VOCATIONAL TRAINING CENTER

NISQUALLY INDIAN TRIBE

PROJECT MANUAL

OCTOBER 5, 2026

RFP# 2026-VCT-P1

NISQUALLY VOCATIONAL TRAINING CENTER
OLYMPIA, WASHINGTON
PHASES 1 AND 2

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REQUEST FOR PROPOSAL

RFP# 2026-VCT-P1

VOCATIONAL TRAINING CENTER

PHASE I

NISQUALLY INDIAN TRIBE

Prepared By:
Nisqually Building Department
4820 She-Nah-Num Drive
Olympia WA. 98513

REQUEST FOR PROPOSAL
RFP# 2026-VCT-P1

DATE: October 5, 2026

The Nisqually Building Department on behalf of the Nisqually Indian Tribe is issuing a Request for Proposal (RFP) for interested Contractors to submit proposals for Phase I of the Vocational Training Center project. Minority and disadvantaged companies are encouraged to submit proposals**.**
Contact information for Elizabeth Glenn is phone: 360-256-5221 x1040 OR glenn.elizabeth@nisqually-nsn.gov.

Free-of-charge access to project bid documents (plans, specifications, addenda, and Bidders List) is provided to Prime Bidders, Subcontractors, and Vendors by going to www.bxwa.com and clicking on "Posted Projects", "Public Works", and "Nisqually Indian Tribe". This online plan room provides Bidders with fully usable online documents with the ability to: download, view, print, order full/partial plan sets from numerous reprographic sources, and a free online digitizer/take-off tool. It is recommended that Bidders “Register” in order to receive automatic e-mail notification of future addenda and to place themselves on the “Self-Registered Bidders List". Bidders that do not register will not be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this project. Contact Builders Exchange of Washington at (425) 258-1303 should you require assistance with access or registration. The content available through bxwa.com is our property or the property of our licensors and is protected by copyright and other intellectual property laws. Access to project documents is intended for use by bidders (general contractors/prime bidders, subcontractors and suppliers), agency personnel and agency’s consultants, as well as for personal, noncommercial, use by the public. You may display or print the content available for these uses only. "Harvesting" (downloading, copying, and transmitting) of any project information and/or project documents for purposes of reselling and/or redistributing information by any other party is not allowed by BXWA.

VIABLE CONTRACTORS: To be awarded this project CONTRACTOR, of the winning bid, must be current will all taxes, insurances, bonding and licensing as listed in the Contractor Provisions. Failure to comply will result in bid rejection.

SEALED PROPOSALS: Vendors will deliver two applications to the following address either by hand, delivery service or by US postal:

Nisqually Indian Tribe
4820 She-Nah-Num Drive SE
Olympia WA. 98513

Nisqually Indian Tribe
Squally-Absch
People of the river, people of the grass

Phone: 360-456-5221
Attn: Jill Wall
Financial Services - Contracts

CLOSING DATE FOR SUBMITAL SHALL BE Friday, October 30, 2026 by noon
Proposals received after the above-cited time will be considered a late response and are not acceptable unless waived by the Building Department Director.

- Please mark the envelopes clearly with Sealed RFP # 2026-VCT-P1
- Bids will be opened privately
- Questions may be directed to Elizabeth Glenn, Sr Project Manager, 360-456-5221 x1040 or e-mail at glenn.elizabeth@nisqually-nsn.gov

Thank you for your Interest

Definitions:

"Tribe"	**is Nisqually Indian Tribe**
"Bidder"	**an individual or business submitting a bid to Nisqually Tribe**
"Contractor"	**One who contracts to perform services in accordance with a contract**

1. PROPOSAL TERMS

A. The Nisqually Tribe reserves the right to reject any and all proposals received as a result of this RFP. If a proposal is selected, it will be the most advantageous regarding price, quality of service, the Vendor's qualifications and capabilities to provide the specified service(s), and other factors in accordance with the Tribal Bidding Procedure policy. The Tribe does not intend to award a Bid fully on the basis of any response made to the proposal; the Tribe reserves the right to consider proposals for modifications at any time before a Bid would be awarded, and negotiations would be undertaken with the provider whose proposal is deemed to best meet the Tribe's specifications and needs.

B. The Tribe reserves the right to reject any or all bids, to waive or not waive informalities or irregularities in bids or bidding procedures, and to accept or further negotiate cost, terms, or conditions of any bid determined by the Tribes to be in the best interests of the Tribe even through not the lowest bid.

C. The price quotations stated in the bidders proposal will not be subject to any price increase from the date on which the proposal is opened at the Tribal headquarters to the mutually agreed-to date Bid.

D. In the event it becomes necessary to revise any part of the RFP, addenda will be provided. Deadlines for submission of the RFP maybe adjusted to allow for revisions.

E. Proposals should be prepared simply and economically providing a straight-forward, concise description of the vendor's ability to meet the requirements of the RFP.

F. Three references of similar scope and project value are required. Bidder must be in good standing with the tribe, if he has current or past projects Nisqually.

2. SCOPE OF SERVICES

General Contracting services to Build Phase 1 of Nisqually's Vocational Training Center as described in the bid document drawings and specifications.

Site is available for inspection and for accuracy of the bid proposal please contact the Building Department to schedule a walkthrough after October 14, 2026.

This phase of the project is funded by a Commerce Grant. The grant requires that the project be Substantially Complete by May 28, 2027 with Final Completion and final billing submitted by June 30, 2027. Please submit a proposed schedule along with the Bid Form.

This project is subject to Davis Bacon, Prevailing Wage applies yes_x_ no ___

CONTRACT PROVISIONS

REPORTING OF CONTRACTOR

Section 1 – The Contractor is to report to the Building Department Manager and/or Director and confer with them as necessary to insure satisfactory work progress.

Section 2 – All reports, estimates, memoranda and documents submitted by the Contractor must be dated and bear the Contractors name.

Section 3 – All reports made in connection with these services are subject to review and final approval by the Building Department Director.

Section 4 – When Applicable, the Contractor will submit a final written report to the Building Department Director.

Section 5 – After reasonable notice to the Contractor, the Tribe may review any of the Contractor's internal records, reports, or insurance policies.

PERSONNEL

Section 1 – The contractor will provide the required services and will not subcontract or assign the services without *prior* written approval of the Building Department Director. Subcontractors, as well as primary contractors, are subject to the TERO ordinance and the Tribe's Native American preference policy (detailed below.) This ordinance applies to all sub tiers as well.

INDEMNIFICATION AGREEMENT

The contractor will protect, defend and indemnify the Nisqually Tribe, its officers, agents volunteers and employees from any and all liabilities, claims, liens fines, demands and costs, including legal fees, of whatsoever kind and nature which may result in injury or death to any persons, including the Contractors own employees and loss of damages to any property, including property owned or in the care, custody or control of the Nisqually Tribe in connection with or in any way incident to or arising out of the occupancy, use, service, operations, performance or non-performance of work in connection with this contract resulting in whole or in part from negligent acts or omissions of contractor, any sub-contractor, or any employee, agent or representative of the contactor or any sub-contractor.

NATIVE AMERICAN PREFERENCE/TERO

- The Nisqually Tribe's Native American preference in contracting policy will be used to select the winning bid.
- The owner wishes to make available any and all opportunities for employment and training for Nisqually Tribal Members, their immediate families, and all other Native Americans. Therefore, the Tribal Employment Rights Ordinance (TERO) will be in effect for this project. This includes but is not limited to:
    a) Native preference in employment.
    b) Native preference in contracting. If applicable, Contractor will provide a list of jobs related to this Contract to the Nisqually Tribal Building Department upon signing this Contract. Contractor will ensure that subcontractors also comply with this provision.
- Every covered employer or entity with a contract or subcontract may be subject to a onetime tax of 1.75% of the total project/contract costs, i.e., equipment, labor, materials and operations and any increase of the contract/project or subcontract amount.
- TERO also applies to subcontractors and all sub tiers.

TRIBAL HISTORIC PRESERVATION OFFICER REQUIREMENTS

- THPO requires 30 day notice prior to any ground disturbances or tree removal to ensure for review and determination of what level of survey is needed to better protect the cultural, historical, and archaeological resources of the TRIBE. A THPO representative shall be present at all dig sites, regardless of size or depth of dig, in order to prevent any damage to known or potential cultural resource sites. THPO laws, regulations and executive orders are in effect.

PERFORMANCE AND PAYMENT BONDS

- Contractor shall furnish a performance bond for 100% of the contract price and a payment bond for 50% of the contract price to the Tribe as security for the faithful performance and payment of all obligations prior to starting work.

INSURANCE REQUIRMENTS

- The Contractor shall purchase and maintain insurance for protection from claims under worker's compensation laws, disability benefits laws or other similar employee benefit laws; for damages due to injury, occupational disease, or death of employees; from personal injury claims; and from property damage claims, including loss of use resulting therefrom -- any and all of which may arise out of or result from the Contractor's operations under the Contract.
- Minimum Levels of Insurance
    a. Commercial General Liability: $1,000,000 per occurrence/ $2,000,000 aggregate for bodily injury, personal injury and property damage.
    b. Workers' Compensation and Employer's Liability: $500,000 per injury, $500,000 per occurrence, and $500,000 per occupational disease.
    c. Automobile Liability: $500,000 Combined Single Limit.

LIQUIDATED DAMAGES

- If the Contractor fails to complete the work within the time specified, the Contractor shall be liable for and shall pay to the Tribe the sum of $1,000 (one thousand dollars) for each calendar day of delay until the work is substantially completed and accepted by the Tribe, except for delays caused because of force majeure.

Bid Form

for

RFP # 2026-VCT-P1

Vocational Training Center
Phase I

Bidder Name: _____

Bidder Address: _____

Bidder Telephone: _____

To: Nisqually Indian Tribe
4820 She-Nah-Num Drive SE
Olympia WA. 98513

CERTIFICATIONS AND BASE BID
Pursuant to and in compliance with issued documents, including any of the following; Instructions to Bidders, Drawings, Specifications, and other Documents relating thereto, the undersigned Bidder, having investigated the Project and being aware of costs and conditions affecting performance of the Contract, and being familiar with Contract Documents, hereby proposes to provide material and perform Work on terms and conditions herein contained. The amount below includes cost of Work but does not include Washington State Sales Tax.

_____ Dollars ($_____)
Base Bid

The above amount may be modified by amounts indicated by Bidder in Schedule of Unit Prices and Schedule of Alternates below.

Include amount of overhead and profit in Base Bid amount.

_____ Dollars ($ _____)
Alternate 1 – Main Entry Canopy: South

_____ Dollars ($ _____)
Alternate 2 – Main Entry Canopy: North

_____ Dollars ($ _____)
Alternate 3 – Stairs: North and South

_____ Dollars ($ _____)
Alternate 4 – Second Floor System

_____ Dollars ($ _____)
Alternate 5 – Elevator System

_____ Dollars ($ _____)
Alternate 6 – Site Hot Mix Asphalt

_____ Dollars ($ _____)
Alternate 7 – Concrete Sitework

_____ Dollars ($ _____)
Alternate 8 – Site Lighting

_____ Dollars ($ _____)
Alternate 9 – North / South Road Extension

Bidder, in submitting this Bid, understands that Owner reserves the right to reject any or all Bids, to waive any informality or irregularity in any Bid received, and to accept any Alternate(s) in any order of combination.

SALES TAX AND PERMITS
Do not include retail sales tax in Bid Sum: Other necessary fees and taxes shall be paid by the Contractor and are included in the bid. Local building department plan check fee, building permit fee, and other fees as outlines in the RFP will be paid by the Owner and shall not be included in the bid.

TIME FOR COMPLETION
The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed issued by the Nisqually Indian Tribe. NTP will be issued by December 1, 2026.

Project Completion shall be Substantially Complete by May 28, 2027 with Final Completion and final billing submitted by June 30, 2027. This phase of the project is funded by a Commerce Grant and the completion date is inflexible.

Provide a schedule of work with this bid form.

ACKNOWLEDGEMENT OF ADDENDA
Receipt of addenda are hereby acknowledged. Note addendums may or may not have been issued. Refer to official plan holder sites for all addendum issued.

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

OVERHEAD AND PROFIT
Include overhead and profit in Bid prices above.

CONTRACT
If the undersigned is notified of the acceptance of this Bid within 45 days after time set for opening Bids, undersigned agrees to execute a Contract for the above Work for the compensation established by adjusting the Base Bid by the amount of the Alternate Bids and / or Substitute Bids selected by the Owner.

BID SECURITY
Comply with and bid security requirements as listed in the RFP.

REFERENCES
Provide project / client references as requested in the RFP as an attachment to this Bid Form.

SUBMISSION OF BID (Complete for all bids.)

Dated this _____ day of _____, 20___.

_____ _____
(Name of Person or Entity Submitting Bid) (Mailing Address)

_____ _____
(Authorized Signature) (City, State, Zip)

(Printed Name)	(Phone)
(Title)	(Email Address)
(WA State Contractor's License No)	(Expiration Date)

END OF BID FORM

DOCUMENT 003132 - INFORMATION AVAILABLE TO BIDDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section contains information on surveys and record information for the building and site.

PART 2 - PRODUCTS

2.1 AVAILABLE INFORMATION

A. Owner has information consisting of reports, surveys and other record information. This information is available to Contractor and subcontractors for review. Available information includes but is not limited to:
   1. Geotechnical Report:
      a. Geotechnical Services Report
         Nisqually Reservation Geotechnical Consultation
         4003 Camas Plaza SE, Olympia, WA 98513
         Project Number: QG26-130
      b. By: Quality Geo NW PLLC
      c. Date: 07/10/26

B. Surveys, reports and record information on existing conditions are provided without warranty as to their accuracy or completeness.

C. Surveys, reports and record information on existing conditions are not part of the Contract Documents.

PART 3 - EXECUTION

Not Used.

END

NISQUALLY VOCATIONAL TRAINING CENTER
OLYMPIA, WASHINGTON
PHASES 1 AND 2

RFI NO.___

REQUEST FOR INFORMATION FORM

Date:

To: **FREIHEIT ARCHITECTS**

From:

Spec Sec. Ref: Para: Drawing Ref: Detail:

Signed:

Response:

❑ Attachments

Response From: To: Sent: Rec'd:

Signed:

Copies: ❑ Owner ❑ Consultants ❑ ❑ ❑ ❑ File

NISQUALLY VOCATIONAL TRAINING CENTER
OLYMPIA, WASHINGTON
PHASES 1 AND 2

SECTION 006325 - SUBSTITUTION REQUEST FORM

TO: **FREIHEIT ARCHITECTS** DATE: _____

ATTN:_____

We hereby submit the following for your consideration in lieu of the specified item(s) for the above project:

Specification Section_____ . Paragraph _____ . Referenced Drawing(s) _____

Specified Item: _____

Proposed Substitution: _____

Reason for Substitution: _____

COMPLETE THE FOLLOWING (Use back or additional sheets if necessary).

1. Does the substitution affect dimensions shown on Drawings? Yes _____. No _____.
   If yes, indicate changes: _____
2. What effect does the substitution have on other trades? _____
   _____
3. What effect do applicable code requirements have on substitution? _____
   _____
4. Describe the differences between the proposed substitution and the specified item(s):
   _____
   _____
5. How do manufacturer guarantees compare between proposed and specified items?
   ☐ Same ☐ Different (Explain on back.)

Attachments: _____

What is projected lump sum installed cost difference between proposed substitution and least expensive specified item? $_____. [Ø; (decrease); increase]

The undersigned hereby

- Certifies that the proposed substitute item has been fully investigated and has been determined to be equal or superior to that specified in all respects; that the same or greater warranty will be furnished, that required maintenance service and source for replacement parts are available, and that incorporation of the proposed substitute item will not affect functional clearances.
- Warrants that coordination, installation, and changes to the project as necessary to accommodate the proposed substitution shall be the Contractor's responsibility, that use of the substitute item(s) will not delay project completion, and that claims for additional costs related to its incorporation which may become subsequently apparent will be borne by the Contractor.

Approved For Architect Review: _____
Signature Title

Signature shall be by a person having authority to legally bind the Contractor to the above terms.

☐ Substitution Recommended Subject to Owner's Consent
☐ Substitution Recommended As Noted Subject to Owner's Consent
☐ Substitution Not Recommended
☐ Substitution Returned – Insufficient Information

Date:_____

By: _____ FREIHEIT
Signature Title

Owner's Consent ☐ Yes ☐ No Date:_____

By: _____ OWNER
Signature Title

END OF SUBSTITUTION REQUEST FORM

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Special work requirements.
   2. Separate work.
   3. Owner-furnished Contractor installed products.
   4. Coordination.
   5. Reference standards.
   6. Applicable codes.
   7. Field engineering.
   8. Request for information

B. This Section applies to all Technical Specification Sections, and supplements the General and Supplementary Conditions.

1.2 SPECIAL WORK REQUIREMENTS

A. Limit use of premises to allow for construction operations and occasional access by the Owner.

B. Smoking is prohibited on site, except for areas designated by the Contractor. No smoking is allowed within enclosed areas.

C. Owner Occupancy:
   1. Owner will occupy portions of the premises during stages of construction, for the installation of equipment. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.
   2. Coordinate use of premises at these times under direction of Owner.
   3. Maintain free and safe passage to and from Owner-occupied portions of the building, in accordance with Code and the Owner's requirements.

D. Noise Producing Activities:
   1. Unless approved otherwise, limit excessive noise producing activities to daylight hours.
   2. Comply with Section 015000 requirements for sound levels and noise control.

E. Select materials, utilize personnel, perform preparatory work, and sequence work in an area as required so that the work may be completed in the least amount of time possible.

1.3 SEPARATE WORK

A. Items noted "NIC" (Not In Contract) or OFOI (Owner-Furnished Owner-Installed), will be furnished and installed by Owner.

B. Owner will remove and retain possession of the following prior to start of Work.

1.4 OWNER-FURNISHED CONTRACTOR INSTALLED PRODUCTS

A. Coordinate work to facilitate installation of products furnished by the Owner for Installation by the Contractor, as directed, and as indicated (OFCI) on the Drawings.

B. Owner's Responsibilities:
   1. Arrange for and deliver shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. Upon delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage.
   5. Arrange for replacement of damaged, defective, or missing items.
   6. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness, for damage, jointly with Owner.
   3. Handle, store, install and finish products.

4. Repair or replace items damaged by Work of this Contract.

1.5 COORDINATION

A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practical; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Execute cutting and patching to integrate elements of Work, uncover ill-timed, defective, and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls, and ceilings.

1.6 REFERENCE STANDARDS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The date of the standard is that in effect as of the Bid date, or date of Owner-Contractor Agreement when there are no bids, except when a specific date is specified, or when a specific date is required under the applicable building code.

C. Obtain copies of standards when required by Contract Documents. Maintain copy at jobsite during progress of the specific work.

1.7 APPLICABLE CODES

A. Conform to the codes listed on the Drawings.

1.8 FIELD ENGINEERING

A. Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices.

B. Control points are those shown on Drawings. Locate and protect control and reference points. Notify the Architect if reference points cannot be located.

1.9 REQUEST FOR INFORMATION

A. A Request for Information (RFI) is a request from the Contractor directed to the Architect for clarification, interpretation, or direction regarding the Work as described by Contract Documents.

B. Coordinate and submit in timely manner so as not to impede delivery, work, and other conditions that may be detrimental to construction progress.

