRUCTION ENTRANCE

A. The rock pad shall be at least 12 inches thick and 100 feet long. Width shall be the full width of the vehicle ingress and egress area – minimum 15 feet allowed.

B. Additional rock shall be added periodically to maintain proper function.

END OF SECTION 312500

SECTION 321100 – BASE COURSES

1.1 SUMMARY

A. This work includes:
   1. Furnishing and placing base course materials for paving.

B. Related Sections:
   1. Section 31 20 00 Earthmoving
   2. Section 32 13 13 Concrete Paving

1.2 REFERENCES

A. Reference the following standards:
   1. Current copy of WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction.
   2. Geotechnical Engineering Report dated November 8, 2013 by Landau Associates.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

B. This work shall consist of preparing a foundation and base in preparation for paving in accordance with these Specifications and in conformity with the lines, grades, thicknesses, and typical cross-sections shown in the plans or established by the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with "Quality Control" provisions, "References", Specifications, and Manufacturer's data. Where these may be in conflict, the more stringent requirements govern.

2.2 CRUSHED SURFACING BASE COURSE (CSBC)

A. Crushed Surfacing Base Course shall conform to the requirements of Section 9-03.9(3) of the WSDOT Standard Specifications. Thickness shall be as shown on the plans.

2.3 CRUSHED SURFACING TOP COURSE (CSTC)

A. Crushed Surfacing Top Course shall conform to the requirements of Section 9-03.9(3) of the WSDOT Standard Specifications. Thickness shall be as shown on the plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes your acceptance of conditions as satisfactory.
   1. Construction shall conform to the details, dimensions and grades specified.
   2. The sub-grade in all areas to be paved shall be graded and compacted in accordance with Section 31 20 00 Earth Moving.

3.2 PREPARATION

A. Protect surrounding areas and surfaces to preclude damage from work of this Section.
   1. Protect work of other trades. Take special care in work adjacent to buildings.
   2. Should any defacement or damage occur, repair or replace as directed.

B. Preparation of Sub-grade: Sub-grade shall be prepared in accordance with these Specifications and the Geotech Report.

3.3 CRUSHED SURFACING BASE COURSE AND TOP COURSE

A. Placement of CSBC and CSTC shall comply with WSDOT. Compaction shall be as specified in the soils report and WSDOT Standard Specification Section 4.04.3(5).

END OF SECTION 321100

SECTION 321313 – CONCRETE PAVING

1.1 SUMMARY

A. This work shall include:
1. Concrete Paving for vehicle travel and parking surfaces
2. Concrete Walks
3. Concrete Access Ramps

B. Related Sections:
1. Division 1 Section Alternatives
2. Section 31 20 00 Earthmoving
3. Section 32 11 00 Base Courses

1.2 REFERENCES

A. Reference the following standards:
1. Current copy of WSDOT Standard Specifications for Roads, Bridges and Municipal Construction.
2. American Society for Testing Materials (ASTM).
3. American Association of State Highway and Transportation Officials (AASHTO).
4. Geotechnical report dated November 8, 2013 prepared by Landau Associates.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 CONTRACTOR QUALIFICATIONS

A. Cement Concrete Paving -
1. The use of an ACI Concrete Flatwork Certified Finisher or similar certification program is required. The Contractor shall furnish Architect a statement attesting to qualifications, experience, and demonstration of the following:
   a. A minimum of four (4) completed Cement Concrete Paving projects of relatively similar scope and size within the last two years.
   b. Addresses of each of the recent projects for inspection
   c. Contact information for owners of each of the recent projects.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Jointing Plan: Contractor to supply Owner with a jointing plan.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities. Provide all joint types and locations.

D. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

E. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
1. Wheel Stops: 6 inches showing cross section; with fasteners.
2. Colored Concrete: 12-inch square sample.

F. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data:
1. For qualified installer of detectable warnings, ready-mix concrete manufacturer.
2. For qualified installer of Cement Concrete Paving.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or epoxy adhesive.
6. Joint fillers.

C. Material Mixes: For all Cement Concrete Paving provide proposed concrete mixture proportions and density. For Permeable Cement Concrete Paving, provide in-place pavement test results from previous Work, completed in the last 12 months, including design void content, density, and concrete mixture proportions.

D. Material Test Reports: For each of the following:

1. Aggregates.

E. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Concrete Testing Service: The Owner will engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

E. ACI Publications: Comply with ACI 301 unless otherwise indicated.

F. Mockups: Build mockups for each Cement Concrete Paving System using the mixture proportions, materials, and equipment as proposed for the project to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving where directed by Architect and not less than 144 inches by 144 inches. Location shall be determined in the field by the Architect in consultation with the Contractor.
3. Mockups shall intentionally be constructed with some irregularities in finish and jointing to demonstrate variations or deviations that may or may not be accepted.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Because of the intentional finish variations, mockups may not become part of the completed Work and shall be demolished and removed from the site.

G. Preinstallation Conference: Preinstallation conferences shall be held for each key paving element. Contractor shall conduct the conference at the Project site. Contractor shall arrange the meeting, including the specific location, invitations, time and day. At a minimum, the attending parties shall include the Owner, Architect, Testing Agency, and Jefferson County inspectors.

1. Review mockups, methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.
c. Testing frequency and process.
d. Unaccepted panel removal procedures.

e. Finishes.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. All subcontractors to be used, including: Concrete paving, concrete specialties.
e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

1.8 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.9 WARRANTY

A. Replace cracked panels, unsatisfactory finish work, irregularities immediately upon notification.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be in conformance with Section 9 of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction in addition to the following. Where the requirements differ, the more stringent shall apply.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 ISOLATION JOINT MATERIAL

A. For isolation joint materials, comply with ASTM D994, D1751, or D1752.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray Portland cement Type II.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal in vehicle paving areas and ¾-inch in sidewalk areas.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by Architect from manufacturer's full range.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified technician or independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4500 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch unless modified with approved add mixtures.

C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd. .
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

C. Admixtures shall be used in accordance with manufacturers' instructions and recommendations.

2.7 WHEEL STOPS

A. Per plan.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Extend joint fillers full width and depth of joint if joint sealer is indicated.
2. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth to one-third of the concrete thickness, by either of the following, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

2. Sawed Joints: Sawcut concrete after concrete has hardened sufficiently to prevent aggregate from being dislodged and soon enough to control pavement cracking. To minimize drying, ensure that curing materials are removed only as needed to make cuts. Minimum joint width for saw cutting is 1/8-inch. When using an early-entry dry-cut saw, the depth of the cut shall be at least 1-inch.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading or rodding.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only

square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs: Use design mixture for automatic machine placement. Produce curbs to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish in pedestrian/sidewalk areas: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
2. Medium-to-Coarse-Textured Broom Finish in parking and drive areas: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

F. All vehicle traffic shall be prohibited from finished surfaces for a minimum of 7-days.

3.8 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch .
4. Joint Spacing: 3 inches
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.9 WHEEL STOPS

A. Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two galvanized-steel bars located as shown on plans. Install bars in drilled holes in the paving and bond bars to wheel stop. Recess head of bars beneath top of wheel stop.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide 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 C 143/C 143M; 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. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. 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.