C. Use "Request for Information" form provided at Section 006313 or another form as approved by the Architect.

D. Allow 5 working days in construction schedule for Architect’s response to the RFIs.

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Identification and description of Alternate work.

B. Related Sections:
   1. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the Work.
   2. Sections of Specifications identified in each Alternate.

C. This Section supplements the General and Supplementary Conditions.

1.2 PROCEDURES

A. Alternates will be exercised at the option of Owner.

B. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each Alternate, when acceptance is designated in Owner-Contractor Agreement.

1.3 ALTERNATE DESCRIPTIONS

A. ALTERNATE NO. 1 – MAIN ENTRY CANOPY: SOUTH
   1. **Under Basic Bid:** Do not provide Entry Canopy over south main entry including concrete slab.
   2. **Under Alternate:** Provide Entry Canopy over south main entry including but not limited to concrete footings, concrete slab and steel framing.

B. ALTERNATE NO. 2 – MAIN ENTRY CANOPY: NORTH
   1. **Under Basic Bid:** Do not provide Entry Canopy over north main entry.
   2. **Under Alternate**: Provide Entry Canopy over north main entry including but not limited to concrete footings, concrete slab and steel framing.

C. ALTERNATE NO. 3 – STAIRS: NORTH AND SOUTH
   1. **Under Basic Bid:** Do not provide steel stairs or railings from ground floor to 2nd level.
   2. **Under Alternate**: Provide both north and south steel stairs and railings (ST-1 and ST-2) from ground floor to 2nd level.

D. ALTERNATE NO. 4 – SECOND FLOOR SYSTEM
   1. **Under Basic Bid:** Do not provide second floor, including steel columns, floor system including steel framing, metal deck and concrete topping, and associated 1st level shear walls. Provide slab on grade at first level.
   2. **Under Alternate:** Provide second floor system, including steel columns, floor system including steel framing, metal deck and concrete topping, and associated 1st level shear walls.

E. ALTERNATE NO. 5 – ELEVATOR SYSTEM
   1. **Under Basic Bid:** Do not provide hydraulic passenger elevator.
   2. **Under Alternate:** Provide hydraulic passenger elevator as indicated and specified in Section 142400.

F. ALTERNATE NO. 6 – SITE HOT MIX ASPHALT
   1. **Under Basic Bid:** Do not provide asphalt paving. Provide in lieu a graded and gravel road base with storm sewer piping, catch basins and clean-outs,
   2. **Under Alternate:** Provide full asphalt paving of parking areas and drive entrances including striping, markings and signage.

G. ALTERNATE NO. 7 – CONCRETE SITEWORK
   1. **Under Basic Bid:** Do not provide concrete paving at sidewalks. Provide in lieu a graded and gravel pavement base with storm sewer lines and cleanouts as indicated. Do provide concrete slabs at areas below entrance canopies.
   2. **Under Alternate:** Provide full concrete paving at sidewalks, equipment pads and associated work in concrete paved areas.

H. ALTERNATE NO. 8 – SITE LIGHTING
   1. **Under Basic Bid:** Provide site lighting routing and capped terminations only. Do not provide fixtures.
   2. **Under Alternate:** Provide all site-lighting fixtures and associated accessories.

I. ALTERNATE NO. 9 – NORTH / SOUTH ROAD EXTENSION
   1. **Under Basic Bid:** Do not provide north/south road extension at east edge of property beyond (north of) south parking lot. Provide in lieu a graded and gravel pavement base with storm sewer lines and cleanouts as indicated.
   2. **Under Alternate:** Provide fully paved north/south road extension as indicated, including striping and signage.

END OF SECTION

SECTION 012663 - CHANGE ORDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures for processing Change Orders.

B. Related Sections:
   1. Agreement Forms: Percentage allowances for Contractor's overhead and profit.
   2. General Conditions: Governing requirements for changes in the Work, in Contract Cost, and Contract Time.
   3. Document 007300 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
   4. 011000 - Summary: Applications for payment.
   5. 012900 - Payment Procedures.
   6. 013300 - Submittals: Schedule of Values.
   7. 016000 - Product Requirements: Substitutions.
   8. 017700 - Closeout Procedures: Project record documents.

C. This Section supplements the General and Supplementary Conditions.

1.2 SUBMITTALS

A. Submit name of the individual authorized to accept changes, and to be responsible for informing others in Contractor's employ of changes in the Work.

B. Change Order Forms: Form provided at Section 006331.

1.3 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

A. Maintain detailed records of work done on a time and material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.

B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.

C. On request, provide additional data to support computations:
   1. Quantities of products, labor, and equipment.
   2. Taxes, insurance and bonds.
   3. Overhead and profit.
   4. Justification for any change in Contract Time.
   5. Credit for deletions from Contract, similarly documented.

D. Support each claim for additional costs, and for work done on a time and material basis, with additional information:
   1. Origin and date of claim.
   2. Dates and times work was performed, and by whom.
   3. Time records and wage rates paid.
   4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

1.4 PRELIMINARY PROCEDURES

A. Architect may submit a Proposal Request which includes: Detailed description of change with supplementary or revised Drawings and Specifications, the projected time for executing the change, with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid.

B. Contractor may initiate a change by submittal of a request to Architect describing the proposed change with a statement of the reason for the change, and the effect on Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 016000.

1.5 CONSTRUCTION CHANGE AUTHORIZATION

A. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. Directive will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.

C. Promptly execute the change in Work.

1.6 LUMP SUM CHANGE ORDER

A. Will be based on Proposal Request and Contractor's lump sum quotation or Contractor's request for Change Order as approved by Architect.

1.7 TIME AND MATERIAL CHANGE ORDER

A. Submit itemized account and supporting data after completion of change, within time limits in Conditions of the Contract.

B. Architect will determine the change allowable in Contract Sum and Contract Time as provided in Conditions of the Contract.

1.8 EXECUTION OF CHANGE ORDERS

A. The Contractor shall prepare and sign Change Orders for submittal to the Architect, who will review and, if approved, will sign and issue to the Owner for signature, as provided in Conditions of the Contract.

B. Architect will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

1.9 CORRELATION OF CONTRACTOR SUBMITTALS

A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum as shown on Change Order.

B. Promptly revise Progress Schedules to reflect any change in Contract Time, revise subschedules to adjust times for other items of work affected by the change, and resubmit.

C. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

A. Not Used.

END OF SECTION

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for preparation and submittal of Applications for Payment.

B. Related Sections:
   1. Request for Proposal (RFP)
   2. Owner-Contractor Agreement: Contract Sum, Amounts of Progress Payments, and Retainages, and times for submittals.
   3. 007200 - General Conditions: Progress Payments, and Final Payment.
   4. 013300 - Submittals: Submittal procedures, Schedule of Values.
   5. 017700 - Closeout Procedures: Contract Closeout Procedures, Final Payment.

C. This Section supplements the General and Supplementary Conditions.

1.2 FORMAT

A. AIA G702 - Application and Certificate for Payment

B. For each item, provide a column for listing: Item Number; Description of work; Scheduled Value, Previous Applications; Work in Place and Stored Materials under this Application; Authorized Change Orders; Total Completed and Stored to Date of Application; Percentage of Completion; Balance to Finish; and Retainage.

1.3 PREPARATION OF APPLICATIONS

A. Type required information.

B. Execute certification by signature of authorized officer.

C. Use data on accepted Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed.

D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.

E. Prepare Application for Final Payment as specified in Section 017700.

1.4 SUBMITTAL PROCEDURES

A. Submit each Application for Payment at times stipulated in Agreement.

B. Submit under transmittal letter specified in Section 013300.

1.5 SUBSTANTIATING DATA

A. When Architect requires substantiating information, submit data justifying line item amounts in question.

B. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

A. Not Used.

END OF SECTION

SECTION 013113 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General coordination provisions.
   2. Requirements for coordination of space.

B. This Section applies to all Technical Specification Sections, and supplements the General and Supplementary Conditions.

1.2 GENERAL COORDINATION PROVISIONS

A. Coordinate work of various specification sections to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of work. Promptly advise Architect of any error, inconsistency, omission, or apparent discrepancy discovered.

C. Allot time in construction scheduling for liaison with Owner and Architect. Establish procedures for handling queries and clarifications. Use Contractor's standard "Request for Information" form to initiate clarifications. Allow sufficient time in construction schedule for Architect's response to the request.

D. In addition to meetings specified in Section 013119, hold coordination meetings and conferences with personnel and subcontractors to assure coordination of the work.

E. Coordinate scheduling, submittals, and work of various specification sections to ensure efficient and orderly sequence of installation of independent construction elements.

F. Verify that characteristics of operating equipment are compatible with building utilities and services.

G. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various specification sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

H. In finished areas, except as otherwise indicated, conceal pipes, conduit and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

I. Execute cutting and patching to integrate elements of work, uncover ill-timed, defective, and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls, and ceilings.

1.3 COORDINATION OF SPACE

A. The Contractor shall be responsible for coordinating the actual layout of plumbing, fire protection, HVAC, electrical, and other similar elements, as necessary to avoid interference, maintain the configurations of architectural elements, and maintain minimum ceiling and clearance heights as required by code, and accommodate existing obstructions which are to remain.

B. Layouts shown on the Drawings are diagrammatic. Follow routings shown for pipes, ducts, and conduit as closely as practical. Where routing changes are required in exposed locations within public spaces, or will affect architectural elements, verify modifications with the Architect prior to proceeding.

C. Develop coordination drawings, and other preinstallation coordination methods as necessary to coordinate layouts prior to installation. Coordination drawings shall be based on the approved structural steel framing shop drawings, and 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.

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 preinstallation coordination methods.

E. Provide clear access to control points, valves, strainers, control devices, and specialty items of every nature to such systems and equipment to obtain maximum head room. Provide adequate clearances as necessary for operation and maintenance.

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

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

A. Not Used.

END OF SECTION

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor participation in pre-construction conferences.
   2. Contractor administration of progress meetings and pre-installation conferences.

B. This Section applies to all Technical Specification Sections, and supplements the General and Supplemental Conditions.

1.2 GENERAL MEETING REQUIREMENTS

A. Make physical arrangements for meetings; notify participants, prepare agenda with copies for each attendee.

B. Take meeting minutes, and distribute copies within 2 days to the Owner, Architect, and all attendees. Distribute copies to other parties as appropriate.

C. All representatives attending meetings shall be authorized to act on behalf of the entity each represents.

D. Architect will attend meetings to ascertain the work is expedited consistent with Contract Documents and construction schedules.

1.3 PRECONSTRUCTION CONFERENCES

A. Owner will administer pre-construction conference for execution of Owner-Contractor Agreement and exchange of preliminary submittals.

B. Owner will administer site mobilization conference at Project site for clarification of Owner and Contractor responsibilities in use of site and for review of administrative procedures.

1.4 PROGRESS MEETINGS

A. Schedule and administer progress meetings throughout the Work at maximum two-week intervals.

B. Attendance: Job superintendent, major subcontractors and suppliers, Owner, Architect, and others as appropriate to the meeting agenda.

C. Suggested Agenda:
   1. Review of Work progress.
   2. Status of progress schedule and adjustments.
   3. Delivery schedules.
   4. Submittals.
   5. Maintenance of quality standards.
   6. Pending changes and substitutions
   7. Other items affecting progress of Work.

1.5 PRE-INSTALLATION CONFERENCES

A. Where required in a specification Section, schedule and administer a pre-installation conference prior to commencing work of the Section.

B. Unless otherwise required, notify the Architect a minimum of 7 calendar days prior to each scheduled meeting.

C. Require the attendance of entities directly affecting, or affected by, the work of the Section.

D. Review conditions of installation, preparation and installation procedures, and coordination with related work.

END OF SECTION

SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Construction schedule updating reports.
   3. Daily construction reports.
   4. Site condition reports.

B. Related Requirements:
   1. 011000 – Summary: Contractor’s use of site.
   2. 017700 - Closeout Procedures: Submitting documentation as Project Record Documents at Project closeout.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.
   1. Float time [belongs to Owner] [is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date].

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at two-week intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for from Notice to Proceed to date of final completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than **30** days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Restrictions: Show the effect of the following items on the schedule:
    a. Coordination with existing construction.
    b. Uninterruptible services.
    c. Partial occupancy before Substantial Completion.
    d. Use of premises restrictions.
    e. Provisions for future construction.
    f. Seasonal variations.
    g. Environmental control.
4. Work Stages: Indicate important stages of construction for each major portion of the Work.
5. Other Constraints: Constraints indicated in other specifications sections.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first [90] <Insert number> days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
   1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **60** days after date established for the Notice to Proceed.
      a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
   2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.
      i. Testing and commissioning.
      j. Punch list and final completion.
      k. Activities occurring following final completion.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.

11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect[**, Construction Manager,**] Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. Related Requirements:
   1. 013200 – Construction Progress Documentation
   2. 017700 - Closeout Procedures: For submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 20 megapixels.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Date photograph was taken.
      d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.3 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 12 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in file name for each image.
   2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before commencement of construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag construction limits before taking construction photographs.

2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

D. Periodic Construction Photographs: Take a minimum 30 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Takea minimum 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified..
1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:
   a. Special events planned at Project site.
   b. Immediate follow-up when on-site events result in construction damage or losses.
   c. Photographs to be taken at fabrication locations away from Project site.
   d. Substantial Completion of a major phase or component of the Work.
   e. Extra record photographs at time of final acceptance.
   f. Owner's request for special publicity photographs.

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittal form requirements.
   2. Submittal schedule.
   3. Contractor responsibilities.
   4. Requirements for each type of submittal.

B. Related Sections:
   1. 007200 - General Conditions of the Contract: Additional submittal requirements.
   2. 016000 - Product Requirements: Substitution submittals.
   3. 017700 - Closeout Procedures: Closeout submittals.

C. This Section applies to all Technical Specification Sections, and supplements the General and Supplementary Conditions.

1.2 SUBMITTAL FORM REQUIREMENTS

A. Provide the following, as applicable, on each submittal:
   1. The Project title and number.
   2. Present and Previous submittal dates.
   3. Contractor's submittal number.
   4. Subcontract identification.
   5. The names of:
      a. Contractor.
      b. Supplier.
      c. Manufacturer.
   6. Identification of revisions on resubmittals.
   7. For each product, reference corresponding specification section and paragraph number.
   8. A 6 x 4 inch blank space for Contractor and Architect stamps.

B. Deliver submittals to the Architect. Include name of contact person identified at the time of Agreement.

C. Transmit submittals under AIA form G810 or other transmittal form as accepted by the Architect.

D. Submittals in graphic form shall be clear readable copies with Contractor's original stamp. Submittals may be transmitted by email or by internet platform approved by the Architect. Facsimile submittals will not be accepted.

1.3 SUBMITTAL SCHEDULE

A. Make submittals to the Architect as required, causing no delay in the work.

B. Require each subcontractor to make submittals within 60 days of the subcontract date, unless specified or approved otherwise, or required to meet the work schedule.

C. Allow a minimum of 10 working days from receipt, for the Architect to review each submittal. Allow additional time for large and complex submittals representing major portions of the Work, such as concrete formwork, PEMB design, structural steel, storefront windows, fire protection, or kitchen equipment.

D. Schedule submittals to allow sufficient time for possible revision and resubmittal of the rejected submittals, without affecting the construction schedule.

E. Make the following submittals to the Owner and Architect prior to starting construction and within 10 working days of the Notice to Proceed:
   1. Certificates of insurance.
   2. List of subcontractors and suppliers.
   3. Construction schedule.

4. Submittal log.
5. Products list.

F. Submit Schedule of Values prior to first application for payment.

1.4 GENERAL REQUIREMENTS FOR SUBMITTALS

A. Make submittals to the Architect, unless otherwise specified.

B. Review submittals prior to submittal to the Architect. Verify specified requirements for products, field measurements, and field construction requirements.

C. Stamp and sign each submittal as certification that the submittal has been reviewed by the Contractor. Submittals not stamped and signed by the Contractor will be returned by the Architect without review for resubmittal.

D. Notify the Architect in writing, at time of submission, of all deviations in the submittals from requirements of the Contract Documents.

E. Make additional copies of approved submittals as necessary to implement the Work.

F. Review and approval of a submittal by the Architect shall not relieve the Contractor from responsibility for the proper fitting, finishing, quantities, and erection of the work in strict accordance with the Contract requirements.

G. Review and approval of a submittal by the Architect shall not relieve the Contractor from the responsibility for providing work not indicated on the submittal, but otherwise required for the completion of the work.

H. Do not fabricate or erect work prior to approval of the submittals.

I. Should discrepancies become evident, immediately notify Architect for resolution before proceeding with shop work.

J. Incorporation of substitutions into submittals will be considered cause for rejection of the submittal.

K. Submittals will be reviewed by the Architect for conformance to the design concept, only. Architect's review of vendor designed items shall not relieve the Contractor of responsibility for compliance with specified performance requirements.

L. If the Contractor fails to review Shop Drawings, Product Data, or Samples to determine their responsiveness to the Contract Documents, or fails to substantially respond to Architect's review comments prior to resubmittal, or if he makes submittals which substantially alter the Contract Documents, the Contractor shall reimburse the Owner for the charges of the Architect for extra services required to review such submittals.

1.5 CONSTRUCTION SCHEDULE

A. Prepare schedule in the form of a network planning system (CPM) for scheduling and controlling the work. Note the critical path.

B. Show commencement and completion dates proposed for each subdivision of work.

C. Update and submit monthly. Indicate actual start and completion of all completed activities. Graphically indicate changes from previously issued schedule.

D. Incorporate remedial construction into schedule when remedial work is required.

E. Show submittal dates required for shop drawings, product data, and samples, and product delivery dates, including those furnished by Owner and those under Allowances.

F. Coordinate with the Owner's schedule, showing all Contract activities to be performed by the Owner including their start, duration, completion, float and critical path.

1.6 SUBMITTAL LOG

A. List each type of submittal, and the date that the submittal will be made. Indicate Architect review time proposed.

1.7 PRODUCTS LIST

A. Complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.8 SCHEDULE OF VALUES

A. Submit Schedule of Values prior to first Application for payment.

B. Submit schedule on AIA Form G703. Contractor's standard form or media-driven printout will be considered on request.

C. Format: Table of Contents of this Project Manual. Identify each line item with number and title of the major Specification Sections.

D. Include in each line item a directly proportional amount of Contractor's overhead and profit.

E. Revise schedule to list change orders, for each application for payment.

1.9 SHOP DRAWINGS

A. Submit Shop Drawings required by individual Sections of the Specifications, and as otherwise required for proper performance of the work.

B. Illustrate fully the requirements of the Specifications and the Contract Drawings, and accurately show quantities, kinds of materials, methods of assembly, and all data required for fabrication, erection, and installation.

C. Show the relationship of adjoining work, relevant field conditions and dimensions; coordinate with affected subcontractors and suppliers if in conflict.

D. Submittal Format:
   1. For hardcopy (paper) submittals, submit 2 legible copies to the Architect for review.
   2. For electronic (digital) submittals, provide editable PDF documents to the Architect for review.

E. The Architect will transmit shop drawings to Contractor with corrections, notations and Architect's stamp indicating action to be taken.