F. Additional Tests: 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.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

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

I. Prepare test and inspection reports.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321600 – CURBS AND GUTTERS

1.1 SUMMARY

A. This Section includes:
   1. Concrete Barrier Curb
   2. Concrete Monolithic Curb

B. Related Sections:
   1. Section 32 13 13 Concrete Paving

1.2 REFERENCES

A. Reference the following standards:
   1. The current WSDOT Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT).

B. American Society for Testing Materials (ASTM).

C. American Association of State Highway and Transportation Officials (AASHTO).

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

B. Concrete Standards: Comply with provisions following standards except where requirements that are more stringent as indicated:
   1. Section 8-04 of the WSDOT Standard Specifications.
   2. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

1.4 SUBMITTALS

A. General: Submit the following according to the General Provisions and Division 1 Specifications Sections of the Contract.
   1. Design mixes for the concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
   2. Material certificates may be submitted in lieu of material laboratory test reports when permitted by the Owner. Material certificates shall be signed by the manufacturer and the Contractor certifying that each material item complies with or exceeds requirements

1.5 WARRANTY

A. Replace cracked, unsatisfactory finish work, or irregularities immediately upon notification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Concrete curbs shall be air entrained concrete Class 3000 concrete per Section 6-02 of WSDOT Standard Specification.

B. Concrete Mix: Comply with requirements of Section 5-05.3(5) of the WSDOT Standard Specification.

2.2 FORMS

A. Forms shall be metal or wood and comply with Section 8-14.3(2) of the WSDOT Standard Specification.

2.3 CONCRETE MATERIAL

A. Portland Cement: shall be in accordance with Section 9-01.2(1) Type 1 of the WSDOT Standard Specification. Use one brand of cement throughout project unless otherwise acceptable by Owner

B. Fine Aggregate: shall be in accordance with Section 9-03.1(2) of WSDOT Standard Specification. Provide aggregates from a single source.

C. Coarse Aggregate: shall be in accordance with Section 9-03.1(3) of WSDOT Standard Specification. Provide aggregates from a single source.

D. Water: shall be in accordance with Section 9-25.1 of WSDOT Standard Specification.

E. Admixtures: shall be in accordance with Section 9-23.6 of WSDOT Standard Specification.

F. Curing: shall be in accordance with Section 8-14.3(4) WSDOT Standard Specification.

G. Concrete Mixing: Comply with requirements of Section 5-05.3(5) of the WSDOT Standard Specification.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared base surface to check for unstable areas and verify need for additional compaction. Do not begin work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted base surface immediately before placing concrete.

3.2 PLACING AND FINISHING

A. Comply with the requirements of Section 8-14.3(3) of WSDOT Standard Specification.

3.3 CURING

A. Comply with the requirements of Section 8-14.3(4) of WSDOT Standard Specification.

3.4 CONCRETE CURBS

A. Forming: Form straight sides against wood or metal. Form tapered sides with a metal mule constructed to required section profile. Check completed formwork and screeds for grade and alignment to following tolerances:
   1. Top of Forms: Not more than 1/8 inch in 10 feet
   2. Vertical Face on Longitudinal Axis: Not more than ¼ inch in 10 feet

B. Mixing and Placing Concrete: Conform to the requirements for mixing and placing 3,500 psi 28-day concrete. Concrete to be placed per Section 8-04 of WSDOT Standard Specification.

C. Joints: Expansion joints to be placed at 30 feet on center. Install so that expansion joint material is ¼ inch below the surface of the concrete.

D. Finish – Broom finish. Round all edges including edges formed by expansion joints.

3.5 REPAIRS AND PROTECTION

A. Remove and replace concrete curb that is broken, damaged, or defective, or does not meet the requirements of this section.

END OF SECTION 321600

SECTION 321723 – PAVEMENT MARKINGS

1.1 SUMMARY

A. This work includes:
   1. Painting pavement markings for parking lot including parking stalls, ADA symbols, and pedestrian walkways.

B. Related Sections:
   1. Section 32 13 13 Concrete Paving

1.2 REFERENCES

A. Reference the following standards:
   1. Current copy of WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Low VOC paint for pavement markings shall meet the requirements of Section 8-22 and 9-34 of the WSDOT Standard Specifications.

B. Selection of paint shall be from a WSDOT Qualified Product List.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for applying paint.

B. Pavement surface shall be clean and dry and free of moisture, dirt, loose particles, grease, curing compounds and the like. The ambient air temperature is to be above 50 degrees. Weather is not to be rainy or foggy.

C. Insure markings to be applied per Section 8-22 of WSDOT Standard Specification.

D. Glass beads shall be applied for per specific application rates in Section 8-22.3(3)G of WSDOT Standard Specification.

E. Protect painting area until paint is completely dry and drivable.

END OF SECTION 321723

SECTION 322919 - SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, 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 materials, equipment, and labor necessary for preparation, hydro-seeding, fertilizing, hydro-mulching, and protection of hydroseeded areas.

B. Related Sections:
1. Division 01 Section “Summary” for description of work by others.
2. Division 31 Section “Earth Moving” for stockpiling and placement of site soils.
3. Division 32 Section “Planting Irrigation” for automatic irrigation of plantings.
4. Division 32 Section “Planting” for adjacent planting areas.

1.3 REFERENCES

A. Plant Grading:
1. “American Standard for Nursery Stock,” Current Edition, American Association of Nurserymen.
2. State of Washington Standards for Nursery Stock.

B. Plant Material Identification:
1. Sunset Western Garden Book, 2007, Eighth edition.
2. 1976 edition of Hortus Third, L.H. Bailey.
3. Current edition of Standardized Plant Names as adopted by the American Joint Committee on Horticultural Nomenclature.

1.4 SUBMITTALS

A. Refer to Section 013300 for submittal procedures.

B. Seed mixes: Submit complete analysis for approval prior to seeding, including purity test data and germination test dates for each cultivar used.

1.5 SUBSTITUTIONS

A. Substitutions will be considered during the bid process per Specification Section 012500.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Hydroseeding firm shall be active and experienced in work of the type specified, and able to show evidence of successful completion of projects of similar scope.

B. Pre-Installation Conference: Meet with Owner and Architect to discuss and verify contract requirements, schedule, and proposed hydroseeding methods.

C. Seed shall be furnished in containers that show the following information: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material. Seed

which has become wet, moldy, or otherwise damaged will not be accepted. Seed shall conform to the requirements of the Washington State seed law and when applicable the Federal Seed Act, and shall be “certified" grade or better.

1.7 WARRANTY

A. Warranty:
1. Warranty materials and workmanship for a period of one year following Owner’s final acceptance.
2. Seeded areas must have a relatively uniform stand of grass with no bare spots over 18" square at the time of provisional acceptance. Reseed at the original rate and fertilize with 15-22-15 at the rate of 15 lbs. per 1,000 square feet. All areas failing to vigorously establish within 90 days after germination or a growing season, whichever is longest, for any reason whatsoever shall be redone.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store and maintain hydroseeding materials from time of approval until delivery to job site for installation.

B. Take precautions to protect the materials during delivery, storage, and handling. Replace damaged goods at no additional cost to the Owner.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate hydroseeding with work of other trades specified elsewhere.

B. Do not hydroseed areas subject to the subsequent work of other sections, unless approved otherwise.

C. Perform work in accordance with the approved schedule specified in Submittals. If a schedule delay occurs, revise and resubmit schedule to reflect each schedule delay.