F. Data of portions of the Contract Documents may be available for use as bases for preparation of shop drawings. The General Contractor shall be responsible for all subsequent distribution of such information to subcontractors and suppliers. Request documents by submitting an executed copy of the "CADD Release Form" following this Section. Use of such documents implies Contractor's and subcontractors' agreement to the terms described on the form. Fully describe requirements for each request.
   1. Database of CADD generated drawings.
      a. Release of CADD information will be restricted to the following categories:
         1) Architectural floor plans.
         2) Site plan.
         3) Reflected ceiling plans.
         4) Exterior elevations.
         5) Stair sections.
         6) Structural framing plans.
      b. The CADD database will be generated on PC hardware with Revit software. Architect has the capability to format CADD output to meet capabilities of all major platforms and major media types.
      c. When requesting CADD databases, specify the output form required.

1.10 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data. Include manufacturer's printed installation instructions.

B. Submittal Format:
   1. For hardcopy (paper) submittals, submit the number of copies which Contractor requires, plus 1 copy which will be retained by Architect.
   2. For electronic (digital) submittals, provide editable PDF documents to the Architect for review.

C. Modify product data and installation instructions to delete information which is not applicable to the work.

D. Supplement standard information to provide information specifically applicable to the work.

1.11 SAMPLES

A. Submit samples as specified in the technical Sections.

B. Include identification on each sample, giving full information.

C. Submit the number of samples specified in the technical Sections. Where quantity is not specified, submit 3 samples. One will be retained by the Architect.

D. Unless specified otherwise, submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes within 30 days after date of Contract.

E. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

END OF SECTION

SECTION 014500 - QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements.
   2. Workmanship.
   3. Special installation procedures
   4. Manufacturer's instructions.
   5. Manufacturer's certificates.
   6. Mock-ups.
   7. Manufacturers' field services.
   8. Testing laboratory services.
   9. Contractor tests and inspections.

B. Related Sections:
   1. 011000 - Summary: Applicability of specified reference standards.
   2. 013300 - Submittal Procedures: Submittal of manufacturer's instructions.

C. This Section applies to all Technical Specification Sections, and supplements the General and Supplemental Conditions.

1.2 GENERAL QUALITY CONTROL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.3 WORKMANSHIP

A. Comply with industry standards, except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work with persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.4 SPECIAL INSTALLATION PROCEDURES

A. Make no attachment to structural concrete or steel members in the building in such a way as to overload or impair the structural integrity of the member.

1.5 MANUFACTURERS' INSTRUCTIONS

A. Unless specified otherwise, comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications Section, submit, in duplicate, manufacturer's certification that products meet or exceed specified requirements.

1.7 MOCK-UPS

A. Provide mock-ups as specified in the individual specification sections. When the initial mock-up is unacceptable to the Architect, provide additional mock-ups until approval is obtained.

B. Unless specified or approved otherwise, schedule mock-ups for completion a minimum of 10 working days prior to actual commencement of the work represented by the mock-up.

C. Notify the Architect and Owner a minimum of 5 working days prior to mock-up.

D. For each mock-up, provide conditions which will replicate the conditions of the actual installation, including lighting, to the greatest reasonable extent.

E. Approved mock-up shall be the standard of workmanship and materials for the remainder of the related work.

F. Contractor may proceed with the work upon Architect's approval of the mock-up

G. Obtain Architect's written approval for each mock-up.
   1. Allow access to the mock-up for Architect's review and for review by manufacturer and trade representatives as the Architect deems appropriate.
   2. Proceed with the work upon Architect's approval of the mock-up. Each approved mock-up shall represent the standard of workmanship and materials for the remainder of the related work.
   3. Modify and correct mock-up as necessary to obtain Architect's approval; allow time in construction schedule for adjustment or reconstruction of mock-up to obtain approval. Claims for delays due to unacceptable field samples will not be considered.

H. Maintain mock-up in approved condition, until directed otherwise.

I. Disposition of Mock-Ups:
   1. Rejected mock-ups shall be selectively demolished to accommodate new mock-ups, or completely removed as appropriate.
   2. Mock-ups constructed as part of the proposed work, and which have been approved by the Architect, may be incorporated into the work.
   3. Unless specified or directed otherwise, approved mock-ups which are not incorporated into the work shall be removed upon project completion.

1.8 MANUFACTURERS' FIELD SERVICES

A. When specified, require product manufacturer to furnish qualified personnel to observe field conditions and quality of workmanship, and to provide recommendations, certifications, and other specified services.

B. Representative shall submit written report to Architect listing observations and recommendations.

1.9 TESTING LABORATORY SERVICES

A. The Owner will arrange for the services of an Independent Testing Laboratory to inspect and test the Work in accordance with regulatory requirements and to verify compliance with the contract documents.

B. Contractor's Responsibilities:
   1. Cooperate with Testing Laboratory personnel, and furnish access, tools, samples, certifications, test reports, design mixes, equipment, storage, and assistance as requested by the Testing Laboratory.
   2. Notify Architect and Testing Laboratory 48 hours prior to expected time for operations requiring inspection and testing. When tests or inspections cannot be performed, through the fault of the Contractor, reimburse the Owner for the additional costs incurred.
   3. Remove and replace all work found not complying with the Contract Documents. Remedies shall be in accordance with the Contract Documents and code requirements.
   4. If initial tests and inspections indicate deficient work, the Contractor shall reimburse the Owner for the costs of all subsequent tests and inspections related to the deficiency.
   5. All damage which may occur to the work as a result of normal testing operations shall be repaired to match surrounding surfaces.
   6. Schedule testing and inspection so that the work of testing and inspection personnel will be as continuous and brief as possible.
   7. Reimburse the Owner for travel and lodging expenses incurred for testing and inspection services performed outside a radius of 100 miles of the site.

C. Tests and inspections shall be in accordance with code requirements and as otherwise required to verify conformance to Contract requirements.

D. Contractor's Convenience Testing: Inspection and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. General requirements.
2. Electricity, lighting.
3. Heat, ventilation, cooling.
4. Telephone service.
5. Water.
6. Sanitary facilities.
7. Barriers.
8. Closures.
9. Protection of installed work.
10. Security.
11. Safety.
12. Site water control.
13. Cleaning during construction.
14. Field offices and sheds.
15. Contractor designated areas.
16. Removal.

B. Related Sections:
1. 011000 - Summary: Contractor use of premises.
2. 017700 - Closeout Procedures: Final cleaning.

C. This Section applies to all Technical Specification Sections, and supplements the General and Supplemental Conditions.

1.2 GENERAL REQUIREMENTS

A. Temporary facilities and controls shall conform to the requirements of the jurisdictional code authorities.

1.3 ELECTRICITY, LIGHTING

A. Owner will bring power onto site to a location and service to be determined (in the vicinity of the transformer).

B. Use existing power and lighting to the greatest practical extent. When approved by the Owner, provide service required for construction operations, with branch wiring and distribution boxes located as necessary for additional service and lighting

C. Provide additional temporary lighting for construction operations.

D. Repair all existing lighting and power equipment, when damaged due to construction operations.

E. The Owner will pay for power used. Take measures to conserve energy.

1.4 HEAT, VENTILATION

A. Provide temporary heating and cooling as necessary to maintain specified conditions for Construction operations, to protect materials and finishes from damage due to temperature or humidity.

B. Provide temporary ventilation of enclosed areas to cure materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.

C. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place.

D. Provide and pay for operation and maintenance of equipment,

E. Take measures to conserve energy.

1.5 WATER

A. The existing well on site does not have supporting equipment such as pump, expansion tank nor filters. See Civil Drawings and specifications for information about development of well and water utilities. Contractor may need to provide temporary water supply or temporary equipment to access well water prior to completion of utility work. Comply with specification requirements for water quality to be used during construction.

B. Conserve water use whenever possible.

1.6 SANITARY FACILITIES

A. Provide and maintain required portable facilities and enclosures.

1.7 BARRIERS

A. Provide as required to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Construction: Contractor's option.

C. Provide barricades and covered walkways as required by governing authorities for public rights-of-way and for public access to adjacent properties or buildings.

D. Provide barricades around openings in floors and roof decks.

1.8 CLOSURES

A. Exterior Closures:
   1. Provide temporary weather-tight closures as necessary to create proper interior environmental conditions, protection of materials, and to prevent entry of unauthorized persons.
   2. Where doors are necessary for access by construction personnel, provide self-closing hardware and locks.
   3. Except as necessary for construction access, do not remove exterior closures until permanent construction is ready to be installed and made weathertight.
   4. Enclosures shall be constructed to prevent blow off during inclement weather, and shall be sealed to prevent water penetration and excessive air infiltration.

B. Interior Closures:
   1. Provide temporary closures to prevent penetration of dust and moisture into occupied areas separate from work areas, damage to operating systems and components, and to create environmental conditions necessary for the proper installation of materials and systems.
   2. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces;

C. Installed construction which has been damaged due to lack of protection shall be replaced or restored to original or new condition at Contractor’s expense.

1.9 PROTECTION OF INSTALLED WORK

A. Provide temporary protection for installed work, including protection from impact, water, dust contamination, overspray, and similar damage.

B. Secure temporary protections as necessary to prevent blow off during inclement weather.

C. Provide protective coverings at exposed exterior walls and horizontal surfaces, projections, and window and door openings.

D. Protect finished surfaces from damage caused by traffic, movement of heavy objects, and storage of materials. Where necessary, control traffic in immediate area as necessary to minimize the risk of impact damage.

E. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.

F. Installed construction which has been damaged due to lack of protection shall be replaced or restored to original or new condition at Contractor's expense.

1.10 SECURITY

A. Provide security program and facilities to protect Work, materials stored off-site, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program.

1.11 SAFETY

A. Furnish safety program and facilities to protect the safety of workers and other persons affected by the Work.

1.12 SITE WATER CONTROL

A. Site has high groundwater levels. Comply with requirements of Division 31 sections and recommendations in Geotechnical Report and Hydrogeologic Evaluation.

B. Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment.

1.13 TEMPORARY CONTROLS

A. Dust Control:
   1. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent airborne dust from dispersing into the atmosphere.
   2. Provide temporary dust-proof partitions to protect public areas, occupied spaces, and adjacent mall areas.

B. Water Control:
   1. Comply with applicable jurisdictional requirements regarding water usage, conservation, detention, pollution, and permits.
   2. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.
   3. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.
   4. Provide, operate and maintain pumping equipment of adequate capacity to control surface water, including water accumulated during excavation operations, below grade.
   5. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas.

C. Construction Waste Control:
   1. Maintain all areas under Contractor's control free of debris.
   2. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.
   3. Schedule periodic collection and disposal of debris to a legal off-site location.
   4. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent excessive accumulation.
   5. Clean interior areas prior to start of the finish work. Maintain the areas free of dust and other contaminants during finishing operations.
   6. Construction Waste Management:
      a. Coordinate with the Owner's construction waste management service to select a local waste handler who will maximize recycling, salvaging, and reuse of construction waste.
      b. Comply with the requirements of the local recycling service and provide space, access, and services necessary to support recycling operations.
      c. Instruct jobsite personnel in the appropriate separation and handling methods as set forth by the local recycling service.
      d. Keep materials to be recycled sufficiently clean and protect from damage which would render them unrecyclable.

D. Pollution Control: Provide methods, means and facilities required by law to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

E. Noise Control:
   1. Construction operations must be performed in accordance with local regulations, ordinances, and jurisdictional Code authorities.
   2. Use of private radios and other similar portable sound equipment is prohibited.

F. Smoking, Eating, and Drinking: These activities shall be permitted only in designated locations selected by the Contractor; these activities are not permitted in interior spaces after carpeting and fixtures arrive on site.

1.14 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish on a daily basis, and dispose of off-site or in a designated container on site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

C. Remove excess debris from cavities which are to be concealed in the finished Work.

1.15 FIELD OFFICES AND SHEDS

A. Field Office:
   1. Office: Weather-tight, with lighting, electrical outlets, heating, cooling, and ventilating equipment, and equipped with furniture. Provide, in addition, space for Project meetings, with table and chairs to accommodate 8 persons.
   2. Equipment:
      a. Copier: Contractor's option; 11 x 17 inch size capability.
      b. Communication Service
         1) Minimum one dedicated telephone line with instrument.
         2) An Internet Service Provider (ISP) account.
         3) Com ISDN LAN modem or Office Connect
         4) Remote Dual Analog Router (analog or ISDN depending on telephone company service), or approved, for use and communication with Internet Service Provider (ISP).
      c. Sheet-feed or flatbed scanner and related software.
      d. Computer: Minimum one PC with minimum 8 GB of RAM, including the following or comparable software by others:
         1) Windows 10 or later, Microsoft Office 2019 or later; Internet Explorer 10 or later.
         2) Adobe Acrobat Pro DC, or later, at least one station for initiating documents.
         3) Adobe Acrobat Reader.
         4) Bluebeam.
      e. Printer: Minimum 11x17 inch graphics capability.

B. Storage Sheds for Tools, Materials, and Equipment: Weather-tight, [with heat and ventilation for Products requiring controlled conditions,] with adequate space for organized storage and access, and lighting for inspection of stored materials.]

1.16 STORAGE SHEDS

A. Storage Sheds for Tools, Materials, and Equipment: Weather-tight, with heat and ventilation for Products requiring controlled conditions, with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.17 REMOVAL

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2 feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Products.
   2. Transportation and handling.
   3. Storage and protection.
   4. General installation requirements.
   5. Product options.
   6. Substitutions.

B. Related Sections:
   1. 006325 - Substitution Request Form.
   2. 011000 - Summary: Owner-furnished products, reference standards.
   3. 014500 - Quality Control: Submittal of manufacturers' certificates.
   4. 017700 - Closeout Procedures: Systems demonstration, operation and maintenance data, warranties and guarantees, spare parts and maintenance materials.

C. This Section applies to all Technical Specification Sections, and supplements the General and Supplementary Conditions.

1.2 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with size, make, type, and quality specified, unless otherwise approved in writing by the Architect. Specifications and referenced standards are minimum requirements.

C. All components required to be supplied in quantity shall be identical, whether furnished under one or several Sections of the specifications.

D. Unless specified or indicated otherwise, materials employed for construction purposes, such as formwork, scaffolding, and temporary lighting, shall not be incorporated into the work.

E. Unless indicated or specified otherwise, all products incorporated into the Work shall be of the most suitable grade of their respective kinds for the intended use.

F. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

1.3 TRANSPORTATION AND HANDLING

A. Transport by methods to avoid product damage.

B. Deliver products in manufacturer's original containers or packaging, with identifying labels intact and legible. [Where options exist, select container or packaging systems that can be recycled or reused.]

C. Furnish equipment and personnel to handle products by methods to prevent soiling or damage.

D. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

E. Immediately replace non-conforming products with new conforming products, at no additional cost to the Owner.

1.4 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. Store sensitive products in weather-tight enclosures. Maintain within temperature and humidity ranges required by manufacturer's instructions, and as otherwise required to prevent damage.

C. For exterior storage of fabricated products, place on sloped supports above ground. Protect from soiling or staining through ground contact. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

E. Arrange storage of products to furnish convenient access for inspection and inventory.

1.5 GENERAL INSTALLATION REQUIREMENTS

A. Unless indicated or specified otherwise, install each product in accordance with the product manufacturer's instructions.

B. Distribute copies of manufacturer's instructions to parties involved in the installation.

C. Maintain one set of complete instructions at the job site during installation and until completion.

1.6 PRODUCT OPTIONS

A. Product Specified by Reference Standards or by Description Only: Provide product meeting those standards.

B. Product Specified by Naming One or More Manufacturers with an "or approved" provision: Use specified product or submit a request for substitution in accordance with the specified substitution requirements. When approved a substitute product may be used.

C. Product Specified by Naming One or More Manufacturers, without a provisions for Substitution: No substitution will be allowed, except as specified under the Article on Substitutions.

1.7 SUBSTITUTIONS

A. Timing: Substitution requests will be considered by the Architect until 5 working days prior to bid opening. Substitution requests received less than 5 days prior to bid opening will be considered at the Architect’s option. Subsequent substitutions will be considered only for the following reasons:
   1. A product becomes unavailable due to no fault of the Contractor.
   2. Subsequent information or changes indicate that the specified product will not perform as intended.
   3. A substitute product will be in the Owner's best interest.

B. Substitution requests prior to bid date may originate directly from the General Contractor, or from a prospective supplier or subcontractor. Subsequent substitution requests shall be submitted through the General Contractor.

C. Documentation:
   1. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
   2. Requests for substitution shall be made on Document 006325 - Substitution Request Form.
   3. Limit each request to one proposed product or system.
   4. For substitutions prior to Agreement, signature and projected cost data are not required.

D. Request for substitution constitutes a representation that the proposer:
   1. Certifies that the proposed substitute item has been fully investigated and has been determined to be equal or superior to that specified in all respects.
   2. Certifies that the same or greater warranty will be furnished
   3. Certifies that required maintenance service and source for replacement parts are available
   4. Certifies that incorporation of the proposed substitute item will not affect functional clearances.
   5. Warrants that coordination, installation, and changes to the project as necessary to accommodate the proposed substitution shall be the Contractor's responsibility, that use of the substitute item(s) will not delay project completion
   6. Warrants that claims for additional costs related to its incorporation which may become subsequently apparent will be borne by the Contractor.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals.

F. Review: The Architect will be the judge of the acceptability of the proposed substitution; in the judgment of Architect the product shall meet the following criteria:
   1. It is equal or superior in quality and serviceability to the specified product.
   2. Its use will not entail unacceptable changes in details and construction of related work.
   3. Its design and artistic effect complies with design concept.

G. The Architect will review requests for substitutions with reasonable promptness, and request additional information, documentation, or samples, as necessary for evaluation of the request. Within two weeks of receipt of the completed request, the Architect will take one of the following actions.
   1. If the substitution is allowed by the Architect prior to the cutoff date, an Addendum to the Bid Documents will be issued by the Architect.
   2. If the substitution is allowed by the Architect after the cutoff date, the Architect will notify the General Contractor and issue the appropriate Construction Change Authorization, Supplemental Instruction, or Proposal Request.
   3. If the request for substitution is denied, the proposer will be notified of the rejection. If a decision on the substitution request cannot be made or obtained within the time allocated, use the specified product.

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

B. Related Sections:
   1. 017700 - Closeout Procedures: Systems demonstration, operation and maintenance data, warranties and guarantees, spare parts and maintenance materials.

C. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor or professional engineer.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Final Property Survey: Submit documentation showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Not used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, request utility locate with Call Before You Dig (811).
   2. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   3. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and. Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.
   6. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work arc indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Civil Engineer promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   3. Inform installers of lines and levels to which they must comply.
   4. Check the location, level and plumb, of every major element as the Work progresses.
   5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
   7. Maintain survey stakes and markers throughout the period when in use. Restore survey information markers disturbed by construction activities, vandalism, accident, etc.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Owner.

F. Phasing: When multiple separate phases are indicated, update survey information and layout for the work in each phase at the beginning and as necessary throughout the phase for progression of the work. Interim construction surveys shall follow the above procedures of this Section.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Final Property Surveys: Engage a land surveyor or professional engineer to prepare a final property survey showing all significant features (real property) and all new lot lines, easements and encumbrances that result from the Work and require recording prior to final acceptance by the Owner. Provide legal descriptions and drawings of utility easements, and modify the project site legal description in the format required by the Authorities Having Jurisdiction (AHJ) for recording.
   1. The contractor may by separate agreement utilize the Owner's surveyor or civil engineer for this work. Include on the survey a certification, signed by preparer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   2. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point. Include existing easements.
   3. Elements requiring special survey attention include, but are not limited to, the following:
      a. Power Utility easement for service and transformer when applicable.
      b. Public right-of-way dedication as indicated
      c. Submission and Recording: Submit surveys and documents to Architect at Substantial Completion. Owner shall have the final property survey, easements, etc. recorded with authorities having jurisdiction and utility companies as necessary.