PART 2 - PRODUCTS

2.1 FERTILIZER

A. Best “Hydrofeed” 21 - 7 -14 or approved alternate (See Paragraph 1.5 SUBSTITUTIONS). 300 lbs per acre.

2.2 HYDRAULIC WOOD FIBER MULCH

A. Wood with tackifier; Profile Products LLC EcoFibre plus Tackifier or approved alternate (See Paragraph 1.5 SUBSTITUTIONS). 2000 lbs per acre.

2.3 MOISTURE RETENTION AGENT

A. Starch based superabsorbent (co-polymer of starch/potassium acrylate deveveloped by USDA and approved by FDA); Stay Moist or approved alternate (See Paragraph 1.5 SUBSTITUTIONS). 65 lbs per acre.

2.4 SEED

A. Meadow Lawn Seed Mix consisting of the following:

1. Low Grow Grasses: 50% Creeping Red Fescue and 50% Zanzibar Double Dwarf Tall Fescue. 50 lbs per acre.
2. Wildflowers: Scarlet Flax, Blue Flax, Prairie Coneflower, Baby's Breath, Wallflower, Lance-leafed Coreopsis, Shirley Poppy, Dame's Rocket, Showy Evening Primrose, Perennial Lupine, Native Coneflower, Black-eyed Susan, Plains Coreopsis, Mexican Hat, Perennial Galliardia, Baby Blue Eyes, Dwarf Catchfly and Dwarf Godella. 20 lbs per acre.
3. Briar Group, Inc., Milton, WA or approved alternate (See Paragraph 1.5 SUBSTITUTIONS).

B. Rain Garden Seed Mix:
1. Native wetland mix consisting of 29.5% Carex stipata, 27% Carex obnupta, 25% Carex microptera, 15% Eleocharis palustris, 3% Scirpus microcarpus and .5% Juncus tenuis. 22 lbs per acre.
2. Sunmark Seeds International, Oregon or approved alternate (See Paragraph 1.5 SUBSTITUTIONS).

C. All seed shall be free of weed seed listed as a primary or secondary noxious by the Washington State Seed Law.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply seed to areas noted on the plans as well as any areas disturbed by utility trenching or other construction. Use hydroseeding method to apply seed, fertilizer, mulch and tackifier.

3.2 SOIL PREPARATION

A. Fine grade seeded areas to uniform finish following grading information shown on the plans. Follow grading tolerances noted in Section 312000. Feather new grades into existing grades. All grades shall flow smoothly into one another. Areas shall be graded to produce positive drainage.

3.3 HYDROSEEDING REQUIREMENTS

A. Hydroseeder shall be a commercially produced piece of equipment providing continuous mechanical agitation of the mixture. Equipment providing agitation by recirculation only is not permitted. Equipment shall maintain continuous agitation of water slurry keeping all additives mixed and suspended homogeneously until pumped from tank. Clean the tank prior to starting work and between applications of each seed type.

B. Contractor and equipment shall meet all federal, state, and local codes for backflow prevention during loading operations.

C. Follow hydro-mulch manufacturer's installation instructions and recommendations.

D. Mix the slurry to ensure a homogenous mixture before application begins. Seed shall not remain in slurry longer than 6 hours or be re-circulated more than 90 minutes before or during application.

E. Seed at any time when conditions are favorable for germination and establishment. Calendar dates are between March 1st and August 31st or as established by contractor and approved by the Architect.

F. Apply hydroseeding mixture uniformly over soil surface. Use hand-held hose in areas adjacent to buildings, sidewalks and planting areas.

G. Clean overspray from all adjacent buildings, pavements and planting areas.

3.4 ESTABLISHMENT

A. Approximately 21 days after germination, any barren area 18 inches in diameter or larger shall be reseeded at specified application rate.

B. Protect the seeded areas from damage until Owner's final acceptance.

C. Apply water lightly and frequently keeping soil moist to ¼" depth through germination.

3.5 MAINTENANCE

A. Maintenance tasks include watering, reseeding, repair of erosion damage, and other operations to ensure germination and growth.

B. Maintain through final acceptance or turnover to Owner, whichever is latest.

3.6 ACCEPTANCE

A. Final acceptance of seeded areas shall be based on 90% germination as determined by the Architect.

END OF SECTION 322919

SECTION 323113 – CHAIN LINK FENCES AND GATES

1.1 SUMMARY

A. This work includes:
   1. Chain Link Fences and Gates.

1.2 REFERENCES

A. Reference the following standards:
   1. Current copy of WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain Link fence and appurtenant materials shall meet the requirements of Section 8.12 of the WSDOT Standard Specification and the plans. If there is a conflict between these, the more stringent requirements shall apply.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Posts shall be installed per Section 8-12.3(1)A of the WSDOT Standard Specification.

B. Top Rail shall be installed per Section 8-12.3(1)B of the WSDOT Standard Specification.

C. Tension Wire and Cable shall be installed per Section 8-12.3(1)C of the WSDOT Standard Specification.

D. Chain Link Fabric shall be installed per Section 8-12.3(1)D of the WSDOT Standard Specification.

E. Chain Link Gates shall be installed per Section 8-12.3(1)E. Location as shown on plans.

END OF SECTION 323113

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative steel fences.
2. Swing gates. (Automatic and Manual)
3. Gate operators, including controls.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls.
2. Division 26 Sections for electrical service and connections for motor operators, controls, limit and disconnect switches, and safety features and for system disconnect switches.
3. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For gates and gate operators. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.
2. Submit gate operator drawings showing connection to adjacent construction range of travel, and all electrical and mechanical connections to the operator. Drawings shall also show the size and location of the concrete mounting pad. Underground electrical runs and inductive vehicle obstruction loop locations shall be shown on the shop drawings.

C. Samples: For each fence material and for each color specified.

D. Installation Instructions: Submit two copies of manufacturer's installation instructions for specific gate operator product.

1.5 INFORMATIONAL SUBMITTALS

A. Fencing Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

B. Gate Operator Product Test Reports:

1. Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without failure.
2. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components, and electrical tests of all overload devices.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products. All laborers and supervisors installing the fence, gate, operators and all appurtenances thereto shall be thoroughly familiar with the type of construction involved and the materials and techniques specified and shall have a minimum of three years experience installing such systems.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel" and AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. UL Standard: Provide gate operators that comply with UL 325.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Include 8-foot (2.4-m) length of fence complying with requirements.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site. Conference attendees shall include General Contractor, Architect, and Owner.

G. Manufacturers: Manufacturers of products to be used shall be companies specializing in the manufacture of their specific products with a minimum of ten years of experience.

1.8 Product Handling and Storage

A. Upon receipt at the job site, all materials and equipment shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure property ventilation and drainage and to protect against damage, weather, vandalism, and theft.

B. Store gate operator materials upright in original shipping containers, covered, ventilated, and protected from all weather conditions.

PART 2 - PRODUCTS

2.1 TEST STANDARDS

A. ASTM B117: Practice for Operating Salt-Spray (Fog) Apparatus.

B. ASTM D1654: Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

C. ASTM D2244: Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

D. ASTM D2794: Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

E. ASTM F2408: Ornamental Fences Employing Galvanized Steel Tubular Pickets.

2.2 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500, cold formed steel tubing.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), and a minimum zinc (hot-dipped galvanized) coating weight of 0.90 oz/SF, coating designation G90 (Z275) coating.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.5 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

    a. Size: 5/8 by 96 inches (16 by 2440 mm).

2.6 DECORATIVE STEEL FENCES

A. Decorative Steel Fences: Fences made from steel tubing, bars and shapes, hot-dip galvanized.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products, 1-800-321-8724; Montage II Heavy Industrial, “CLASSIC” style for all fencing, or comparable product by one of the following:

    a. Or approved substitute during the bid process per Instructions to Bidders and Specification 012500.

B. Posts: Square steel tubing. The following sizes shall be considered minimums, and shall be increased if recommended by the manufacturer based on fence height or design.

1. Line Posts: 3 by 3 inches with 12 gauge wall thickness.
2. End and Corner Posts: 3 by 3 inches with 12 gauge wall thickness.
3. Swing Gate Posts for Man Gates: 3 by 3 inches with 12 gauge wall thickness.

4. Swing Gate Posts for Generator Enclosure Gates: 4 by 4 inches with 11 gauge wall thickness.
5. Horizontal-Slide Gate Post: 4 by 4 inches with 11 gauge wall thickness.
6. Guide Posts for Class 1 Horizontal-Slide Gates: 4 by 4 inches with 11 gauge wall thickness wall thickness; installed adjacent to gate post to permit gate to slide in space between.

C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming finished to match the fencing.

D. Rails: Two-rail design, pre-cut to specified lengths and pre-punched to accept pickets.

1. Steel Channel Rails: Steel channels 1-3/4 by 1-3/4 inch by 0.105 inch.

E. Pickets: 1 inch (25 mm) square by 14 gauge steel tubes.

1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape.
2. Picket Spacing: 4.715 inches on center, maximum.
3. Wire Mesh at Gate Pickets: To make the gate UL compliant, add black wire mesh to the secure side of all electrically operated gates. Mesh shall have clear openings of not more than 2-1/4 inches. Mesh shall full cover gates, as required to meet UL standards. Securely fasten mesh to gates with tamper proof, corrosion resistant fasteners as recommended by the gate manufacturer.

F. Infill: As provided by the basis of design products.

G. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.

H. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Fabricate sections with clips welded to rails for fastening to posts in field.
2. Drill posts and clips for fasteners before finishing to maximum extent possible.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes may be acceptable.

J. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

1. Hot-dip galvanize all components except pre-galvanized components.

K. Finish for Metallic-Coated Steel Items: Basis-Of-Design Manufacturer's standard high-performance coating with 20-year finish warranty.

2.7 SWING GATES

A. Automated swing gates to comply with ASTM F2200.

B. Gate Configuration: As indicated on drawings.

C. Gate Frame Height: As indicated on drawings.

D. Gate Opening Width: As indicated on drawings.

E. Galvanized-Steel Frames and Bracing. Fabricate members from square tubes 6 by 6 inches with 3/16 inch wall thickness, hot-dip galvanized after fabrication, and finished to match fencing.

F. Galvanized-Steel Frames and Bracing at Man Gates: Fabricate members from square tubes 3 by 3 inches with 12 gauge wall thickness hot-dip galvanized after fabrication, and finished to match fencing.

G. Frame Corner Construction: Welded.

H. Additional Rails: Provide as indicated, complying with requirements for fence rails.

I. Infill: Comply with requirements for adjacent fence.

J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

K. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and non-removable cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking at gates with two leafs; padlock accessible from both sides of swing gates.

L. Spring Hinges for Single Man Gates: BHMA A156.17, Grade 1, suitable for exterior use.

1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
2. Material: Malleable iron.

M. Hinges for 2-Leaf Gates: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron.

N. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- (19-mm-) diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

O. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.

1. Function: Electric lock tie to electronic access system.
2. Material: Brass or bronze.
3. Levers: Cast, forged, or extruded brass or bronze.
4. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel plate.

P. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail safe, and suitable for exterior use.

1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- (3.2-mm-) thick, steel plate.
2. Mounting: Mortise into post.

Q. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes may be acceptable.

R. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

2.8 GATE OPERATORS FOR SWING GATES

A. Manufacturers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide HySecurity; "SWINGSMART DC 20" with Smart DC Controller, or comparable product by one of the following:

   a. Or approved substitute during the bid process per Instructions to Bidders Specification 012500.

B. Gate Operator Warranty:

1. A. Provide a five-year limited warranty against all defects in materials or workmanship. Defective materials shall be replaced with NEW, comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the Owner.

C. Operation
1. Operation shall be by means of a brushed DC electric motor driving a double reduction gear reducer with 600:1 ratio and an articulating arm to rotate from zero to 90 degrees.
2. The closing action of the articulating arm shall cause the gate to be mechanically locked in place without the use of externally operated electric or mechanical locks.
3. The opening and closing cycle times will vary depending on gate size and weight, from 10 to 15 seconds.
4. The output of the gear reducer shall be protected from excessive torque loads by means of an adjustable breakaway torque limiter which can also function as an emergency means of opening the gate.
5. The gear reducer shall be filled with synthetic lubricant capable of allowing operation down to -25˚C (-13˚F) without a heater.
6. Operator shall operate in the event of a power failure in an uninterruptible power supply mode to the extent the two 8Ah batteries can maintain adequate power.

D. Gate Capacities
1. 1,300 lb (590 kg) for a 12 ft. (3.65 m) gate
2. 800 lb (363 kg) for a 16 ft. (4.87 m) gate
3. 600 lb (272 kg) for a 20 ft. (6.1 m) gate *(maximum length)*

E. Standard mechanical components shall include as a minimum
1. Two piece linear low density polyethylene cover with locking toggle action latches. Access to electronics does not require removal of gate arm linkage.

2. Articulating linkage for actuation of gate with covers to protect bystanders from pinch hazards and provision to bolt linkage as well as weld linkage. Spherical connection at gate.
3. Electronic circuit boards to be conformal coated to resist moisture induced failures.
4. Frame to be constructed of ¼" thick steel plate, welded.
5. Finish Frame to be zinc plated. Other components zinc plated or non-corroding.
6. Easily adjustable limit switches to limit travel in each direction.

F. Minimum standard electrical components: Industrial grade.
1. Motor: ½ HP brushed DC motor with ball bearings.
2. Voltage: 208v, single phase.
3. All components shall have overload protection.
4. Controls: Smart DC Controller Board with 512K memory containing:
   a. Inherent entrapment sensor;
   b. Built in "warn before operate" system;
   c. Built in timer to close;
   d. 2 line liquid crystal display for reporting of functions;
   e. 24 programmable output relay options;
   f. Anti- tailgate mode;
   g. Built-in multi-level power surge/lightening strike protection using gas discharge and optoisolation technology;
   h. Multi-stage intelligent battery charging under microprocessor control;
   i. Capable with optional software, of viewing EEPROM stored event logs for troubleshooting diagnostics;
   j. RS232 and USB port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems.
   k. Pulse width modulated control of brushed DC motor using 110 Amp rated solid state switching devices.
5. Transformer: 250 VA, dual voltage.
6. Accessory power: 12 VDC, 24VDC.

G. Reset switch, accessible from outside.

H. Remote Controls: Provide electric controls interface separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 enclosure for pedestal mounting, by civil contractor and with space for additional optional equipment:

1. Card Reader: Functions only when authorized card is presented. Card reader provided and installed by Owners Security/Access Control Vendor, (Convergint).