3.5 GENERAL INSTALLATION PROCEDURES

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise specifically indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Utilize containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in other Division 01 Sections.

3.7 STARTING AN ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding,

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION.

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

D. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

E. Limiting Exposures: Supervise construction activities to ensure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Conduct construction activities to prevent, mitigate and remove conditions that could lead to damage, deterioration. infestation, etc., of the work, Where applicable, such exposures include, but are not limited to, the following:
   1. Excessive static or dynamic loading.
   2. Excessive internal or external pressures.
   3. Excessively high or low temperatures.
   4. Thermal shock.
   5. Excessively high or low humidity.
   6. Air contamination or pollution.
   7. Water or ice intrusion or accumulation.
   8. Solvents.
   9. Chemicals.
   10. Light.
   11. Puncture.
   12. Abrasion.
   13. Heavy traffic.
   14. Soiling, staining and corrosion.
   15. Bacteria, mold, mildew, or conditions that promote their growth.
   16. Rodent and insect infestation.
   17. Combustion.
   18. Electrical current.
   19. High speed operation.
   20. Improper lubrication,
   21. Unusual wear or other misuse.
   22. Contact between incompatible materials.
   23. Destructive testing.
   24. Misalignment.
   25. Excessive weathering.
   26. Unprotected storage.
   27. Improper shipping or handling.
   28. Theft.
   29. Vandalism.

F. Building Security: Supervised construction activities to insure that security of the building is maintained in any occupied area. That is, once equipment and products or possessions of the building tenant or Owner are installed, or placed on site, it is the responsibility of the Contractor to maintain physical security of the building. Any openings in the building that cannot be locked need to be secured during non-work hours to prevent access.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

B. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Closeout procedures.
   2. Final cleaning.
   3. Project record documents.
   4. Operation and maintenance data.
   5. Operation instruction.
   6. Manufacturer's warranties.
   7. Guaranties.
   8. Spare parts and maintenance materials.

B. Related Sections:
   1. 015000 - Temporary Facilities and Controls: Cleaning during construction.
   2. Division 23 and 26 for special closeout requirements for mechanical and electrical systems.

C. This Section applies to all Technical Specification Sections, and supplements the General and Supplemental Conditions.

1.2 CLOSEOUT PROCEDURES

A. Comply with procedures stated in General Conditions of the Contract for Substantial and Final Completion.

B. Submit all certificates of approval issued by the governing authorities, including, without limitation, the following:
   1. Certificate of occupancy.

C. Prior to final payment, submit the following affidavits using the forms listed below:
   1. Contractor's Affidavit of Payment of Debts and Claims AIA Document G706.
   2. Consent of Surety to Final Payment AIA Document G707.
   3. Contractor's lien release, and lien releases from each subcontractor; Contractor's Affidavit of Release of Liens AIA Document G706A

D. Submit final Application for Payment identifying total adjusted contract sum, previous payments, and sum remaining due.

E. Submit building permit documents and building inspection signoff sheets to the Owner.

1.3 FINAL CLEANING

A. Execute prior to final inspection.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Clean or replace filters of mechanical equipment.

E. Clean roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean other surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the Project and from the site.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain a complete set of record documents which clearly and neatly indicate all changes from the Contract Documents, and all uncovered existing conditions which will be subsequently concealed.

B. Record documents shall include:
   1. Contract drawings.
   2. Specifications.
   3. Reviewed shop drawings, product data, and samples

C. Record documents shall be used for no other purpose and shall be stored separate from those used for construction.

D. Keep documents current; do not permanently conceal any work until required information has been recorded.

E. Mark specifications legibly and record at each Product section a description of actual products installed. Include the manufacturer's name and product model and number and color selection if applicable.

F. Drawings shall indicate exact installed locations and dimensions of all concealed work, including, without limitation, conduit, piping, ducts, mechanical and electrical equipment, and foundations. Indicate all changes to details which involve concealed construction.

G. Prior to approving each Payment Request, the Architect reserves the right to inspect the Record Documents. The Payment Request may not be approved until the record documents are current to the Date of the Payment Request.

H. At Contract Closeout, submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.5 OPERATION AND MAINTENANCE DATA

A. Furnish published operation and maintenance information covering all equipment and finish materials installed on the project. Whether specified or not, furnish published information whenever special maintenance procedures are required to assure the proper operation and durability of project material, equipment, and finishes.

B. Number of copies: Unless otherwise specified, submit one hard-copy and one digital copy of each at time of project substantial completion.

C. For hard copy, submit operation data and maintenance data bound in a three ring binder. Include divider tabs to separate data for each component. Include name of Project, Contractor, and Architect.

D. Information shall be submitted by the General Contractor through the Architect.

1.6 OPERATION INSTRUCTION

A. Prior to Final Completion, instruct Owner’s personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.

B. Use experienced personnel trained and experienced in the operation and maintenance of the building equipment or system involved.

C. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

D. Refer to the individual technical Sections for additional requirements for instruction of Owner’s personnel.

1.7 MANUFACTURER'S WARRANTIES

A. Furnish original and duplicate copies of each manufacturer warranty executed to the Owner.

B. Execute Contractor's submittals to the manufacturers, and assemble documents executed by the manufacturers.

C. Provide table of contents and assemble in binder with durable plastic cover.

D. Submit material prior to final application for payment in accordance with Section 013300. For equipment put into use with Owner's permission during construction, submit warranty within 10 days after first operation. For items of Work delayed materially beyond Date of Substantial Completion, furnish warranty within ten days after acceptance, listing date of acceptance as start of warranty period.

1.8 GUARANTIES

A. Furnish written guaranty, executed to the Owner, on work covered by the additional guaranty requirements specified in the technical sections. The guaranty shall commence on the date of Owner acceptance of that portion of the work.

B. Transmit through the Architect in accordance with Section 013300.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

A. Furnish products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of Work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

B. Unless specified otherwise, deliver materials in manufacturer’s original factory cartons or containers.

C. Materials shall be clearly labeled, and shall include designations used in the Contract Documents.

1.10 KEYS

A. Deliver properly identified and tagged keys and hardware maintenance tools to the Owner, including those specified in Sections087100 and 102813.

B. Obtain itemized receipt for all keys and tools.

C. Send all master keys by registered mail directly from manufacturer to Owner's representative as later directed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete.
   2. Concrete accessories.
   3. Formwork, shoring, bracing, and anchorage.
   4. Concrete reinforcement.
   5. Underslab vapor retarder.
   6. Concrete Sealer

B. Related Sections:
   1. 072616 - Below-Grade Vapor Retarders
   2. 079200 - Joint Sealants: Expansion joint fillers.
   3. 312000 - Earth Moving: Fill under slabs on grade.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. 117 - Standard Specification for Tolerances for Concrete Construction and Materials.
   2. 301- Specifications for Structural Concrete.
   3. 305R – Guide to Hot Weather Concreting
   4. 306R – Guide to Cold Weather Concreting
   5. 315 - Details and Detailing of Concrete Reinforcement.
   6. 347 – Guide to Formwork for Concrete

B. American Society for Testing and Materials (ASTM):
   1. A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
   2. C33 - Specifications for Concrete Aggregates.
   3. C94 - Specifications for Ready Mixed Concrete.
   4. C132 - Test for Slump of Portland Cement Concrete.
   5. C150 - Specification for Portland Cement.
   6. C156 - Test Method for Water Retention by Concrete Curing Materials.
   7. C171 - Specification for Sheet Materials for Curing Concrete.
   8. C260 - Specifications for Air-Entraining Admixtures for Concrete.
   9. C309 - Specification for Liquid Membrane Forming Compounds for Curing Compounds.
   10. C494 - Specifications for Chemical Admixtures for Concrete.
   11. C618 - Specification for Fly Ash and Raw or Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
   12. C939 - Test Method for Flow of Grout for Preplaced-Aggregate Concrete
   13. C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
   14. C1315 - Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
   15. D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
   16. E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System.

C. U.S. Army Corps of Engineers: CRD-C-621-83 - Specifications for Non-Shrink Grout.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit data for each accessory, admixture, and curing material proposed for the work.

C. Shop Drawings:
   1. Reinforcing:
      a. Detail reinforcing in accordance with ACI 315. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing, bending and cutting schedules, splicing, and supporting and spacing devices.
      b. Indicate embedded items.
   2. Slab Layouts: Dimension locations of control, expansion, and construction joints. Relate to building grid lines.

D. Quality Control Submittals:
   1. Mix Designs: Prior to concrete work, submit mix designs for approval.
   2. Test Results: Submit test results per ASTM C311 performed less than 6 months prior to use for approval by Architect.
   3. Certifications: Submit mill certificates for cement, aggregates, and reinforcing.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301. Maintain copy of ACI 301 on site.

B. Concrete work is subject to special testing and inspection as specified in 003153. Notify Architect at least 48 hours before concrete is poured.

C. Installing concrete in cold weather follow recommendations of 306R and in hot weather follow 305R

D. Pre-Installation Conference:
   1. At least 35 days prior to start of concrete work the Contractor shall hold, in accordance with Section 013119, a meeting to review the detailed requirements of the concrete design mixes and to determine the procedures for producing proper concrete construction.
   2. Required in attendance:
      a. Contractor's superintendent.
      b. Testing Laboratory representative.
      c. Concrete subcontractor.
      d. Ready-mix producer.
      e. Admixtures manufacturer's representative.
      f. Architect/Engineer
      g. All subcontractors with work to be installed in, or affected by concrete work.
   3. Notify Architect 10 days prior to the scheduled date of the meeting.
   4. Agenda: Include the following.
      a. Installation scheduling and coordination; scheduling of mock-up construction and review.
      b. Classes of concrete required; mix designs; applicable references.
      c. Formwork.
      d. Reinforcement and placement.
      e. Climatic conditions; hot and/or cold weather concreting procedures (as appropriate); unusual placing conditions.
      f. Substrate preparation; placement methods; construction joints.
      g. Flatwork; flatness and levelness requirements; finishing; criteria for acceptance; remedies.
      h. Curing and protection procedures
      i. Site quality control; inspection and testing requirements.
      j. Sealers; locations and coverage rates

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Unless specified otherwise, conform to ACI 301 and 347.

B. Plywood:
   1. APA rated High Density Overlay, Plyform Class 1. EXT.

2. APA B-B Plyform Class 1, EXT.

C. Form Ties: Snap-off metal; metal washer ends.

D. Chamfers and Rustication Strips: Wood or plastic; fabricate to the shapes indicated.

2.2 REINFORCING

A. Reinforcing Steel: Types as indicated on the structural drawings.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, normal - Type 1 Portland, grey color. Acquire all cement for the Project from a single source.

B. Fly Ash: ASTM C618, Class C or F; loss on ignition (LOI) not to exceed 1 percent. Use fly ash from one single source for the whole Project.

C. Normal Weight Fine and Coarse Aggregates: ASTM C33; severe weather exposure. Acquire all aggregates for the Project from a single source.

D. Water: ASTM C94, para. 5.1.3

2.4 ADMIXTURES

A. Air-Entrainment: ASTM C 260; Master Builders Inc. "Micro-Air" or "MBVR", Euclid Chemical Co. "Air Mix," or approved.

B. Water Reducer Normal: ASTM C 494, Type A; Master Builders Inc. "Pozzolith/Polyheed," Euclid Chemical Co. "Eucon WR 75," or approved.

C. High Range Water Reducer (Superplasticizer): ASTM C 494, Type F or G and shall be of the second or third generation type. Shall be batch plant added, extend plasticity time, reduce water 20 to 30 percent. Master Builders Inc. "Rheobuild," Euclid Chemical "Eucon 37," or approved.

D. Accelerator: ASTM C 494, Type C or E, non-corrosive, non-chloride; Master Builders "Pozzutech 20," Euclid Chemical Co. "Accelgard 90," or approved.

E. Set Retarder: ASTM C494, Type B.

F. Shrinkage Reducing Admixture: Eclipse by W.R. Grace Company.

2.5 ACCESSORIES

A. Bonding Agent: Acrylic type; Sonneborn "Sonnocrete", W.R. Grace "Duraweld C", Euclid Chemical Co. "Flex-con", or approved.

B. Non-Shrink Grouts: ASTM C1107, Grade B; non-shrink non-catalyzed natural aggregate grout; minimum compressive strength of 7000 PSI at 28 days; 25 to 30 second flow when tested in accordance with ASTM C939 at 45 to 90 degrees F; cement gray in color; Master Builders Inc. "Masterflow 928," Euclid Chemical Co. "HiFlow Grout," or approved.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces when applied to forms or form liners.

D. Curing Materials:
1. Waterproof Sheet Material: Waterproof paper in accordance with ASTM C171; reinforced waterproof kraft paper; white color at exterior applications; Burke Kraft Curing Paper Type I-SK-30, or approved.
2. Mats and Burlap: Fabric covering composed of quilted polyethylene sheeting laminated to outer covering of burlap, cotton, or other approved fabric; outer covering shall weigh not less than 6 ounces per square yard.

3. Curing Compound: ASTM C309; clear or translucent with fugitive dye; moisture loss not more than 0.055 gr./sq.cm. when tested in accordance with ASTM C156 and applied in a single coat at the manufacturers recommended rate. Euclid Chemical Co. "SuperFloor Coat" or "Floorcoat," or approved
4. Curing/Sealing Compound: ASTM C309; water based curing compound; Euclid Chemical Company "Aqua-Cure," Sonneborn "Kur-N-Seal WB," Burke by Edoco "Spartan-Cote WB II," or approved.

E. Finishing Aid: Evaporation retardant for preventing rapid drying during hot windy weather, Master Builders "Confilm."

2.6 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94, and in accordance with the requirements indicated on the structural drawings.

B. Concrete at slabs on grade [and elevated slabs] shall have a maximum water/cement ration of 0.45.

C. Admixtures:
1. All concrete shall contain the specified water reducing or high range water reducing admixture, except concrete with a required water/cement ratio of 0.45 or lower shall contain a high range water reducing admixture.
2. All concrete required to be air entrained shall contain air entraining admixture to produce 4% to 6% air.
3. All concrete placed in ambient temperatures from 40 degrees F to 20 degrees F, and all slab concrete placed in ambient temperatures below 50 degrees F, shall contain an accelerator at the manufacturer's required dosage.
4. All concrete placed in ambient temperatures of 90 degrees F or above, shall contain a set retarder at the manufacturer's required dosage.

D. Provide 28 day compressive strengths as indicated on the Structural Drawings. Where not indicated on the Structural Drawings, provide minimum 3000 psi compressive strength unless indicated otherwise.

E. Fly Ash: A minimum of 15 percent and a maximum of 50 percent by weight of cementitious materials.

2.7 REINFORCEMENT FABRICATION

A. Fabricate as indicated and in accordance with ACI 315.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 FORMWORK ERECTION

A. Verify lines, levels, and measurement before proceeding with formwork. Align form joints.

B. Use plywood forms, unless other systems are approved by the Architect.

C. Use form coating on forms in accordance with the manufacturer's recommendations. Verify that form coatings will not affect the bond of subsequent concrete surface treatments.

D. Coordinate with work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

E. Tolerances: Comply with ACI 117.

F. Where earth forms are used, hand trim sides and bottoms of earth forms. Remove loose dirt.

3.3 UNDERSLAB VAPOR RETARDER

A. Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions under all interior slabs-on-grade.

B. Lap and seal all seams a minimum of 6 inches, seal around all penetrations, lap and seal against foundation walls and footings with manufacturer's recommended sealing tape or mastic.

C. Surfaces to Receive Interior Floor Slabs:
   1. Install 6 inch lift of gravel fill; compact to 95 percent of maximum dry density as determined by ASTM D1557.
   2. Place sand or compactible fill layer over gravel fill as necessary to prevent puncturing of vapor retarder during placement.
   3. Place rigid insulation over compactible fill where indicated.
   4. Place vapor retarder (Refer to Section 072616). Lap joints a minimum of 6 inches and seal with tape. Seal around penetrations; repair all damage to vapor retarder prior to covering.

3.4 REINFORCEMENT

A. Place, support, and secure reinforcement against displacement.

B. Locate reinforcing splices not indicated on the drawings at points of minimum stress.

C. Provide laps and concrete cover as indicated in the Drawings.

3.5 PLACING CONCRETE

A. In accordance with ACI 301.

B. Maintain consistent slab elevation at walls. Slope interior of slabs towards drains where applicable

C. Bonding Agent: Mix thoroughly and apply strictly in accord with the manufacturer's instructions; do not use when ambient temperature is below 45 degrees F. Place concrete in contact immediately while bonding agent is still tacky.

3.6 SUBSEQUENT TREATMENT FOR FORMED SURFACES

A. Provide smooth form finish for concrete to remain exposed in the finished work; rough form finish for concrete to remain concealed in the finished work.

B. Where waterproofing or dampproofing is scheduled or indicated, grout fill all rock pockets, tie holes, and other surface imperfections to create a smooth surface ready to receive the membrane. Grind concrete fins and other surface projections flat with adjacent surfaces.

3.7 SLABS

A. Expansion Joints for Slabs on Grade:
   1. Place expansion joints at locations indicated and where exterior slabs abut concrete walls, the building perimeter, and other fixed objects abutting or within the slab area. [At exterior sidewalks, place expansion joints at maximum [20]foot intervals unless otherwise indicated.]
   2. Form joints 1/2 inch wide x full depth of slab.
   3. Form expansion joints with preformed joint filler. Install strippable joint at joints to receive sealant specified in Section 079200.
   4. Tool expansion joints to 1/4 inch radius.
   5. Discontinue reinforcing at the expansion joint. Use 16 inch long sleeved 3/4 inch diameter smooth dowels at 12 inches on center for expansion joints in the field of the slab.
   6. Place perpendicular to longitudinal axis of wall and curbs. Where possible, make joints of curbs coincide with joints in walks.

B. Control Joints for Slabs on Grade:
   1. Make joints straight; perpendicular or parallel to building lines and slab edges, as appropriate.

2. Control joints shall be saw cut or tooled, unless indicated otherwise.
3. Radius tooled control joints to match expansion joints.
4. Control joints shall penetrate the slab a minimum of 1/4 the thickness of the slab and shall be 3/16 inch in width minimum.
5. Space control joints at the locations indicated in the approved Shop Drawings, except when not indicated locate in at 32 times the slab thickness.
6. Align joints with column lines when ever possible. Joints shall form rectangular panels with the long side less than 1-1/2 times the length of the short side. Provide circular or diamond shaped joint lines around columns. Locate control joints at reentrant corners.

C. Tooled Joints for Slabs on Grade: Provide tooled joints to match control joints. Tooled joints do not need to penetrate the slab 1/4 the depth of the slab.

D. Construction Joints: Place at either expansion or control joint locations for slab on grade construction.

E. Curing:
1. Moisture cure all concrete for a minimum of 7 days, unless approved or specified otherwise.
2. Use curing/sealing compound on concrete slabs scheduled to receive sealer.
3. Use waterproof sheet material at surfaces to receive subsequent bonded finish materials, including sealing compound. A curing compound may be used on surfaces to receive subsequent bonded finish materials, provided the curing compound is approved in writing by the manufacturer of the adhesive or the bonding finish material. Curing compound may also be used on surfaces to receive subsequent bonded finish materials, provided the curing compound is removed with shot blasting or other approved method prior to installation of bonded materials.
4. Apply curing compounds and curing/sealing compounds in accordance with the manufacturer's recommendations.
5. Maintain concrete temperatures above 50 degrees F.

F. Finishes:
1. Full Trowel finish interior floor slab surfaces, unless specified otherwise.
2. Light steel trowel finish at exterior vehicle slab.

G. Curing/Sealing Compound: Apply a second coat of curing/sealing compound to concrete slabs scheduled to receive sealer. Clean floor and apply just prior to substantial completion. Apply in accordance with the manufacturer's recommendations.

H. Tolerance: Provide Random Traffic floor tolerances as follows, when measured in accordance with ASTM E1155, including those floors to receive subsequent finishes.
1. Slab on Grade at Warehouse Floors: F_F 45, F_L 35, over test area; F_F 30, F_L 24, minimum local value.
2. Slabs on Grade to receive thinset flooring and resilient floor covering : F_F 35, F_L 25, over test area; F_F 24, F_L 17, minimum local value.
3. Slabs on Grade to receive carpet: F_F 25, F_L 20, over test area; F_F 17, F_L 15, minimum local value.

END OF SECTION

SECTION 030130 - CONCRETE SLAB REPAIR AND PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Repair of new concrete slabs.
   2. Preparation of slabs to receive finishes.
   3. Underlayments and topping slabs as necessary for leveling of cast-in-place concrete slabs to meet specified tolerances.
   4. Ramps and tapers as necessary to correct levels between dissimilar finishes.

B. Related Sections:
   1. 030013 – Building Concrete
   2. 033514 – Polished Concrete Flooring System

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Proposals for alternate products and methods for applications indicated may be considered by the Architect, subject to requirements of Section 016000, system performance requirements, and applicable requirements of this Section.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Manufacturer's product data and installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in their original unopened packages and protect from freezing, direct sun exposure, and exposure to moisture.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Maintain surface and ambient temperature of between 50 and 80 degrees F for 24 hours before, during, and 24 hours after underlayment installation.

B. Keep traffic out of area in which underlayment is being applied or cured.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Self Leveling Underlayment System: Self-leveling, pourable, cement based material, minimum 28 day compressive strength 2,000 psi; minimum bond strength 200 psi; one of the following.
   1. Mapei Corporation "Ultraplan 1".
   2. Ardex Inc. "K-15" Self-Leveling Underlayment Concrete
   3. Laticrete International, Inc. "Laticrete 86 LatiLevel Thin Pour Underlayment."
   4. Laticrete International, Inc. "Laticrete 88 LatiLevel Thick Pour Underlayment."

B. Trowelable Underlayment System:
   1. Ardex Inc. "SD-P" Fast-Setting Underlayment.
   2. Laticrete International, Inc. "Laticrete 220 Medium Bed Mortar mixed with "Laticrete 3701 Latex Mortar Admix."
   3. Mapei Corporation "Mapacem 100" or "Planitop 10".
   4. Tamms Industries Co. "Thin Patch."

C. Interior Traffic Bearing Topping System: Ardex Inc. "SD-T" Self-Leveling Self-Drying Concrete Topping; minimum 28 day compressive strength 6,000 psi.

D. Patching Compound:
   1. Ardex “CP”.

2. Mapei “Quickpatch”.
3. Similar approved.

E. Non-Shrink Grout: ASTM C1107, Grade B; non-shrink non-catalyzed natural aggregate grout; minimum compressive strength of 7000 PSI at 28 days; 25 to 30 second flow when tested in accordance with ASTM C939 at 45 to 90 degrees F; cement gray in color; Master Builders Inc. "Masterflow 928," Euclid Chemical Co. "HiFlow Grout," or approved.

F. Accessories: Furnish primers, patching compounds, and sand fillers as recommended by the underlayment manufacturer for the conditions of the project.

2.2 MIXING

A. Thoroughly mix underlayment materials for each type of product in proper proportions to achieve smooth homogeneous mix, free of lumps.

PART 3 - EXECUTION

3.1 GENERAL

A. With the exception of areas where leveling can be accomplished by use of latex underlayment, as specified in other sections, install cementitious underlayment to concrete slabs as indicated on the Drawings, and as necessary to level slabs or bring substrates to proper elevation.

3.2 PREPARATION AND REPAIR

A. Comply with appropriate floor finish manufacturer recommendations and as follows: prepared surface shall be smooth and free of ridges and irregularities including those occurring in concrete and from mastics.

B. Initial Concrete Slab Preparation: Provide initial preparation of concrete surface as follows.
1. Remove dirt, oil, soap, grease, mastic, and other bond-breaking contaminants.
2. Surface shall be smooth and free of unwanted ridges from by either mastics or concrete.

C. Surface Repair: Fill holes, spalls, cracks, voids and joints as recommended by the system manufacturer with minimal residue on surrounding surface and as required to provide a smooth, level and even substrate.
1. Spalls 1 to 3 inches in diameter shall be struck flush with patching compound
2. Spalls larger than 3 inches in diameter and areas requiring leveling or resurfacing shall be filled with self-leveling or trowelable compound.
3. Fill cracks of 3/16 inch in width or wider with patching compound.
4. Cracks between 1/16 to 3/16 inch in width shall be filled with joint sealant specified in Section 079200 following the completion of the Work of this Section.
5. Cracks less than 1/16 inch in width will not be filled.

D. Final Preparation: Surfaces to be treated shall be clean, dry and absorbent. Confirm surface absorbency with a light water spray. If surface does not wet uniformly, use the appropriate surface preparation method to remove remaining surface contaminants.

3.3 PREPARATION – UNDERLAYMENT AND TOPPINGS

A. Inspect floor to verify that demolition is complete to the point where work may progress.

B. Survey floor as necessary to set screeds and reference points. Identify construction joints, control, and expansion joints. Prepare for underlayment at all locations where floor does not meet specified tolerance requirements.

C. Ensure that subfloor is clean, dry, hard, sound, and free of oils, or other substance which would affect proper bonding and curing. Verify that all areas to be leveled are at or below final design elevation.

E. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions and responsibility for defective installation caused by prior observable conditions.

3.4 APPLICATION

A. Install trowelable underlayment at locations where slopes are indicated and at other locations as appropriate to installation conditions; install self leveling underlayment at other locations as necessary to correct slab flatness and levelness.

B. Set screeds, markers, and reference blocks. Set screeds at all construction and control joints to establish weakened plane joints in underlayment.

C. Install patching compounds in accordance with the manufacturer's recommendations. Where subsequent finishing of the material is required, float to level surface. Do not trowel.

D. Apply primer to all areas to receive underlayment; repeat application if necessary to achieve proper build.

E. Mix materials and pour or pump and squeegee into place to achieve appropriate thickness. At areas to receive cork tile flooring, provide fill thickness as necessary to align cork flooring with adjacent floor surfaces.

F. Finish to a smooth level surface within tolerances specified for concrete floors.

G. Cure in accordance with the manufacturer's instructions.

H. Tolerances:
   1. Class B in accordance with ACI 301.

3.5 CLEANING

A. As work proceeds, clean up excess materials, rubbish, and splash.

END OF SECTION

SECTION 033514 – POLISHED CONCRETE FLOORING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polished concrete.

B. Related Sections:
   1. 030013 – Building Concrete
   2. 030130 - Concrete Slab Repair and Preparation

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. B101.3 - Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials.

B. American Society for Testing and Materials (ASTM):
   1. C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   2. C171 Standard Specification for Sheet Materials for Curing Concrete.
   3. C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surface

C. Reunion Internationale des Laboratoires D'Essais et de Recherches sur les Materiaux et les Constructions (RILEM):
   1. Rilem Test Method 11.4 Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surface

D. National Floor Safety Institute (NFSI):
   1. 1. NFSI Test Method 101-A Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

E. South Coast Air Quality Management District (SCAQMD)
   1. Rule #1168 (July 1, 2005; Amended January 7, 2005).

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
   1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch (mm) wear in 30 minute
   2. Reflectivity: Increase of 35% as determined by standard gloss mete
   3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
   4. High Traction Rating: NFSI 101-A, non-slip properties.

1.4 SUBMITTALS

A. Product Data: Submit product data, including manufacturer's SPEC-DATA® product sheet, for specified product
   1. Material Safety Data Sheets (MSDS
   2. Preparation and concrete grinding procedure
   3. Dye Selection Guide

B. Shop Drawings: Indicate information on shop drawings as follows:
   1. Typical layout including dimensions and floor grinding schedule.
   2. Plan view of floor and joint pattern layout.
   3. Areas to receive colored surface treatment.

C. Quality Assurance Submittals:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in Performance Requirements.
   2. Certificates:
      a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

b. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.
c. Current contractor's certificate signed by manufacturer declaring contractor as an approved installer of polishing system.

3. Manufacturer's Instructions: Manufacturer's installation instruction

D. Closeout Submittals
1. Warranty: Submit warranty documents.
2. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Section 017700 - Closeout Procedures. Include:
a. Manufacturer's instructions on maintenance or renewal of applied treatments.
b. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Installer trained and holding current certification for installation specified.
3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Concrete finishing components and materials shall be from single manufacturer.

C. Installation Conditions: Comply with manufacturer's written recommendations.

D. Sequence With Other Work: Comply with manufacturer's written recommendations for sequencing construction operations.

E. Slip Resistance: Unless approved otherwise, measured Dynamic Coefficient of Friction (DCOF) shall be not less than 0.30 (WET) at time of testing as measured using a Regan Scientific Instruments Bot-3000 Tribometer, in accordance with ANSI B101.3.

1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Section 016100 - Product Requirements.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Mock-Ups:
1. Construct mock-ups in accordance with Section 014500 - Quality Control.
2. Mock-Up Size: 50 ft2 sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
4. Allow 48 hours for inspection of mock-up before proceeding with work.
5. When accepted, mock-up will demonstrate minimum standard of quality required for this work.
6. Approved mock-up may remain as part of finished work.

D. Delivery:
1. Deliver materials in manufacturer's original packaging with identification labels and seals intact.

E. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
2. Protect concrete slab:
a. Protect from petroleum stains during construction.
b. Diaper hydraulic power equipment.
c. Restrict vehicular parking.
d. Restrict use of pipe cutting machinery.
e. Restrict placement of reinforcing steel on slab.
f. Restrict use of acids or acidic detergents on slab.

1.7 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

C. Warranty: Commencing on date of acceptance by Owner.

1.8 MAINTENANCE

A. Comply with manufacturer's written instructions to maintain installed product.

PART 2 - PRODUCTS

2.1 POLISHED CONCRETE FINISHING PRODUCTS

A. Manufacturer: L & M Construction Chemicals, Inc. (Omaha, NE; 800-362-3331; www.fgs-permashine.com); “FGS Permashine” system.

B. Component Products/Systems:
   1. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
      a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Hardener Plus.
   2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
      a. Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 75
   3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
      a. Acceptable Material: L & M Construction Chemicals, Inc., Petrotex.
   4. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
      a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Concrete Conditioner
   5. Finish: Standard High gloss (HG-1), 1500 grit, or optional Medium gloss (MG-2), 800 grit, as scheduled.

PART 3 - EXECUTION

3.1 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and L & M Construction Chemicals, Inc., SPEC-DATA sheets.

3.2 EXAMINATION

A. Site Verification of Conditions:
   1. Verify that concrete substrate conditions are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

B. Verify Concrete Slab Performance Requirements:
   1. Verify concrete is cured to 28 day strength.
   2. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.

3.3 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

C. General Contractor to remove surface contamination.

3.4 INSTALLATION

A. Floor Surface Polishing and Treatment:
   1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
   2. Apply floor finish prior to installation of fixtures and accessories.
   3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method.
      a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.
      b. Expose aggregate in concrete surface only as determined by approved mock-up.
      c. All concrete surfaces shall be as uniform in appearance as possible.
   4. Polished Concrete:
      a. Locate demarcation line between polished surfaces and other finishes.
      b. Polish concrete to final finish level.
      c. Remove residue with dry buffer; reapply as necessary for desired result.
   5. Apply FGS Hardener Plus, Hardener, and Densifier As Follows:
      a. First coat at 250 ft2/gal.
      b. Second coat at 350 ft2/gal.
      c. Follow manufacturer's recommendations for drying time between successive coats.
   6. Remove defects and re-polish defective areas.
   7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.5 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.6 FINAL CLEANING

A. Do cleanup in accordance with Section 017421 – Construction Waste Management and Disposal.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

D. Install sealant at slab joints in compliance with Section 079200.

3.7 PROTECTION

A. Protect installed product from damage during construction.

B. Protect with “EZ Cover”™ by McTech Corp (866-913-8363) or comparable product.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Elements indicated on the Structural Drawings, including the following:
      a. Structural steel.
      b. Shear connector studs and stud anchors.
      c. Structural welding.
      d. Baseplate grouting.
   2. Priming of structural steel.

B. Related Sections:
   1. 014500 - Quality Control: Requirements for testing and inspection.
   2. 030013 - Building Concrete: Placement of structural steel to be embedded in concrete.
   3. 053100 - Steel Decking.
   4. 054000 - Cold-Formed Metal Framing; Lightgage structural elements.
   5. 055000 - Metal Fabrications: Steel fabrications not indicated on the Structural Drawings.
   6. 055139 - Metal Stairs and Railings: Steel stair assemblies.
   7. 099600 – High Performance Coatings: Field painting of structural steel elements.

C. Drawings, the provisions of the Agreement Conditions of the Contract, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. Specification for Structural Steel Buildings, 2010.
   2. Code of Standard Practice for Steel Buildings and Bridges, 2010.
   3. Manual of Steel Construction, 14th Edition 2010.
   4. Specifications for Structural Joints Using ASTM A325 or A490 Bolts, 2014.

B. American Society for Testing and Materials (ASTM):
   1. A36 - Structural Steel.
   2. A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
   3. A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
   4. A572 - High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
   5. A992 - Standard Specification for Steel for Structural Shapes For Use in Building Framing
   6. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

C. American Welding Society (AWS): D1.1 - Structural Welding Code - Steel.

D. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual, Volume 2, Systems and Specifications."

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data:
   1. Shop applied primers.
   2. Non-shrink grout.

C. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, loads.
   2. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
   3. Indicate types and locations of field welds.

4. Indicate members to be shop primed.

D. Quality Control Submittals:
   1. Certifications: Submit certification of materials with copies of mill reports for each heat of steel used.

1.4 QUALITY ASSURANCE

A. The work of this Section is subject to testing and inspection as specified in Section 014500.

B. Use only certified welders approved by the jurisdictional code authorities.

C. Unless specified or indicated otherwise, work shall comply with AWS and AISC Standards.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Types as indicated on the Structural Drawings.

2.2 ACCESSORIES

A. Non-Shrink Grout: BASF "Masterflow 713 Plus," Sonneborn "Sonogrout," or approved; non-shrink, non-metallic grout in compliance with ASTM C1107.

B. Welding Electrodes: E-70 series, low hydrogen, appropriate for use.

C. Interior Primer: Modified alkyd type (VOC compliant); lead and chromate free; gray or white color; one of the following unless approved otherwise.
   1. "Azeron Primer Series 88HS" by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
   2. "Amercoat 5105" by Ameron Protective Coatings (Brea, CA; 714-529-1951).
   3. "Carbocoat 150HG" by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645).

D. Special Exterior Primers:
   1. First Primer: One of the following; provide product from same manufacturer selected for finish systems specified in Section 099000.
      a. “Series 394 PerimePrime" by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
      b. "Carbozinc 859" by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645); organic zinc-rich epoxy primer.
      c. "68HS" by Ameron Protective Coatings (Brea, CA; 714-529-1951); organic zinc-rich epoxy primer.
      d. "Catha-Coat 302H" by Akzo Nobel / International Coatings; "reinforced" inorganic zinc-rich epoxy.
   2. Epoxy Tie-Coat Primer: One of the following; provide product from same manufacturer selected for first primer specified above:
      a. "Hi-Build Epoxoline II" Series N69 by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
      b. "Carboline 888 " by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645); organic zinc-rich epoxy primer.
      c. "Amercoat 385." by Ameron Protective Coatings (Brea, CA; 714-529-1951); organic zinc-rich epoxy primer.
      d. " "Bar-Rust 231," or "Bar-Rust 233H." by Akzo Nobel / International Coatings; "high-build epoxy primer.

2.3 FABRICATION

A. Fabricate structural steel items in accordance with AISC and AWS Standards and in accordance with approved shop drawings. Properly mark and match-mark all materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling.

B. Shop Assembly: Fabricate units in as large a part or section as practicable.

C. Structural Steel to be Exposed in the Finished Work:
   1. Comply with provisions of AISC "Code of Standard Practice for Steel Buildings and Bridges" Section 10 "ARCHITECTURAL EXPOSED STRUCTURAL STEEL."
   2. Grind welds smooth with adjacent surfaces. Grind butt welds flat and perpendicular to the weld direction.
   3. All welds for structural steel elements to receive organic zinc primer shall be continuous.
   4. The cross section of abutting members shall match.
   5. Raised manufacturer identification markers shall be ground smooth to match adjacent surfaces.
   6. Stamped manufacturer identification markers shall be filled to match adjacent surfaces.

D. Standard Shop Primer Application:
   1. Preparation: Remove rust and scale by wire brushing, scraping, and sanding down to bare metal in accordance with SSPC-SP2 and SP3. Where SP2 and SP3 measures are insufficient, provide commercial blast cleaning in accordance with SSPC-SP6.
   2. Application: Spray apply primer in accordance with manufacturer's recommendations, mil minimum dry film thickness.
   3. Shop Primer: Shop prime all steel except:
      a. Steel encased in concrete.
      b. Surfaces to be field welded.
      c. Contact surfaces at high-strength bolts.
      d. Members to be galvanized.
      e. Members which will be concealed by interior finishes.
      f. Surfaces to receive sprayed fireproofing.
      g. Surfaces to receive other special shop primers.

E. Special Shop Primer Application:
   1. Prepare surfaces in accordance with the manufacturer's recommendations, and as specified below.
   2. Solvent clean in accordance with SSPC SP-1; near white blast ungalvanized ferrous metal surfaces in accordance with SSPC SP-10.
   3. Spray apply one coat organic zinc primer and one intermediate coat epoxy primer in accordance with the manufacturer's recommendations. Apply primers to receive field application of finish coats as specified in Section 099000.
   4. Maintain at least one coat of primer at all times during installation. Immediately patch damaged coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 ERECTION

A. Embedded Items: Provide anchor bolts and templates, and other items as indicated, to other Sections for installation prior to placement of cast-in concrete.

B. Temporary Shoring and Bracing: Provide as required with connections of sufficient strength to bear imposed loads. Remove temporary members when permanent members are in place and final connections are made.

C. Erect structural steel in accordance with approved shop drawings and AISC "Code of Standard Practice," Section 7.

D. Welds shall be in accordance with AWS D1.1.

E. Cut holes by drilling only.

F. Tolerances: Maximum deviation from plumb, level, and alignment shall not exceed 1 to 500.

G. Base Plate Grouting: Set on leveling nuts to accurate elevations and grout solid with non-shrink grout.

H. Cleaning and Touch-Up:
   1. Clean steel of oil or other contaminants as specified under Fabrication.
   2. Columns, beams, girders, and other members which are to receive sprayed-on fireproofing shall be cleaned free of loose rust, heavy mill scale, oil, dirt or other foreign substances prior to application of fireproofing materials.
   3. Immediately after erection, clean field welds, bolted connections, and abraded areas and touch-up factory primed surfaces with same primer as used in shop; touch-up galvanized surfaces with zinc-rich primer.