2. Telephone/Intercom Entry System: Hands-free, voice-communication system that dials the purchasing reception desk when entry is requested. Telephone/Intercom system provided and installed by Owners Telephone Vendor (INSI)

3. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing and loop detector designed to open and close gate, hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on

Drawings, as recommended in writing by detection system manufacturer for function indicated.

a. Pre-Formed Loop: Wire, in size indicated for field assembly, for pave-over or saw cut with epoxy-grouted installation

I. Required external sensors: All additional safety precautions and accessories must be installed to comply with a Class III gate installation as defined by UL 325. One set of through beam photo eyes shall be installed on the secured side of the gate 24" from grade and no further than 5" from the face of the gate. Edge sensors to be used on the leading edges of the gate

J. Accessories and Other Features:

1. Warning Module: Audio and Visual, ADA/ABA-compliant, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
2. Fire (Knox) box.
3. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
4. Lock for operator cover.
5. Gate edge and transmitter radio reversing device.
6. HY-5A plug in loop detectors.

2.9 METALLIC-COATED STEEL FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

B. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.

C. High-Performance Coating for Fencing: Apply epoxy primer, epoxy intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: Black.
2. Remove and refinish, or recoat work that does not comply with specified requirements.

D. Gate Operator Housing: Manufacturers standard powder coating.

2.10 FACTORY TESTING

A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rated capacity of the operator components.

B. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.

C. Inspect zinc finish for completeness. Touch up any imperfections prior to shipment.

D. Check all electrical wires to assure that chafing cannot occur during shipping or operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Division 01 Section "Execution"

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 36 inches (900 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1200 mm). Also, see footing requirements on the Drawings.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices. Locations of posts shall be within 1/2 –inch of designed locations and manufacturers recommendations. For installations that must be raked to follow sloping grades, the pose spacing dimension

must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by manufacturer.

2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

   a. Exposed Concrete: Extend 2 inches (50 mm) above grade. Finish and slope top surface to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Space posts uniformly at 8 feet (2.44 m) o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. Gate hardware shall be provide by the manufacturer of the gate and shall be installed per manufacturer's recommendations. Attach hardware using tamper-resistant or concealed means. Install ground-set items in Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade. Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding. Coordinate locations of operators with contract drawings, other trades and shop drawings.

B. Excavation for Support Posts, Pedestals, and Concrete Bases: Hand-excavate holes for bases, in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 24 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Owner may engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of

reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

B. Gate Operator Testing

1. Test gate operator through ten full cycles and adjust for operation without binding, scraping, or uneven motion. Test limit switches for proper "at rest" gate position.
2. All anchor bolts shall be full concealed in the finished installation.
3. Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warrantee documentation to the manufacturer.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 323119

SECTION 329000 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, 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 preparation and finish grading of planting areas, topsoil and amendments, trees, shrubs, and groundcover, staking, cleanup and maintenance.

B. Related Sections:
1. Division 01 Section "Summary" for description of work by others.
2. Division 31 Section "Earth Moving" for subgrade preparation.
3. Division 32 Section "Seeding" for preparation and seeding of grass and wildflower areas.

1.3 REFERENCES

A. Plant Grading:
1. "American Standard for Nursery Stock," Current Edition, American Association of Nurserymen.
2. State of Washington Standards for Nursery Stock.

B. Plant Material Identification:
1. Sunset Western Garden Book, 2007, Eighth edition.
2. 1976 edition of Hortus Third, L.H. Bailey.
3. Current edition of Standardized Plant Names as adopted by the American Joint Committee on Horticultural Nomenclature.

1.4 SUBMITTALS

A. Refer to Section 013300 for submittal procedures.

B. Samples: Submit samples of all materials, other than plants, including fertilizers, soil, mulch and rock. Include a list of sources. Samples shall be unaltered and of quantity sufficient to allow for proper inspection and review.

C. Schedule for the work. Indicate the dates for commencement and completion of each phase of landscaping work. Allow in the schedule adequate time for inspections specified, plant procurement, storage and delivery to the site.

D. Plant Procurement List: Submit a written schedule of the supplier, root condition, and size of all plants on the plant list. Schedule shall indicate plants that must be dug while dormant.

1.5 SUBSTITUTIONS

A. Substitutions will be considered during the bid process per Specification Section 012500.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Landscaping firm shall be active and experienced in landscape work of the type specified, and able to show evidence of successful completion of projects of similar scope.

B. Comply with referenced standards for identification and grading of plant materials.

C. Pre-Installation Conference: In conjunction with the procurement of the plants specified herein, meet with Owner and Architect to discuss and verify contract requirements, schedule, and proposed planting methods.

1.7 WARRANTY

A. Warranty:
1. Warranty materials and workmanship for a period of one year following Owner's final acceptance.
2. After final acceptance, Contractor will not be held responsible for damage to properly installed plants resulting from excessive climatological conditions, vandalism, or other factors beyond his control.
3. Plants that require replacement during the warranty period shall be reinstated with a one-year guarantee beginning from the date of replacements.

B. Replacement:
1. Plants found in unsatisfactory condition, as determined by the Architect, shall be removed from the site. All removed plants shall be replaced as soon as conditions permit within the normal planting season, at no additional cost to the Owner.
2. Perform all corrective procedures within contract requirements, as directed by the Architect, when the replacement plants are installed.
3. Tag replacement plants with green nursery tape at base of stalk.

C. Replacement Materials: All replacement plants shall be of the same variety, size and root condition as existing adjacent plant materials and shall include new growth that may have occurred since planting, such that replacement plants match existing plants of the same variety.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store and maintain plant materials from time of approval until delivery to job site for installation.

B. Take precautions to protect the plants during delivery, storage, and handling. Replace damaged plants at no additional cost to the Owner.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate landscaping installation with work of other trades specified elsewhere.

B. Do not perform landscaping work in areas subject to the subsequent work of other sections, unless approved otherwise.

C. Perform work in accordance with the approved schedule specified in Submittals. If a schedule delay occurs, revise and resubmit schedule to reflect each schedule delay.

PART 2 - PRODUCTS

2.1 PLANTS

A. Furnish plants in sizes; conditions and quantities as scheduled on the Plant List. Where there is a quantity discrepancy between Drawings and the Plant List, determine the exact quantities from planting plans.

B. In grouped planting areas, precedence shall be given to the specified distance on center rather than the estimated number of plants, be it a larger or smaller quantity of plants.

C. Root-bound plants will not be accepted.

2.2 TOPSOIL

A. General: Imported topsoil for seeded areas, planting areas, rain gardens and planting pit backfill.

B. Soil shall be well mixed, free of weeds, weed seed, deleterious materials, rocks, debris, and particles that will not pass through a 3/4" screen.

C. Imported topsoil mix: 1/3 sandy loam, 1/3 sand, 1/3 composted green waste. Mix shall be free of weeds, deleterious materials, rocks, debris and particles that will not pass through a ¾" screen. (See Paragraph 1.5 SUBSTITUTIONS).

D. Submit sample and source for approval prior to installation.

2.3 MULCH

A. Decomposed sawdust mixed with aged manure or compost. Cedar Grove Compost, Steerco, or approved alternative (See Paragraph 1.5 SUBSTITUTIONS). Submit sample and source for approval prior to installation.

2.4 FERTILIZER

A. Top Dressing Fertilizer: 'Osmocote' 14-14-14, Best Apex Blue 14-14-14, or approved alternate (See Paragraph 1.5 SUBSTITUTIONS).