END OF SECTION

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel deck and accessories.

B. Related Sections
   1. 030013 – Building Concrete: Concrete fill.
   2. 051200 - Structural Steel Framing: Support framing.
   3. Division 22 - Plumbing: Sleeves for conduit and pipe penetrations.
   4. Division 26 - Electrical: Sleeves for conduit and pipe penetrations.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Galvanized Process, Structural (Physical Quality).
   2. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

B. American Welding Society (AWS): D1.3 - Structural Welding Code Sheet Steel.

C. Steel Deck Institute (SDI): Design Manual for Composite Decks, Form Decks, Roof Decks.

D. International Code Council (ICC)

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Product literature and recommended installation instructions for metal decking, including verification of gravity load and shear capacities.

C. Shop Drawings: Indicate the following.
   1. Deck layout, types and gages, framing and supports, and unit dimensions and sections.
   2. Types of welds and weld patterns.
   3. Details of fasteners and accessories.
   4. Edge form details and locations.
   5. Locations and types of closures
   6. Locations of all holes and openings in decking.

D. ICC-ES report, confirming compliance of metal deck with regulatory fire-resistance requirements.

1.4 QUALITY ASSURANCE

A. Work of this Section is subject to testing and inspection as specified in Section 014500.

B. Erector Qualifications: Minimum of 5 years experience on comparable steel deck installations.

C. Requirements of Regulatory Agencies: Metal deck shall be fabricated and installed to meet requirements of the International Building Code.

D. Roof deck system shall be capable of resisting shear loads noted on the structural drawings.

E. Welders: Approved by the jurisdictional authorities.

F. Refer to Structural Drawings for loads and additional requirements.

1.5 PRODUCT HANDLING

A. In accordance with Section 016000, and as follows:
   1. Store off ground with one end elevated for drainage.
   2. For storage over extended periods of time, cover deck with waterproof material.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Steel Roof Deck: As indicated on the Structural Drawings.
   1. ASTM A653, SS Grade 33 minimum quality. Galvanized coatings as follows
      a. Concealed locations: A40 or G60, minimum.
      b. Deck with surfaces to be permanently exposed to view in exterior locations (surfaces to be painted): A60, minimum.
      c. Deck with surfaces to be permanently exposed to view in interior locations (surfaces to be painted): A40, minimum.
   2. Fabricate deck in accordance with SDI Design Manual.
   3. Furnish deck of depth and profile indicated on the structural drawings. Where gage of deck is not shown, furnish deck capable of supporting design loads indicated on the structural drawings with detailed support conditions. Maximum deflection L/360, unless otherwise indicated.]

B. Accessories:
   1. Cover Plates and Closures: Fabricate from same material as metal deck. Configure to match contour of deck units, for tight fitting closure of sides and ends of decks.
   2. Weld Washers: Per manufacturer's recommendations.

C. Galvanizing Repair Paint: ZRC Worldwide, (Marshfield, MA;781-319-0400; 800-831-3275) "Cold Galvanizing Compound," or approved; organic zinc-rich coating containing 95 percent metallic zinc by weight in the dried film; conforming to Federal Specification DODP-21035A for repair of hot-dip galvanizing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install metal deck units as indicated, and in accordance with the deck manufacturer's instructions.

B. Install deck with minimum 2 inch bearing unless indicated otherwise. Install roof deck with minimum end laps of 2 inches, centered over the supports.

C. Place deck units flat and square; secure to framing without warp or deflection.

D. Perform welding in accordance with AWS D1.3.

E. Cutting and Fitting: Cut deck units for all penetrations. Make cuts neat, square, and trim.

F. Install closures at open ends and sides of deck units as indicated, and as required to retain concrete fill.

G. Touch-up Painting: Touch-up field welds and scratched or damaged galvanizing in accordance with requirements of ASTM A780.

H. Touch-up Painting: Retouch field welds and scratched or damaged galvanizing with galvanizing repair paint, in accordance with ASTM A780 and the paint manufacturer's recommendations.

END OF SECTION

SECTION 054000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior lightgage (axial and transverse) load bearing metal framing, with anchorage and bracing.
   2. [Structural Design of systems.]

B. Related Sections:
   1. 051200 - Structural Steel Framing: Related steel supports.
   2. 053100 - Steel Decking: Roof deck.
   3. 072100 - thermal Insulation: Thermal insulation.
   4. 092200 – Lightgage Metal Support Framing: Non-structural lightgage metal framing.
   5. 092843 - Gypsum Sheathing: Exterior cladding.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI).

B. American Society for Testing and Materials (ASTM)
   1. A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   3. C954 - Standard Specifications for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 In, (0.84mm) to 0.112 In. (2.84mm) in Thickness
   4. C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

C. American Welding Society (AWS): D1.3 - Structural Welding Code - Sheet Steel.

1.3 [SYSTEM DESCRIPTION

A. Structural Design:
   1. Size and arrange members to support dead loads, and to resist live loads indicated on the Structural Drawings, and including wind [and snow]loads in accordance with the local jurisdictional [requirements.
   2. Design system to resist dead and live loads from [windows, curtainwall, flagpoles, awnings], and other items indicated to be supported by cold formed metal framing.
   3. Design system to resist 100-percent of the design load with a maximum deflection of [L/720][L/360].
   4. Anchorages shall be designed to simultaneously resist all vertical and lateral loads, with a safety factor of [2].

B. Design system to accommodate building deflection, dynamic building movement, and temperature variations without damage to system components. Design systems to accommodate a floor deflection of [1/2 inch].]

C. Configuration:
   1. Provide framing of depth indicated on the Drawings.
   2. Where stud gage is indicated on the Drawings, provide studs of indicated or heavier gage.
   3. Where stud spacing is indicated on the Drawings, provide additional studs or closer spacing as necessary to meet design requirements.
   4. In addition to cold formed metal framing, provide structural steel members as required to support the loads imposed.

5. [In addition to cold formed metal framing indicated on the Drawings, provide additional members located as necessary to anchor superimposed loads.]

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Indicate each type of framing member proposed; include structural characteristics ad span tables.

C. Shop Drawings:
1. Indicate all typical and special details, including framing details, anchorage systems, fastening systems, loads, and accessories or items required of other work for complete installation.
2. Indicate framing layouts and sizes of framed openings.
3. [Shop drawings shall be sealed by the designing engineer.]

D. [Shop Drawings: Indicate all typical and special details, including framing details, anchorage systems, fastening systems, loads, and accessories or items required of other work for complete installation.]

E. [Samples: Submit 6 inches long sample sections of studs, finished as specified.]

F. [Quality Control Submittals: In accordance with Section 014500.
1. Certification: Submit written certification that the framing system has been designed to meet the specified requirements.]

G. Closeout Submittal:
1. In accordance with Section 017700.
2. Submit designing engineer's certification that products and installation comply with design requirements.

1.5 QUALITY ASSURANCE

A. The work of this section is subject to testing and inspection as specified in 014500.

B. Use only welders approved by the jurisdictional authorities

C. Welding shall comply with AWS D1.3.

D. Calculate structural properties of framing members in accordance with the AISI "Specification for the Design of Cold Formed Steel Members".

E. [Structural Design: Structural design of the framing system shall be by a structural engineer licensed to practice in the State where the Project is located.

F. Regulatory Requirements:
1. Framing system shall meet the requirements of the jurisdictional code authorities.
2. [Furnish all calculations, engineer's stamps, drawings, and other items required by the code authorities to obtain approval of the installation.]

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Cold Formed Light-gage Steel Framing: ASTM A653. [; types as indicated on the structural drawings; G60 [G90]galvanized coating.]
1. [Fabricate from steel sheet; Quality SQ, Grade 50; minimum 16 gage.
2. Finish: G60 [G90]zinc coated finish in accordance with ASTM A653.
3. Studs: C shaped sections; minimum 1-5/8 inch wide flanges with return lip.
4. [Joists: [ ]]]

B. Accessories:
1. Screws: ASTM C954; self drilling, self tapping; pan head; galvanized or fluoropolymer coated steel.

2. [Sill Gasket: Closed cell polyethylene foam, glass fiber strips, or approved; continuous rolls; width of sill plate.]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 ERECTION

A. Install lightgage structural framing in accordance with ASTM C1007, unless indicated or specified otherwise.

B. Erect metal framing as indicated [in accordance with the approved shop drawings.]

C. [Unless indicated or approved otherwise, all joints shall be welded in accordance with AWS D1.3. [Mechanical fasteners may be used only when approved by the Architect.]]

D. [Screw or weld each joint. Welds shall be in accordance with AWS D1.3.]

E. Metal framing members shall be saw or shear cut. No torch cutting is permitted.

F. Construct corners with a minimum of 3 studs per corner.

G. Frame both sides of expansion and seismic joints. Do not bridge joints with system components or accessories.

H. Provide framing as required to form solid backing for all edges of gypsum sheathing, and trim accessories. Frame both sides of control joints in [portland cement plaster].

I. Tolerances:
   1. Plumb: 1/8 inch in 10 feet.
   2. Location: Within 1/4 inch of the required location.
   3. [Alignment: Stud and runner faces to receive finish materials shall not vary more than 1/8 inch from the required plane.]
   4. Level: 1/8 inch in 10 feet.

J. Erect studs in one piece full length. Splicing and wire tying of framing components shall not be used.

K. Make provision for erection stresses. Provide temporary alignment and bracing. Touch-up field welds and scratched or damaged galvanizing in accordance with requirements of ASTM A780.

L. Attach cross studs or furring channels to studs for attachment of wall mounted items.

M. Install framing between studs for attachment of electrical boxes and other mechanical and electrical items.

N. Ensure framing provides true and flat surfaces, ready to receive designated finish.

O. [Place sill gasket directly on concrete foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.]

3.3 FIELD QUALITY CONTROL

A. The structural design engineer or an authorized representative shall visit the site to inspect the work. Verity and certify that the installation has been installed in accordance with the structural requirements.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabricated metal items indicated on the Architectural Drawings.

B. Related Sections:
   1. 014500 - Quality Control: Requirements for testing and inspections.
   2. 030013 - Building Concrete: Embedment of metal fabrications; fill at metal bollards.
   3. 051200 - Structural Steel Framing: Steel elements indicated on the Structural Drawings.
   4. 055139 - Metal Stairs and Railings
   5. 055141 - Architectural Railings
   6. 099000 - Painting: Field painting of metal fabrications shop primed in this section.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A36 - Specification for Structural Steel.
   2. A53 - Specification for Welded and Seamless Steel Pipe.
   3. A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. A143 - Safeguarding Against Embrittlement of Hot Dipped Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
   5. A153 - Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
   1. A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners.
   7. A366 - Specification for Carbon Steel Cold Rolled Sheet.
   8. A384 - Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies.
   9. A385 - Providing High Quality Zinc Coatings (Hot Dip).
   10. A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   11. A501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   12. A569 - Specification for Commercial Quality Hot Rolled Sheet and Strip Carbon (0.15 Maximum Percent) Steel.
   13. A570 - Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Literature: Submit product literature for all prefabricated products.

C. Shop Drawings:
   1. Show details of fabrication and installation; indicate materials, thicknesses, dimensions, methods of reinforcement and embedment, attachments, shop finishes, provisions for work of other trades, and other pertinent information as requested by Architect.

D. Closeout Submittal:
   1. In accordance with Section 017700.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Experienced and regularly engaged in producing metal fabrications of the type specified; must employ only skilled personnel using proper equipment to produce work.

B. Testing and Inspection: All metal fabrications are subject to special inspection as specified in Section 014500.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carbon Steel:
   1. Structural Shapes, Plates, and Bars: ASTM A36.
   2. Sheet: ASTM A366.
   3. Pipe: ASTM A53, seamless, Type S, plain end; schedule 40 unless indicated otherwise.

B. Stainless Steel: ASTM A167 Type 302 or 304.

B. Fasteners: Types as indicated, specified, or required for the assembly and installation of fabricated items.
   1. Bolts: ASTM A307, unless indicated otherwise; include nuts and plain hardened washers.
   2. Drilled-In Concrete Anchors: Ramset "Trubolt Stud Anchor," Hilti Fastening Systems "Kwikbolt," or approved.

C. Interior Primer: Modified alkyd type (VOC compliant); lead and chromate free; gray or white color; one of the following unless approved otherwise.
   1. "Azeron Primer Series 88HS" by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
   2. "Amercoat 5105" by Ameron Protective Coatings (Brea, CA; 714-529-1951).
   3. "Carbocoat 150HG" by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645).

D. Exterior Finish Materials:
   1. Manufacturer: Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
   2. Epoxy Primer: Tnemec Series 69 Epoxoline."
   3. Urethane Finish Coat: "Series 1075 "Endura-Shield" Acrylic Polyurethane Enamel;" semi-gloss sheen; custom color for each item as selected by the Architect.

E. Powder Coating: Polyester-urethane resin.

F. Cold Galvanizing Compound: "Galv-Weld," "Galvican," "ZRC Cold Galvanizing Compound," or equivalent zinc-rich primer.

G. Miscellaneous Materials: Furnish incidental accessory materials, tools, and equipment as necessary for fabrication and installation of miscellaneous metal items as indicated on the Drawings.
   1. Non-Shrink Grout: Master Builder's "Master Flow 713," Sonneborn "Sonogrout," or approved.

2.2 PREFABRICATED COMPONENTS

A. Steel Bar Grating Treads: Fabricate from materials as specified for steel gratings, in accordance with NAAMM recommendations and tolerances. Carrier plate design; checkered nosing; number and size of bearing bars in accordance with tread widths and spans indicated.

B. Steel Gratings:
   1. Fabricate from welding quality mild carbon steel conforming to the requirements of ASTM A569.
   2. Fabricate in accordance with NAAMM standards for steel grating.
   3. Load Capacity:
      a. Provide bearing bars sized in accordance with manufacturer's load tables for the spans indicated.
      b. Pedestrian Traffic: 100 psf, but in no case less than 3/4 inch deep by 1/8 inch thick.
      c. Auto Traffic: H-20 loading.
      d. Sump Pit Grating: Minimum 125 psf; 300 lb point (4 sq. in.) load.
   4. Fabrication: Fully welded construction; space bearing bars on 1-3/16 inch centers and cross bars on 4 inch centers except at building entrance and garage ventilation grates, space bars as necessary for a maximum 1/2 inch clear space between bars. Provide banding bars of minimum thickness as bearing bars; weld banding bars to bearing bars.
   5. Finish: Hot dipped galvanized after fabrication.

6. Provide hold down lugs at grating subject to auto traffic.

C. Unistrut: Unistrut Corporation (Wayne, MI), or approved. Furnish manufacturer's standard components corresponding to "P" numbers indicated on the drawing. Include 1/4 inch thick steel connecting hardware, and 1/2" diameter bolts, nuts, and lock washers.

D. Stainless Steel Corner Guards (SSCG): Model WCG by Wilkinson-Hi-Rise, LLC (866-424-8837) or CG-50 by Pawling Corporation (800-431-3456); 1/8 inch radius corner bend; 16 ga type 304 stainless steel; 3-1/2” wings with returned edges; 48" length unless otherwise indicated. Furnish cement and related accessories as required for adhesive installation.

E. Steel Corner Guards: 16 gage ASTM A653 G60 galvanized sheet steel; leg dimension and length as indicated; exposed countersunk oval head screw fastenings equally spaced; all edges eased.

2.3 FABRICATION

A. General Fabrication Requirements: Fabricate as follows, unless specified or indicated otherwise.
1. Verify all dimensions and fabricate to detail with accurate sizes and shapes, straight lines, smooth curves, and sharp angles.
2. Welds shall have sufficient strength to withstand the loads applied.
3. For items exposed to view or subject to contact, grind welds smooth and level with adjacent surfaces; remove all burrs from cut edges. Fill imperfections with body putty as necessary for a smooth even finish.
4. Bend curved sections to a smooth radius free from buckles and twists.
5. Fabrications in exterior locations shall be fabricated to shed water.

B. Fabrication of Elements to Receive Galvanized Coatings:
1. Fabricate in accordance with the applicable requirements of ASTM A143, A384, and A385.
2. Remove welding slag and burrs prior to galvanizing.
3. Avoid fabrication techniques which could cause distortion or embrittlement of the steel.

2.4 SHOP FINISHES

A. Hot Dip Galvanizing:
1. Steel fabrications shall be galvanized in accordance with ASTM A123. Bolts, nuts, washers, and other hardware shall be galvanized in accordance with A153.
2. Surface Finish: The galvanized coatings shall be continuous, firmly adhered, smooth, and free from defects.
3. Locations: Provide hot dip galvanizing for all metal fabrications in exterior or moist conditions, and where otherwise indicated. Unless otherwise approved by the Architect, plug and cold galvanize ventilation and lifting holes which will be exposed to moisture penetration in the finished work.

B. Interior Primed finish:
1. Preparation: Solvent clean in accordance with SSPC-SP1. Remove rust and scale by wire brushing, scraping, and sanding down to bare metal in accordance with SSPC-SP2 and SP3. Where SP2 and SP3 measures are insufficient, provide commercial blast cleaning in accordance with SSPC-SP6. Immediately apply specified prime coat.
2. Apply interior primer in accordance with manufacturer's recommendations.
3. Locations: Provide at all interior metal fabrication exposed to view, unless otherwise indicated. Do not prime surfaces to be embedded in concrete, and surfaces to be field welded.

C. Exterior Special Finish:
1. Prepare surfaces in accordance with the finish coat manufacturer's recommendations, and as specified below.
2. Solvent clean in accordance with SSPC SP-1. Abrade galvanized surfaces with a metal preparation pad.
3. Spray apply primers and one finish coat in accordance with the manufacturer's recommendations.
4. Except for surfaces indicated to be field welded, coat all surfaces of fabrication, whether or not exposed to view in installed position.

5. Maintain at least one coat of primer at all times during installation. Immediately patch damaged coatings.
6. Finish coat shall be free of dirt, flow lines, sags, blisters, pinholes, and other surface imperfections.
7. Locations: Provide at all exterior metal fabrication exposed to view, all galvanized steel, and other fabrications as scheduled. Do not prime surfaces to be field welded.

D. Powder Coated Steel:
1. Prepare steel by solvent cleaning in accordance with SSPC-SP1. Remove rust and scale by wire brushing, scraping, and sanding down to bare metal in accordance with SSPC-SP2 and SP3. Where SP2 and SP3 measures are insufficient, provide commercial blast cleaning in accordance with SSPC-SP6.
2. Spray apply powder coating and cure in accordance with manufacturer's instructions.

2.5 PROTECTION

A. For metal in contact with concrete, masonry, and other dissimilar materials, coat contact surfaces with zinc-rich primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install metal fabrications in accurate locations shown. Unless indicated otherwise, fabrications shall be installed plumb and level.

B. Provide all anchorage devices as indicated and required for a secure installation.

C. Touch-up all surfaces damaged during installation. Patch all welds and damage marks with matching primer.

D. Coordinate with Section 030013 for foundations, installation, and concrete fill at pipe bollards.

3.3 SCHEDULE

A. The following list includes, without limitation, the principal metal fabrications and finishes in the Work.
1. Steel bollards; galvanized finish with special exterior primer.
2. Corner Guards: Stainless steel, #4 finish.

END OF SECTION

SECTION 055139 – METAL STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel stairs in Warehouse Building, including related guard and hand rails.
   2. Steel guardrails at Level 2 Mezzanine.
   3. Structural design of Level 2 guardrails

B. Related Sections:
   1. 051200 - Structural Steel Framing: Surrounding construction.
   2. 055141 - Architectural Railings: Exterior railings at entrance.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SYSTEM DESCRIPTION

A. Guardrails, Railings, and Handrails:
   1. Steel pipe or steel tube design, continuous top and bottom rail, with vertical steel bar pickets spaced at maximum of 4 inch centers, or solid surface material.
   2. Rail transitions between flights shall be continuous with uniform radius section; vertical drops with mitered joints are not permitted.
   3. Handrails may be mounted to the stairs, or to building walls at the Contractor's option. Where handrails are attached to walls, include support brackets spaced at 6 foot maximum and metal backing plate for anchoring.
   4. Return terminating ends to within 1/2 inch of wall.
   5. Provide guardrail where elevation to adjacent surfaces exceeds 1'-6".

B. Design Requirements at Level 2 Guardrails:
   1. Railing assembly, wall rails, and attachments shall be capable of resisting a force of 200 lbs at any point in any direction without damage or permanent set.
   2. Railing assembly, wall rails, and attachments shall be capable of resisting a force of 50 plf in any direction without damage or permanent set.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A36 - Structural Steel.
   2. A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. A143 - Safeguarding Against Embrittlement of Hot Dipped Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
   4. A153 - Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
   5. A325 - High Strength Bolts for Structural Steel Joints.
   6. A384 - Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies.
   7. A385 - Providing High Quality Zinc Coatings (Hot Dip).
   8. A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

B. American Welding Society (AWS):
   1. D1.1 - Structural Welding Code.

C. The National Association of Architectural Metal Manufacturers (NAAMM):
   1. AMP (Architectural Metal Products) 510-92, Metal Stairs Manual.

D. American Institute of Steel Construction, Inc. (AISC):
   1. Code of Standard Practice for Steel Buildings and Bridges:

a. Paragraph 4.2.1 is modified by deleting the following sentence: This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as part of his preparation of these shop drawings.
b. Paragraph 4.2.1 is modified by adding the following sentence: If the fabricator wishes to change a connection that is fully detailed in the Contract Documents, the fabricator shall submit the change with all relevant and substantiating calculations and data for review by the Owner's authorized representative in a manner that clearly indicates that a change is being requested.

2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, including the Commentary of the AISC Specification.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Shop Drawings:
1. Indicate member profiles, sizes and gages, welds, connections, attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
2. Include erection drawings, elevations, and details where applicable, including adjacent construction and headroom clearances.
3. Indicate welded connections using standard AWS welding symbols.
4. Indicate net weld lengths.
5. Shop drawings of Level 2 guardrails shall bear the stamp of the designing structural engineer.

1.5 QUALITY ASSURANCE

A. Standards: Comply with applicable referenced AISC and AWS Standards.

B. Comply with the requirements of the jurisdictional code authorities for design, construction, and installation of stairs, handrails, and guardrails.

C. Maintain minimum 7'-0" vertical clearance from all obstructions.

D. Installer Qualifications: Minimum of 5 years successful experience in installation of steel stair and railing systems of types indicated for this Project.

E. Welders Qualifications: Use only certified welders approved by local authorities having jurisdiction.

F. Inspection and Tests: Work is subject to testing and inspection as specified in Sections 003153 and 014500.

G. Quality Control Submittals:
1. Certification: Submit written certification that the guardrail system has been designed to meet the specified requirements.

H. Closeout Submittal:
1. In accordance with Section 017700.
2. Submit designing engineer's certification that products and installation comply with design requirements.

I. Structural Design: Structural design of the Level 2 guardrail system shall be by a Structural Engineer Licensed to practice in the State where the Project is located.

1.6 SUBCONTRACTOR GUARANTEE

A. Furnish Subcontractor Guarantees in accordance with Section 017700.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Types as indicated on Structural Drawings.

B. Standard Primer: Modified alkyd; Azeron Series FD-88 by Tnemec Company Inc. (816/483-3400), GP 818 by Carboline (914/644-1000.

C. Gate Hardware:
   1. Hinges: One each McKinney T2314; 4" x 4", stainless steel; and one each Bommer 4310 spring hinge; provide steel mounting plates on the vertical guardrail post, and plates mounted on the hinge stile of the gate to mount hinges.
   2. Stop: Provide steel plate approximately 1-1/2" x 3"x 1/4" thick, welded to vertical guardrail post as detailed, and installed as a stop for guardrail gate; radius and ease all edges. Provide 1/8 inch thick neoprene pad mounted to face of plate to cushion gate at stop.]

D. Treads: McNichols (Seattle, WA; 877-415-8906); Bar Grating, Standard-Duty Welded, Stair Tread, Rectangular Bar, GW-150, 19-W-4 Spacing, Galvanized Steel, Hot Dipped, 1-1/2" x 3/16" Rectangular Bars, Smooth Surface, Checkered Plate 90° Angle Nosing, CP-BG-1230 Bar Grating Stair Tread Carrier Plates Attached, 77% Open Area

E. Non-shrink Grout: Hallemite "Por-Rok" cement, Sonneborn Building Products "Sonogrout", or approved;-non-shrink grout mix.]

F. Welding Electrodes: E-70 series, low hydrogen, appropriate for use.

G. Handrail Brackets: Round saddle design, malleable iron, No. P-2-1/2 by R & B Wagner, Inc., Milwaukee, WI (800/786-2111); or approved.

2.2 FABRICATION

A. Comply with applicable requirements of NAAMM AMP 510 for Service Class stairs.

B. Fit and shop assemble sections in largest practical sizes, for handling through building openings.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise indicated.

D. Form bent metal corners to smallest radius possible without causing grain separation, or otherwise impairing the work.

E. Welding:
   1. Comply with AWS standards.
   2. Welded connections exposed to view within travel surfaces shall be neat and uniform, free of spatter and protrusions.
   3. Grind exposed welds on handrails and railings flush and smooth with adjacent surface.

F. Joints shall be accurately fitted to present neat hairline joints.

G. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

H. Accurately form components required for anchorage of stairs to each other and to building structure.

I. Galvanizing:
   1. Fabricate in accordance with the applicable requirements of ASTM A143, A384, and A385.
   2. All welding slag and burrs shall be removed prior to galvanizing.
   3. Care shall be taken to avoid fabrication techniques which could cause distortion or embrittlement of the steel.
   4. Steel fabrications shall be galvanized in accordance with ASTM A123. Bolts, nuts, washers, and other hardware shall be galvanized in accordance with A153.
   5. Surface Finish: The galvanized coatings shall be continuous, firmly adhered, smooth, evenly distributed, free from defects detrimental to the usefulness of the product, and ready to receive paint coatings as specified in Section 099000.
   6. Locations: Provide hot dip galvanizing at all steel stairs and railings.

2.3 SHOP FINISH

A. Shop prime metal components after fabrication.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to primer application.

C. Apply shop primer, except do not prime surfaces to be in direct contact with concrete or where field welding is required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Place inserts, blocking, and related support framing in adjacent construction in accordance with construction sequence requirements.

3.3 INSTALLATION

A. Erect assemblies square, plumb and level, free from distortion and defects detrimental to appearance or performance.

B. Verify alignment with adjacent construction. Coordinate related work.

C. Do not field cut or alter fabricated members.

D. Field bolt and weld to match standard of shop bolting and welding. Unless otherwise detailed, place fasteners in concealed locations wherever possible.

E. Mechanically fastened joints shall be butted tight, flush, and hairline. Where field welds are required, grind fillet welds exposed in the travel surfaces to form neat and uniform radius; grind exposed butt welds smooth and flush with adjacent surfaces.

F. Immediately after erection, clean field welds, bolted connections, and damaged shop prime coat and touch-up with same primer used in shop.

G. When applicable, fill treads and intermediate landings at metal pan assemblies with 3000 psi concrete meeting requirements of Section 030013. Provide steel trowel finish at stairs to receive carpet and light broom finish perpendicular to foot traffic at other stairs.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Dimensional wood framing.
   2. Sheathing.
   3. Blocking, nailers, and curbing.

B. Related Sections:
   1. 064000 – Architectural Woodwork

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Plywood Association (APA)

B. American Society for Testing and Materials (ASTM):
   1. D2898 - Test Method for Accelerated Weathering of Fire-Retardant Treated Wood for Fire Testing.
   2. E84 - Test Method for Surface Burning Characteristics of Building Materials.

C. American Wood Preservers' Association: Book of Standards (AWPA).

D. National Lumber Grading Authority of Canada (NLGA).

E. Product Standard (PS): PS-20 - American Softwood Lumber Standard.

F. West Coast Lumber Inspection Bureau (WCLB): Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association (WWPA).

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit complete technical and product data on the following:
   1. Preservative wood treatments.
   2. Framing and sheathing accessories.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Work shall conform to the requirements of the currently enforced International Building Code as adopted by the jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 016000.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Lumber shall be manufactured in accordance with PS 20, and shall be stamped and graded in accordance with WWPA, WCLB, or NLGA, grading rules.

B. Moisture Content: Kiln dried to 19% maximum moisture content, except for material whose least dimension is 4 inches thick or greater.

C. Species: Hem-Fir, Spruce-Pine-Fir (SPF), or Douglas Fir Larch, unless indicated or specified otherwise.

D. Architectural Lumber Grades: Unexposed non-structural wood framing and blocking indicated on the Architectural Drawings shall be graded as follows:
   1. Structural Framing: In accordance with Structural Drawings.
   2. Non-Structural Framing (2" to 4" thick, 2" to 6" wide): "Construction - Light Framing," "Stud," or better.
   3. Blocking and Nailers: "Utility - Light Framing," or better.

2.2 PANEL MATERIALS

A. Wall and Roof Sheathing: APA Rated Sheathing; Structural I; CD grade; Exterior; plywood, unless approved otherwise; thicknesses as indicated.

B. Floor Sheathing: APA Span Rated Sturd-I-Floor; Exterior; plywood, unless approved otherwise; thicknesses as indicated.

2.3 ACCESSORIES

A. Fasteners:
   1. Hot-dipped galvanized steel for exterior and high humidity locations.
   2. For Use With Preservative Treated Wood: 300 Series stainless steel.
   3. Use ring shank nails at floor sheathing.
   4. Screws: Self tapping; countersunk or low profile head.

B. Metal Connectors: Simpson Company, Silver Metal Products, Inc, USP Structural Connectors, or approved; types as indicated on the Drawings; minimum G-185 galvanized coating.

C. Sill Gasket: Closed cell polyethylene foam, glass fiber strips, or approved; continuous rolls; width of sill plate.

D. Strip Flashing: "Vycor Ultra" by WR Grace., 800-444-6459, or "Moistop E-Z Seal" by Fortifiber Corporation 800-343-3972.

2.4 WOOD TREATMENT

A. Wood Preservative (Pressure Treatment):
   1. Preservative treat all exterior lumber, including roofing nailers, curbs and other wood in contact with concrete, masonry, and moist conditions.
   2. For above ground use, use AWPA certified Ammonium Copper Quaternium (ACQ) waterborne preservative with 0.25 pounds per cubic foot of wood retention.
   3. For ground contract use, use AWPA Treatment C-22 using CCA waterborne preservative with 0.40 pounds per cubic foot of wood retention.]
   4. Treated lumber shall be kiln dried to a maximum moisture content of 19%; treated plywood shall be kiln dried to a maximum moisture content of 15%.
   5. Treated lumber shall bear the quality stamp of an inspection agency approved by the jurisdictional code authorities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 FRAMING

A. Erect as indicated.

B. Erect wood framing members level and plumb unless indicated otherwise.

C. Place horizontal members crown side up.

D. Nailing shall be in accordance with IBC.

E. Use framing members full length without splices.

F. Tolerances:
   1. Maximum 1/4 inch from true position.
   2. Maximum 1/4 inch in 10 feet from true plumb or level.

G. Site treat cut ends of field cut pressure preservative treated lumber with compatible material as recommended by the treatment materials manufacturer.

H. Place sill gasket directly on concrete foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

3.3 SHEATHING

A. Install sheathing as indicated. When not indicated, install as follows:
   1. Secure sheathing with edges on firm bearing. Provide solid edge blocking between sheets.
   2. Secure roof sheathing perpendicular to framing members with ends staggered.

B. Fastening shall be in accordance with code requirements. Use screws at all floor and deck sheathing.

C. Allow 1/8 inch spacing at ends and edges between panels, unless otherwise recommended by panel manufacturer.

3.4 BLOCKING, NAILERS, AND CURBS

A. Provide blocking, nailers, and curbs for sheathing, roof construction, metal flashing, and other construction as indicated, and as necessary for firm support. Unless otherwise indicated, solid wood backing shall be minimum 2 inch nominal thickness; plywood shall be minimum 3/4 inch thick.

B. Blocking: Install wood blocking to receive mechanical fasteners for support of plumbing and electrical fixtures and equipment, cabinets, door stop plates, wood base, wainscots, coat hooks, toilet and bath accessories, kitchen equipment, and all other wall and ceiling mounted components.

C. Screw fasten wood components to metal framing and support elements.

D. For attachment of plywood backing, kerf plywood 1/4" (3/8", maximum if required for heavy gage studs) to receive flange return (or crimp the return closed); provide supplementary sheet metal angle attached to back of stud where necessary to support backing. Screws into edge of plywood are unacceptable.

END OF SECTION

SECTION 064000 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood standing and running trim.
   2. Wood door frames.
   3. Plywood panel wainscot.
   4. Casework.
   5. Solid surfacing.
   6. Shop applied finishing.

B. Related Sections:
   1. 061000 - Rough Carpentry: Blocking for finish carpentry.
   2. 081400 - Wood Doors
   3. 087100 - Door Hardware.
   4. 087300 - Door and Hardware Installation.
   5. 099000 - Painting: Field applied stains and finish coatings.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American National Standards (ANSI)
   1. ANSI A208.1 - Standard for Particleboard
   2. ANSI A208.2 - Standard for Medium Density Fiberboard (MDF)

B. American Society for Testing and Materials (ASTM)
   1. C1036 Standard Specification for Flat Glass
   2. E84 Test Method for Surface Burning Characteristics of Building Materials

C. American Plywood Association (APA)

D. Architectural Woodwork Institute (AWI): Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program (Current Edition).

E. West Coast Lumber Inspection Bureau (WCLB): Standard Grading Rules No. 16.

F. U.S. Product Standard (PS) PS 1 Product Standard for Construction and Industrial Plywood.

1.3 DEFINITIONS

A. Exposed Portions of Casework: Those surfaces visible when doors and drawers are closed, including edges of doors and drawers, edges of cabinet boxes visible between doors and drawers, backs of hinged doors, interiors behind glass doors, and interiors in open cabinets.

B. Semi-Exposed Portions of Casework: Those areas not defined as exposed, but visible when solid (not glazed) doors and drawers are opened.

C. Concealed Portions of Casework: All remaining areas not defined as exposed or semi-exposed.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Shop Drawings. Indicate materials, components, profiles and configurations, dimensions, fastening methods, jointing details, colors and finishes, and accessories. Details shall be at a minimum scale of 1-1/2 inch per foot.

C. Samples:
   1. Solid Wood with Transparent Finish: Submit a minimum of 3 - 12 inch long samples representative of the maximum range of color and graining to be expected for each species, cut, and finish combination specified. Include samples of transparent finish with putty filled holes and specified field applied top coat.
   2. Opaque Finish Wood: Submit a minimum of 3 - 12 inch long samples representative of the maximum range of graining and surface imperfections to be expected.
   3. Submit 12-inch long sample of finish stair rail cap.
   4. Prefinished Board: Submit a minimum 8 x 11 sample of each color and pattern specified.
   5. Casework Hardware: Submit sample or product literature for each type.
   6. Plastic Laminate:
      a. Submittal for Selection: Provide manufacturer's standard sample chain(s) of full lines available for Architect's selection.
      b. Submit a minimum 8 x 11 sample of each color and pattern specified or selected for confirmation.

D. Product Literature:
   1. Submit literature for a sample of each hardware component proposed.
   2. Particle Board and MDF Materials: Literature verifying materials are formaldehyde free.
   3. Paint and Adhesive Systems: Submit product literature and Material Safety Data sheets stating VOC limits and chemical component limits for each product.

1.5 QUALITY ASSURANCE

A. Fabricator: A minimum of 5 years experience in the fabrication of custom architectural woodwork of the type specified.

B. All Architectural Woodwork shall be under the responsibility of a single fabricator.

C. Qualifications of Installers: Use only journeyman finish carpenters who are thoroughly trained and skilled in the work, and who are completely familiar with the materials and quality standards specified. No allowance will be made for lack of skill on the part of workmen.

D. Conform to AWI Custom grade standards except use premium grade standards for clearances and tolerances, unless specified or indicated otherwise.

1.6 DELIVERY, STORAGE AND HANDLING

A. In accordance with 016000, and as follows:
   1. Do not deliver wood materials to the building until "wet" work such as gypsum wallboard work has been completed.
   2. Store materials indoors in ventilated area with a minimum temperature of 60 degrees F., and a maximum humidity of 55%.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:
   1. Transparent Finish Lumber: AWI Grade I; Douglas Fir (Pseudotsuga taxifolia); quarter sawn.
   2. Opaque Finish Lumber: AWI Grade II Poplar.
   3. Concealed Framing Lumber: AWI Grade II pine, fir, hemlock, or other species as approved.
   4. Moisture Content: Optimum moisture content per AWI recommendations.

B. Plywood:
   1. Typical Plywood: APA rated in accordance with PS 1; 3/4 inch thick AC exterior grade unless indicated or specified otherwise; touch sanded where plastic laminate veneers are to be applied.

C. Wood Veneer Flitches: AWI Grade AA; Douglas fir; vertical grain; veneer flitches shall be selected and approved by the Architect at the wood fabricators plant.

D. Particle Board: ANSI A208.1; grade M-2 (medium density); no added urea-formaldehyde (NAUF); where indicated or specified, fire retardant treated to a flame spread of 25 or less when tested in accordance with ASTM E84. Provide quality assurance stamp or manufacturer's certifications as required by local jurisdictional code authorities.

E. Medium Density Fiberboard (MDF): ANSI A208.2 Class MD (medium density); exterior glue; no added urea-formaldehyde (NAUF).

F. Pre-finished Board: Low pressure melamine over particle board, MDF, or hardboard core; no added urea-formaldehyde (NAUF); colors as selected from manufacturer's standard.

G. Plastic Laminate:
   1. Brands and colors as scheduled on Drawings.
      a. Basis of Design: Nevamar HPL. .050" thick; finish and color as selected by Architect.
   2. Exposed: NEMA LD-3; general and vertical grade,
   3. Backing Sheets: NEMA LD-3; backing grade; undecorated.

H. Solid Surfacing:
   1. "Corian" by E.I. duPont de Nemours & Co. (Wilmington DE; 800-426-7426) or approved equal.
   2. Fabricate solid surface elements to the configurations indicated in accordance with the manufacturer’s recommendations.