B. Planting Pit Tablets: Agriform 20-10-5, 2-year tablets, or approved alternate (See Paragraph 1.5 SUBSTITUTIONS).

2.5 RIVER ROCK

A. 3"-6" diameter cobbles with fines and soil removed.

2.6 STEEL EDGING

A. General landscape edging complete with loops pressed from, or welded to, face of sections to receive anchor stakes. Ryerson Inc, Chicago IL; verify local distributor.
   1. Size: ¼ inch by 5 inches deep.
   2. Anchoring Stakes: Manufacturer's standard 16 inch tapered steel.
   3. Finish: Manufacturer's standard green-black painted finish.

2.7 ACCESSORIES

A. Tree Staking and Guying Materials:

1. Ties and Anchors: 1", 600 lb test, black polypropylene guy line; nylon tension bars; and nylon arrowhead anchors. ArborGuy PRO40 or approved equal (See Paragraph 1.5 SUBSTITUTIONS).
2. Stakes: 1½" diameter Lodgepole Pine poles, 8' length.
3. Verify site locations for staked or guyed trees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection: Inspect the planting areas for the conditions specified below, and other conditions which would adversely effect the landscaping installation. Notify Architect if adverse conditions are discovered. Commencement of landscaping installation indicates acceptance of the surrounding conditions.
   1. Contaminants: Inspect planting areas for contaminants that may have been discarded during construction activities, such as paint thinner or plaster.
   2. Improper Drainage: Inspect for drainage conditions that would adversely effect plant growth.
   3. Subgrade: Inspect planting areas for condition and depth. If subgrades do not meet specified depths, excavate or provide fill to bring to specified depths.
   4. Building Wall and Planter Waterproofing: Verify that waterproofing work has been completed, tested, and accepted, prior to installation of landscape materials adjacent to buildings.

3.2 PREPARATION

A. Protect surrounding construction from damage caused by the work of this section.

3.3 SUBGRADES AND SOIL DEPTHS

A. As specified in Division 31 Section "Earth Moving": planting areas to be left clean and even at the following depths:
   1. Ornamental Planting areas: 9" below finish grade for 7" compacted depth of imported topsoil and 2" of mulch.
   2. Rain Gardens: For bottoms: 12" below finished grade for 12" compacted depth of imported topsoil; incorporate to overall depth of 18". For slopes: 12" below finished grade for 12" compacted depth of imported topsoil; incorporate to overall depth of 18".
   3. Water Quality and Infiltration Ponds: 4" compacted depth of imported topsoil; incorporate to overall depth of 8".
   4. Other seeded areas: 2" below finished grade for 2" compacted depth of imported topsoil; incorporate to overall depth of 4".

3.4 INSTALLATION

A. Exterior Soil Application:
   1. Scarify all subgrades to a minimum depth of 12".
   2. Incorporate topsoil by tilling or scarification to depth noted.
   3. For topsoil depths greater than 4", apply one-half depth of topsoil and incorporate into scarified subgrade. Apply remaining depth to specified profile. For topsoil depths less than 4" incorporate directly into scarified subgrade.
   4. Compact each lift of topsoil to 85% of maximum dry density, as measured in accordance with ASTM D1557. Soil depth measured after compaction.

5. Crown planting areas to provide smooth, even grades with a minimum of 2% slope away from buildings or to drainage structures or swales and from high point in center of planting beds toward edges.

3.5 PLANTING PROCEDURES

A. Location:
1. Plant Layout: Set all plants in the actual locations proposed for planting. Set outside row of groundcover plantings parallel to adjacent edges and at a distance from edges of 1/2 the on center spacing.
2. Layout Approval: Notify Architect a minimum of 14 days before planting layout is completed for review. Make placement changes the Owner deems necessary at no additional cost.

B. Planting: Upon approval of the plant layout by the Architect, install plants as specified below. Special planting techniques, defoliating, wiltproofing or spray-misting may be required by the County for unseasonable planting, prolonged periods of drought, etc.
1. Dig pits for plants as indicated. Planting pits shall be rough, not smooth.
2. Set plants in center of planting pit approximately 2” above normal growing position on fully compacted pad and backfill approximately halfway.
3. Place fertilizer tablets around rootball in accordance with manufacturer's printed instructions.
4. Backfill to within 4” of finish grade, fill planting pit with water and allow backfill to settle around the rootball. Upon settlement, backfill to subgrade depths (if mulch is to be applied) or to nursery grown depth with topsoil as specified herein. Construct watering basin per details.
5. Apply top dressing fertilizer to the surface around the periphery of the plant's rootball.
6. Provide positive drainage away from stalk or trunk at plant crowns, after planting and settling, at no greater than 1/2" per foot, unless otherwise indicated.
7. Soak rootballs which have dried significantly before planting; broken roots 1/2" diameter or greater shall be pruned cleanly.
8. Do not install rootbound plants. If roots in container show even minor circular growth, slash the rootball vertically with a sharp knife along outside of ball in three places minimum before planting; remove all string ties, wire or straps holding rootball of plants from planting pit prior to backfilling. For B&B plants, remove burlap from top of rootball. Remove treated burlap completely.
9. Install at any time plant materials are available and weather conditions are consistent with good horticultural practice.

C. Pruning: Do no pruning prior to delivery or after planting, without prior review and approval by the Architect.

D. Staking and Guying: Secure trees during the first two growing seasons, as indicated in the details. Secure loose or tipped shrubs with a single stake.

E. Mulching:
1. Before mulch installation, contact the Architect for a semi-final review of planting areas, grades, soil depth, and plant location.
2. After review and approval of items above, cover all planting areas with uniform 2” layer of mulch over the properly cleaned and graded subsurface.
3. Should mulch be installed prior to inspection, it will be at Contractor's risk, and subject to removal.

F. Steel Landscape Edging: Install edging material flush with finished grade with straight lines and tight, square corners. Stake per manufacturer's recommendations.

G. Plant Establishment:
1. Not less than twelve (12) weeks, nor more than twenty four (24) weeks after initial planting, make second application of time released of top dressing fertilizer to all plantings.
2. Where planting conditions or rootball sizes warrant, apply root stimulant in accordance with the manufacturer's recommendations.
3. Verify time and type of fertilizer application with the Architect prior to installation if outside the normal growing season.

3.6 CLEANUP

A. Daily Cleanup: Keep all areas clean, neat and orderly at all times. Keep dirt and rubbish off pavements and out of planted areas during construction. Leave project clean and neat at the end of each working day.

B. Final Cleanup: Prior to final completion and acceptance, remove all plant tags and remove all deleterious materials and debris from planting areas and dispose of off site. Rake all planting areas neatly to an even, fine grade; remove soil and stains caused by work of this Section from building faces and adjacent pavements.

3.7 PLANT PROTECTION

A. Properly protect all plantings and groundcover from the harmful effects of wind, unusual weather, construction activities, and abuse until final completion.

3.8 FINAL REVIEW OF PLANTING

A. The Architect will review all work to verify substantial completion of the planting. Provide notice a minimum of 7 days prior to the anticipated date for the review. Include itemization of all work, such as pruning, backordered materials, maintenance procedures, and the like, which remain incomplete. The Architect will determine from the letter of request whether sufficient work is completed for final review.

B. The site shall be thoroughly cleaned, and all work completed unless otherwise indicated in the accepted request for final review.

3.9 MAINTENANCE

A. Maintain the installation until final acceptance of the project and for an extended maintenance period of 30 days beyond final acceptance. After the 30 day extended maintenance period, the Owner will assume responsibilities for correct maintenance practices through the remainder of the warranty period.

B. Planting area maintenance work includes checking irrigation operation, weeding, soil cultivating, removal of dead materials, re-staking or resetting plants to proper grades or upright position, replenishing mulch and other operations necessary for the proper care of the landscape work.

END OF SECTION 329000

SECTION 329400 – FIELDSTONE ACCENT WALLS (ADDITIVE ALTERNATE #5)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, 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 installation of native stone walls.

B. Related Sections:
   1. Division 01 Section "Summary" for description of work by others.
   2. Division 31 Section "Earth Moving" for subgrade preparation.

1.3 REFERENCES

A. See Related Sections for reference standards.

1.4 SUBMITTALS

A. Refer to Division 013300 for submittal procedures.

B. Samples: Submit samples of all materials and finishes.

C. Mock Up: Prepare 4'-0" long section for review.

PART 2 - PRODUCTS

2.1 STONE

A. Local Weathered Granite, Basalt or similar. Angular shapes, size range 6" – 18" in each direction.

2.2 CRUSHED ROCK BASE

A. "3/4" crushed ledge stone.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide clean, level subgrade in native soil compacted to 95%.

B. Place crushed rock base in maximum 4" deep lifts. Compact each lift to 95%.

C. Install the first course of stone on gravel base with full contact between rock and base.

D. Provide consistent batter with flat vertical faces and level top.

E. Provide relatively tight joints. Blind mortar where required.

END OF SECTION 329400

SECTION 331100 – WATER UTILITIES

1.1 SUMMARY

A. This work shall consist of constructing water mains and appurtenances.

B. Related Sections:
   1. Section 31 20 00 Earthmoving

1.2 REFERENCES

A. Reference the following standards:
   1. Current copy of the WSDOT Standard Specifications for Roads, Bridge and Municipal Construction.
   2. Jefferson County PUD Standards.

1.3 SUBMITTALS

A. Submit cut sheets for shop drawings for all materials.

1.4 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

B. The Contractor shall be responsible for all coordination with Jefferson County PUD.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

   1. Notify Owner no fewer than two business days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

1.6 PERMITS

A. The Contractor shall be responsible for permits, fees and inspections which are to be obtained and scheduled buy the Contractor at its own expense.

1.7 DIMENSIONS AND LAYOUTS

A. The Contractor shall be responsible for furnishing, setting and marking all line and location stakes. When work-requiring control is being performed, all necessary related equipment, supplies and instruments shall be on site. A qualified layout engineer, surveyor, or technical specialist shall be assigned to the Contractor's crew for this work. This equipment and personnel shall be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

B. The Contractor shall be responsible for review of all County, PUD and Owner's records relative to the existing underground utilities. The Contractor is responsible for avoiding damage to the facilities indicated in the project documents and records available to the contractor and shall restore all such facilities at Contractor's own expense.

C. The Contractor shall notify the Owner immediately if underground utilities not shown on the records are encountered.

D. The Contractor is responsible for preserving all benchmarks and stakes and the replacement of any that are displaced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials for Water Distribution and Transmission: Comply with American Water Works Association (AWWA) standards and the Jefferson County PUD Standards.

2.2 WATER MAIN PIPE

A. Water main pipe shall be C900 PVC meeting the requirements of the WSDOT Standard Specification Section 9-30.1(5) and be per Jefferson County PUD Standards.

2.3 VALVES AND VALVE BOXES

A. Gate valves shall be per AWWA C500 and per the Jefferson County PUD Standards.

B. Valve boxes shall be per the WSDOT Standard Specification 9-30.3(4) and conform to the Jefferson County PUD Standards.

2.4 HYDRANTS AND YARD HYDRANTS

A. Hydrants shall be Mueller Model Century 200 or approved equal with 4 inch Storz adapter meeting AWWA C502 and shall conform to the Jefferson County PUD Standards and per the plans.

B. Yard hydrants per plan.

2.5 THRUST BLOCKS

A. Thrust blocks shall meet AWWA C600 and shall conform to Jefferson PUD Standards and per the plans.

2.6 METERS

A. Meters shall conform to Jefferson County PUD Standards and per the plans.

2.7 BACKFLOW PREVENTION

A. Backflow prevention assemblies shall be Jefferson County Department of Health approved shall meet AWWA C605 and shall conform to Jefferson County PUD Standards. .

2.8 BLOW OFF ASSEMBLY

A. Blow off assemblies shall conform to Jefferson County PUD Standards and per the plans.

2.9 FIRE DEPARTMENT CONNECTION AND POST INDICATOR VALVE

A. The fire department connection and post indicator valve shall conform to the Jefferson County PUD Standards and per the plans.

2.10 BEDDING AND BACKFILL

A. Bedding and backfill shall be per Section 31 20 00 Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to beginning work verify installation conditions as satisfactory to receive materials of this Section.

3.2 TRENCHING AND BACKFILL

A. Trenching and backfill shall be per the Jefferson County PUD Standards and Section 31 20 00 Earth Moving.

3.3 INSTALLATION

A. Shall be in accordance with Jefferson County PUD Standards and Section 7-09.3 of the WSDOT Standard Specification.

B. All water mains shall be installed with a minimum cover of three feet.

C. Provide concrete thrust blocks at all water distribution line elbows and tees.

3.4 TESTING

A. Hydrostatic pressure test in accordance with Jefferson County PUD Standards and Section 7-09.3(23) of the WSDOT Standard Specification.

3.5 DISINFECTION AND TESTING

A. All new water mains and repaired portions of, or extensions to, existing mains shall be flushed and disinfected in accordance with Jefferson County Department of Health, Jefferson County PUD Standards, AWWA C601-68 and D105-80, and Section 7-09.3(24) of the WSDOT Standard Specification. The facility will not be accepted or approved for use until after a satisfactory bacteriological report is obtained.

END OF SECTION 331100

SECTION 333600 – UTILITY SEPTIC TANKS

1.1 SUMMARY

A. This work shall consist of constructing septic tanks, sewer piping and septic drainfields.

B. Related Sections:
   1. Section 31 20 00 Earthmoving

1.2 REFERENCES

A. Reference the following standards:
   1. Jefferson County Environmental Health Standards.
   2. Current copy of the WSDOT Standard Specifications for Roads, Bridges and Municipal Construction.

1.3 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

B. The Contractor shall be responsible for all coordination with Jefferson County Environmental Health.

1.4 SUBMITTALS

A. Submit cut sheets for shop drawings for all materials.

1.5 PERMITS

A. The Contractor shall be responsible for permits, fees and inspections which are to be obtained and scheduled by the Contractor at its own expense.

1.6 DIMENSIONS AND LAYOUTS

A. The Contractor shall be responsible for furnishing, setting and marking all line and location stakes. When work-requiring control is being performed, all necessary related equipment, supplies and instruments shall be on site. A qualified layout engineer, surveyor, or technical specialist shall be assigned to the Contractor's crew for this work. This equipment and personnel shall be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of work on the site.

B. The Contractor shall be responsible for review of all County, PUD and Owner's records relative to the existing underground utilities. The Contractor shall be responsible for avoiding damage to

the facilities indicated in the project documents and records available to the contractor and shall restore all such facilities at Contractor's own expense.

C. The Contractor shall notify the Owner immediately if underground utilities not shown on the records are encountered.

D. The Contractor shall be responsible for preserving all benchmarks and stakes and the replacement of any that are displaced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Washington State Recommended Standards and Guidance for On-site Sewage Systems (WAC 246-272A) and the Jefferson County Environmental Health Standards.

2.2 SEWER SERVICE LINE

A. Sewer service line shall be 4 inch PVC ASTM 3034 as per plans.

2.3 SEPTIC TANK AND ACCESSORY STRUCTURES

A. Septic tank shall be a 1,500 gallon Sound Placement tank or approved equal as per plans.

2.4 PUMP CHAMBER AND ACCESSORY STRUCTURES

A. Pump chamber shall be an 1,800 gallon Sound Placement pump chamber or approved equal as per plans.

2.5 FORCE MAIN

A. Force main shall be 1 ½ inch class 200 force main and per plans.

2.6 DRAIN FIELD AND ACCESSORY STRUCTURES

A. Per plans.

2.7 MANIFOLD

A. Manifold shall be a 1 ½ inch Class 200 Manifold.

2.8 BEDDING AND BACKFILL

A. Bedding and backfill shall be per Section 31 20 00 Earth Moving. Backfill over septic drainfield shall be a loamy soil as per plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to beginning work verify installation conditions as satisfactory to receive materials of this Section.

3.2 TRENCHING AND BACKFILL

A. Trenching and backfill shall be per Section 31 20 00 Earth Moving.

3.3 INSTALLATION

A. Sewer service line shall be installed per Section 7-18.3 of the WSDOT Standard Specification.

B. Septic tank, pump chamber, drain field and appurtenant facilities shall be in accordance with Chapter 245-272A WAC, Jefferson County Environmental Health Standards and per plan. Jefferson County Environmental Health jurisdictional rules, regulations, ordinances, policies, procedures or practices take precedence should inconsistencies arise.

3.4 TESTING

A. Drainfield pressure testing shall be completed prior to backfilling. Contractor shall coordinate with designer and Jefferson County Environmental Health for witnessed pressure testing of completed system. All system components shall be completed and ready for backfill as per plan prior to calling for final inspection and pressure test. All testing shall be in accordance with Jefferson County Standards and 246-272A WAC.

END OF SECTION 333600

SECTION 334000 – STORM DRAINAGE UTILITY

1.1 SUMMARY

A. This work includes:.
1. Site-storm drainage piping, fittings, accessories and bedding.
2. Drainage structures – catch basins, cleanouts, trench drains, oil/water separators
3. Infiltration Galleries
4. Cleaning and testing storm drainage piping.

1.2 REFERENCES

A. Reference the following standards:
1. Current copy of WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction.
2. Jefferson County Standards.

B. Related Sections:
1. Section 31 20 00 Earth Moving

1.3 SUBMITTALS

A. Submit cut sheets for shop drawings for all materials

1.4 QUALITY ASSURANCE

A. A pre-installation meeting shall be held with the Owner prior to work related to this section.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two business days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

1.6 PERMITS

A. The Contractor is responsible for permits, fees and inspections which are to be obtained and scheduled by the Contractor at its own expense.

1 1.5 DIMENSIONS AND LAYOUTS

2 A. The Contractor shall be responsible for furnishing, setting and marking all line and location
3 stakes. When work-requiring control is being performed, all necessary related equipment,
4 supplies and instruments shall be on site. A qualified layout engineer, surveyor, or technical
5 specialist shall be assigned to the Contractor's crew for this work. This equipment and
6 personnel shall be available, at no additional cost to the Owner, for the purpose of verifying
7 layout and certifying the accuracy of work on the site.
8 B. The Contractor shall be responsible for review of all City and Owner's records relative to the
9 existing underground utilities. The Contractor shall be responsible for avoiding damage to the
10 facilities indicated in the project documents and records available to the Contractor and shall
11 restore all such facilities at Contractor's own expense.
12 C. The Contractor shall to notify the Owner immediately if underground utilities not shown on the
13 records are encountered.
14 D. The Contractor shall be responsible for preserving all benchmarks and stakes and the
15 replacement of any that are displaced.
16
17 1.6 SUBMITTALS

18 A. Submit cut sheets or shop drawings for all materials.

19 PART 2 - PRODUCTS

20 2.1 DRAIN PIPE

21 A. Storm Drainage Pipe shall be Schedule A in accordance with Section 7-04 of the WSDOT
22 Standard Specification and per the plans.

23 2.2 BEDDING AND BACKFILL

24 A. Bedding and backfill shall be per Section 31 20 00 Earth Moving.

25 2.3 CATCH BASINS

26 A. Catch Basins shall be in accordance with Section 7-05 of the WSDOT Standard Specifications.

27 B. Catch Basin Type 1 shall be as referenced in WSDOT Standard Plan B-5.20-00.

28 2.4 FRAME

29 A. Frame shall be per WSDOT Standard Plan B-30.10-00.

30 2.5 GRATE

31 A. Grate shall be per WSDOT Standard Plan B-30.50-01.

32 2.6 CLEANOUT

33 A. Cleanouts shall be per WSDOT Standard Plan B-85.40-00.

2.7 INFILTRATION GALLERY

A. Drain rock shall be 1 ½ inch minus and per the WSDOT Standard Specification Section 9-03.12(5).

B. Filter fabric shall be Mirafi 140N Filter.

C. Perforated pipe shall be per drain pipe requirements of this specification.

2.8 OIL AND WATER SEPARATOR

A. Shall be per plan.

2.9 TRENCH DRAINS

A. Shall be per plan.

2.10 VALLEY GUTTER

B. Shall be per plan.

2.11 RAIN GARDEN

A. Shall be per landscape plans and specifications.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER WORK

A. Verify location from the Owner's records.

B. Before installation, Contractor shall make proper provisions for site storm lines to avoid interferences with installation of other work and/or other contractors. Any changes caused by Contractor's neglect to coordinate work shall be made by Contractor at Contractor's expense.

C. Site storm drain drawings and Specifications shall be compared with drawings and Specifications of other trades and any discrepancies between the documents reported to the Owner prior to installation of work.

3.2 EXCAVATION

A. Excavation and preparation shall be in accordance with Section 31 20 00 – Earth Moving. All excavation shall conform to the Washington Administrative Code (WAC) 296-155 and WISHA requirements for Excavation, Trenching and Shoring.

B. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings.

3.3 INSTALLLATIONS

A. Verify existing locations from the Owner.

B. Excavation and preparation of the trench shall be in accordance with Section 31 20 00 – Earth Moving. All trenching shall conform to the Washington Administrative Code (WAC) 296-155 and WISHA requirements for Excavation, Trenching and Shoring.

C. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings.

D. Shall be in accordance with the WSDOT Standard Specification Section 7.04.

E. Pipe installation shall be per Section 7-04.3 of the WSDOT Standard Specification.

F. Provide all necessary fittings for connections to roof drains and downspouts. Provide all necessary fittings for complete connections of roof drains and downspouts to the site storm drainage system.

3.4 BEDDING AND BACKFILLING

A. Bedding and Backfilling shall be in accordance with Section 31 20 00 Earth Moving.

3.5 CLEANING AND TESTING

A. Provide cleaning and testing in accordance with the referenced WSDOT Standard Specification Section 7-04.3(1).

END OF SECTION 334000