2.2 ACCESSORY MATERIALS

A. Cabinet Hardware:
   1. Pulls: 4 inch wire pulls; brushed chrome finish.
   2. Drawer Slides: Full extension ball bearing; clear zinc finish; rail mount; Accuride, or approved; load rating as required for the application.
      a. Light Duty Rating (drawers 12 inches wide or less): Accuride 2632; 65 lb BIFMA load rating
      b. Medium Duty Rating(drawers 32 inches wide or less): Accuride 7432; 100 lb BIFMA load rating.
      c. Heavy Duty Rating (drawers 42 inches wide or less): Accuride 3640; 200 lb BIFMA load rating.
   3. Drawer Locks: Olympus Lock or approved; 5 pin tumbler cylinder locks; ANSI Grade 1; configuration to suit condition; keyed alike as directed, and masterkeyed. Furnish two keys for keyed alike group, and four masterkeys; finish to match pulls.
   4. Hinges: 5 knuckle hinges; brushed chrome finish.
   5. Concealed Hinges: European style; concealed[(except at touch latches]; self-closing; 176 degree of opening, Blum, Grass or Hafele.
   6. Catch: Ives 327 A92 magnetic catch.
   7. Touch Latches: Epco 507PWS.
   8. Cabinet Shelf Standards and Brackets: Zinc plated; Knape and Vogt No. 255 and 256
   9. Cabinet Shelf Brackets: Metal pin style support; chrome finish.
   10. Wiring Grommets: "TG Series" by Doug Mockett and Company, Inc., Manhattan Beach CA.; size to match application; color as selected by Architect from manufacturer's standard colors.

B. Closet Hardware:
   1. Closet Rod: Knape & Vogt # 770 5; 1-5/16 inch diameter; chrome finish.
   2. End Flanges: Knape & Vogt # 764/766; chrome finish.

C. Wall Shelf Hardware:
   1. Brackets: Knape & Vogt # 185 Anochrome finish; length as appropriate for shelving indicated.
   2. Standards: Knape & Vogt # 85 Anochrome finish.

D. Counter Support Brackets:
   1. Manufacturer/Source
      a. Oodles of Parts Plus (Patchogue, NY; 800-286-5471)
      b. A&M Hardware Inc. (Manheim PA; 888-647-0200)
      c. Steelcase
      d. Herman Miller

2. Bracket: "Work Station Bracket"; 1/8" steel; 24" x 24" size unless otherwise indicated; prime paint finish.

E. Contact Bond Adhesive: Water based low VOC.

F. Low VOC Polyurethane: Polyureseal BP by American Formulating and Manufacturing, San Diego, CA 619-239-0321.

2.3 STANDING AND RUNNING TRIM FABRICATION

A. Shop fabricate all trim to the shapes indicated.

B. Assemble built-up sections. All glue lines shall be free of squeeze-out where transparent finishes are to be applied.

C. Tolerances for overall assembly dimensions shall be within 1/32 of an inch.

D. Shop fit and assemble to the greatest extent possible.

E. Back or kerf cut all trim greater than 2 inch in width, except terminate before exposed ends.

F. Fabricate trim from solid lumber.

2.4 WOOD DOOR FRAME FABRICATION

A. Fabricate door frames to the shapes indicated.

B. Fabricate to provide the following door installation clearances:
1. 1/8 inch at top, and edges.
2. 1/2 inch from door bottom to the floor finish.

C. Machine frames to receive hardware specified in Section 087100. Request templates from the hardware supplier.

D. Fabricate to receive glazing with proper clearances for expansion and contraction.

E. Fabricate frames from single length pieces, without joints, for each straight length.

F. Fabricate each section from composite construction consisting of fabricator selected solid wood or laminated core clad with specified transparent finish veneer. Exposed edges and corners shall have minimum 1/8 inch thick solid wood to match the veneer. Provide minimum 1/8 inch thick veneer.

2.5 CASEWORK FABRICATION

A. General Fabrication Requirements:
1. Fabricate to the configurations indicated, unless approved otherwise on the shop drawings.
2. Provide openings in casework for the incorporation of all electrical and mechanical components. Openings for all plumbing equipment shall be cut from templates obtained from the plumbing equipment installer.
3. Provide concealed access to casework electrical fixtures and wiring.
4. Unless indicated or approved otherwise, provide adjustable base to provide level installation which accommodates variations in floor levelness.
5. Shop assemble casework to the greatest practical extent
6. Adjustable Shelves: All casework shelves shall be adjustable, unless otherwise noted. Provisions for shelf adjustment shall be by drillings at 2 inches on center in the cabinet body for the placement of shelf support brackets. Provide 4 supports for each shelf. Drillings shall be in straight even lines.
7. Provide all hardware, fasteners, and exposed trim.
8. Provide openings with wiring grommets at locations indicated. When not indicated, provide openings with wiring grommets along countertops with knee spaces underneath. Space at 36 inches maximum, with a minimum of one opening per knee space.

B. Plastic Laminate Casework Construction:
1. Fabricate casework in accordance with AWI standard section 400; custom grade.
2. Design: AWI Flush Overlay design, unless indicated otherwise. Joint between exposed doors,

drawer faces, and countertop edges shall be 1/8 inch plus or minus 1/16.

3. Exposed Surfaces:
   a. Plastic laminate clad with PLam self-edging, unless otherwise indicated; provide hardwood trim at locations indicated.
   b. Finish to match plastic laminate to match face and applied before face sheets are applied unless otherwise indicated. Ease exposed edges of overlapping sheet.
4. "Inside" Exposed Surfaces of Shelving Units and Cabinets Without Doors: Plastic laminate finished board, with exposed edges banded with plastic laminate self edging or PVC tape to match face color.
5. Semi-Exposed Surfaces: Prefinished board, unless indicated otherwise.
6. Provide vertical grade plastic laminate, except use general purpose grade at countertops.
7. Backs of Doors and Drawers: Prefinished board.
8. Particle board shall be minimum 3/4" thick unless indicated otherwise. Shelves shall be 1" thick, minimum.

C. Transparent Finish Wood Casework Construction:
1. Fabricate transparent finish wood casework in accordance with AWI standard section 400; "Premium" grade.
2. Fabricate wood casework with wood veneer over medium density particle board. Provide solid wood edging at veneer panels.
3. Veneers shall be as follows:
   a. Fabricate each panel from sequential flitches.
   b. Book match veneers.
   c. Provide no veneer end joints within each panel.
   d. Provide grain direction as indicated.
4. Where veneers are indicated to be single piece or slip matched leaves for each panel, adjoining panels shall be end matched and/or slip matched as appropriate.

D. Hardware:
1. Unless otherwise shown or specified, all drawers shall be equipped with standard full extension slides.
2. Install hardware straight and true and in perfect alignment horizontally and vertically with adjacent casework and hardware.
3. Carefully fit and securely attach cabinet hardware in accordance with manufacturers' printed instructions, and exercise caution not to mar or injure finish surfaces.

2.6 SOLID SURFACING

A. Fabricate solid surfacing countertops and other elements to detail in accordance with the manufacturer's recommendations. Include back and side splashes.

B. Seal joints with Dupont SCS 1752 silicone sealant.

2.7 VENEER PANEL FABRICATION

A. Fabricate veneer paneling to AWI "Custom" grade standards.

B. Fabricate panels with specified plywood, ‘A’ grade veneer to exposed side . Use fire retardant treated plywood where indicated.

C. Fabricate panels with joints accurately matched, tightly fitted.

2.8 SHOP FINISHING

A. Shop finish all architectural woodwork wood surfaces.

B. Sand all exposed and semi-exposed wood surfaces smooth, always sanding in the direction of the wood grain.

C. Sand all exposed transparent finish wood surfaces to AWI "Premium " grade standards. Sand all semi-exposed transparent or opaque finish wood surfaces to AWI "Custom" grade standards.

D. Fill all depressions and imperfections with color matched putty, except imperfections shall not exceed AWI Premium grade standards.

E. Transparent Finish Coating: Spray apply in accordance with AWI finishing system, Premium Grade Waterborne Conversion Varnish; satin sheen.

F. Opaque Finish Coating: Spray apply in accordance with AWI finishing system, Custom Grade Catalyzed Lacquer; satin sheen.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

A. Coordinate the installation of blocking and other supports required for the installation of architectural woodwork elements.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Jointing: Make all joints to conceal shrinkage; miter all exterior corners; cope all interior corners, miter or scarf all end-to-end joints; install all trim pieces as long as possible, jointing only where solid support is obtained. Make no joints closer than 4 feet to corners.

B. Lengths of Material: Use random lengths and show typical joint locations on shop drawings. The minimum length shall be 8 feet, except where short lengths are required by installation conditions.

C. Fastening:
   1. Install all items straight, true, level, plumb, and firmly anchored in place; where blocking or backing is required, coordinate as necessary with other trades to ensure placement of all required backing and blocking in a timely manner.
   2. Fasten trim with finish nails or screws of proper dimension to hold the member firmly in place without splitting the wood.
   3. On exposed finish work, set all nails and screws.
   4. Align exposed fasteners for uniform pattern; random or "shotgun" patterns will not be accepted.

D. Select and arrange standing and running trim so that abutting members have a similar grain and color match to the greatest extent possible.

3.4 DOOR FRAMES

A. Install wood door frames to receive operable doors in accordance with 087300.

B. Install in accordance with the applicable requirements specified for standing and running trim.

C. Glaze relite frames and fix in position with wood stops as indicated.

D. Provide wood support framing and nailers.

3.5 CASEWORK INSTALLATION

A. Coordinate casework installation with work of other trades for final electrical and mechanical connections.

B. Install all casework accurately, plumb, square, and level, and permanently secured in precise position as indicated on the Drawings. Casework shall be scribed to adjacent surfaces as follows:
   1. Countertops and splashes to wall surfaces.

2. Cabinet endwalls and other exposed surfaces to walls.
3. Cabinet bases to floors.

C. The casework installation shall be made complete with all required fastenings, clip angles, braces, anchors, adjustable levelers, and other fittings as required to render the work rigid and secure.

D. All fasteners securing casework shall be in concealed or semi-concealed locations, unless approved otherwise.

E. Avoid damaging finished surfaces. Repair or replace all damaged materials and surfaces in a manner approved by the Architect.

F. Upon completion of work, and in the Architect's presence, demonstrate hardware to work freely as intended.

3.6 PLYWOOD PANELING

A. Install paneling as indicated in accordance with AWI Section 500C Custom grade standards.

B. Install wood paneling to framing at an even regulated spacing with stainless steel pan-head screws and beauty washers.

C. Cut and fit each panel to it particular position including cutting around items which cannot be remounted to panel face, and predrilling for holes for wire access for electrical devices to be mounted on the panel face.

3.7 CLEANING UP

A. Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends, and debris.

B. At the end of each working day, or more often if necessary, thoroughly sweep and/or vacuum surfaces. Remove the refuse to the area of the job site set aside for its storage.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Bituminous dampproofing.

B. Related Sections:
   1. 030013 – Building Concrete: Substrate.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D1227 - Specification for Emulsified Asphalt Used as a Protective Coating for Built-up Roofing.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit manufacturer's product literature and application instructions.

1.4 SUBCONTRACTOR GUARANTEE

A. Furnish Subcontractor Guarantees in accordance with Section 017700.

1.5 JOB CONDITIONS

A. Environmental Requirements: Unless approved otherwise, install dampproofing at temperatures above 40 degrees F.

PART 2 - PRODUCTS

2.1 DAMPPROOFING

A. Asphalt emulsion; spray or trowel grade; ASTM D1227 type III.

B. Approved Products:
   1. “Sealmastic Type 1” by W.R. Meadows (800-342-5976).
   2. “Hydrocide 600" by Sonneborn Building Products (800-433-9517).
   3. “A-T Sealer WB” by Applied Technologies (877-277-5948).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Install in accordance with the manufacturer's recommendations.

B. Apply in 2 separate coats from the bottom edge of the foundation footing to within 3 inches of grade or paving, as applicable.

C. Apply each coat at rate to produce wet film thickness of 1/16 inch. Allow first coat to cure before application of 2nd coat; follow manufacturers instructions.

D. Apply to outer below grade surfaces of building perimeter foundation walls and footings.

END OF SECTION

SECTION 071313 - BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Bituminous sheet membrane waterproofing system.
   2. Protective covering.

B. Related Sections
   1. 030013 – Building Concrete: Concrete Substrate.
   2. 312000 - Earth Moving: Backfilling at below grade surfaces.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 SYSTEM DESCRIPTION

A. The waterproof membrane shall form a continuous water tight barrier in the locations indicated.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Submit manufacturer's complete product data for each product proposed, including, membrane materials, and protection board [drainage matting].

C. Submit manufacturer's installation instructions and details applicable to the project. Include special details to indicated application at all special conditions.

D. A minimum of 10 days prior to membrane installation, submit draft copies of warranty and guarantee provisions.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years experience in the trade; certified by the waterproofing materials manufacturer.

B. Pre-Installation Meeting: Arrange and administer a meeting prior to the installation of the membrane. Include in attendance the General Contractor, the membrane applicator, the membrane manufacturer’s representative, the Architect, and all other parties affected by this work.
   1. Agenda:
      a. Review all installation details.
      b. Review installation requirements for other work including concrete conditions, penetrations, and joint conditions.
      c. Review installation requirements including environmental conditions, crack preparation, water and trash removal, storage of materials, and protection of surrounding surfaces.
      d. Establish waterproofing protection procedures after installation.
      e. Request that all conditions which would prevent the satisfactory installation of the waterproof membrane be mentioned.
   2. Record: Record all decisions, and send each attendee a copy of the meeting record prior to installation.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Unless otherwise specifically approved by the waterproofing materials manufacture. Maintain temperatures above 40 degrees F for 24 hours before application.

B. Provide ventilation when waterproofing in an enclosed space.

1.6 WARRANTY

A. Furnish warranty and guarantee under provisions of Section 017700.

B. Manufacturer’s Warranty: Five year manufacturer's material warranty under provisions of Section 017700.

C. Installer’s Guarantee: Three year installer's full performance guarantee. Include coverage of waterproofing failing to resist penetration of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

A. Manufacturers: Grace Construction Products (GCP) is listed as the standard for approval.

B. Waterproof Materials:.
   1. Sheet Membrane: Bituthene 3000.
   2. Primer: Bituthene Primer P-3000.
   3. Liquid Membrane: Bituthene Liquid membrane.
   4. Mastic: Bituthene Mastic.

C. Products such as Carlisle "," Polyguard Products, Inc. "Polyguard 650," TC MiraDRI "MiraDRI 860/861," or Protecto Wrap "Jiffy Seal 140/60" may be used subject to the specified requirements.

D. Adhesive: As recommended by the waterproofing manufacturer.

2.2 ACCESSORY MATERIALS

A. Protection Board: Preformed expanded or extruded polystyrene boards, minimum 1 inch thick; density minimum 1 pcf.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify surfaces are solid, smooth, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

D. Verify items which penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. At horizontal waterproofing over soil subgrade, such as at elevator and escalator pits and utility tunnels, provide working slabs as necessary to receive waterproof membrane. Form from minimum 2500 psi concrete with reinforcing mesh in accordance with the applicable requirements of Section 030013. Coordinate installation with the installers of construction which will be built over the membrane and working slabs.

3.3 APPLICATION

A. Apply membrane in accordance with the manufacturer's recommendations.

B. Apply liquid membrane material to seal penetrations, small cracks, and honeycomb in substrate.

C. Apply surface conditioner to all concrete surfaces to receive waterproofing. Apply using methods and rates per manufacturer's instructions. Apply only to surfaces that will be waterproofed during the same day. Allow to dry.

D. Form fillets at all inside corners, using liquid membrane materials.

E. Prestrip cracks greater than 1/16 inch in width with minimum 9-inch width strip of membrane material.

F. Membrane installation:
   1. Sidelap membrane 2-1/2 inches minimum; stagger end laps.
   2. Roll into place in accordance with manufacturer's instructions.

G. Apply membrane strip at all inside corners.

H. Apply double layer of membrane around protrusions; firmly adhere to protruding member to maintain seal.

3.4 FIELD QUALITY CONTROL

A. Inspect and test horizontal installed membranes for leaks prior to installation of insulation.

B. Stop drains and provide temporary dams as necessary to contain water sufficiently for testing. Monitor testing operations when drains are plugged to prevent overload of structure. Testing shall not be scheduled during times when rains are present or expected.

C. Fill contained waterproofing areas with 1" of water for a minimum of 24 hours.

D. If leaking is found, patch using new waterproofing materials; repeat test. Repair damage to building.

3.5 PROTECTION

A. Protect finished membrane from damage by adhering protection board with mastic over treated surfaces.

B. Scribe boards around pipes and projections.

3.6 SCHEDULE

A. Apply waterproofing to the following surfaces:
   1. Foundation walls at elevator pit.
   2. Subslab at elevator pit

END OF SECTION

SECTION 071816 - VEHICULAR TRAFFIC COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Traffic bearing waterproofing at garage decks.

B. Related Sections: 030013 - Building Concrete: Substrate.

1.2 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years experience in the application of traffic bearing waterproofing.

B. Pre-Installation Meeting: In accordance with Section 013119, the Contractor shall arrange and administer a meeting prior to the installation of the traffic bearing waterproofing.
   1. Minimum Agenda:
      a. Review all installation details.
      b. Review installation requirements for other work including concrete finishes, mechanical and electrical penetrations, joints, environmental conditions, water and trash removal, storage of materials, and protection of surrounding surfaces.
      c. Establish protection procedures.
      d. Request that all conditions which would prevent the satisfactory installation of the waterproof membrane be mentioned. Record all items mentioned.
   2. Include in attendance the membrane applicator, the Architect, and all other parties affected by this work.

C. Manufacturer's Field Services: Require the traffic bearing waterproofing manufacturer's representative to inspect the installation, and certify the following:
   1. Substrate was in acceptable condition upon commencement of waterproofing installation.
   2. Traffic bearing waterproofing system was installed in accordance with the manufacturer's recommendations.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 013300.
   1. Product Data: Submit product literature and application instructions for traffic bearing waterproofing materials proposed.
   2. Finished samples of top coat colors and aggregates for selection.

B. Submit manufacturer's certifications prior to contract closeout.

C. Submit a signed copy of the specified warranty in accordance with 017700.

1.4 PRODUCT HANDLING

A. In accordance with 01600, and in accordance with manufacturer's printed recommendations.

1.5 JOB CONDITIONS

A. In accordance with manufacturers printed recommendations.

1.6 WARRANTY

A. Provide warranty, executed to the Owner jointly and severally by the manufacturer and the applicator, on a single document, against defects in materials and workmanship for a period of 3 years, beginning with the date of substantial completion of the traffic bearing waterproofing system.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Approved Systems:
   1. "Autogard II" by The Neogard Corporation, Dallas, Texas.
   2. “Vulkem 350/950NF/951NF” by Tremco, Beachwood, OH.
   3. “Centaflex U-62” by GACO Western, Inc., Tukwila, Washington. **obsolete**

B. Color: [ ]

C. Related Materials: Provide all related materials recommended and approved by the system manufacturer for the installation. Related materials shall include without limitation, primers, backer rod, aggregate, sealants, adhesives, sheet and liquid flashing, aggregate, and membrane reinforcements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that substrate surfaces are acceptable for the application of the traffic bearing waterproof membrane. Report unsatisfactory conditions to the Architect. Do not commence application until all unsatisfactory conditions have been resolved.

3.2 PREPARATION

A. Protection: Protect all adjacent surfaces from overspray.

B. Cleaning: Thoroughly clean substrate surfaces of all dust, oil, grease, and other elements which would effect the bond of the waterproof materials. Sandblast if necessary.

C. Prepare cracks and joints as recommended by the waterproofing manufacturer.

3.3 MEMBRANE APPLICATION

A. Apply fluid applied membrane in strict accordance with manufacturer's recommendations.

3.4 CLEANING

A. Remove all debris resulting from this work.

B. Clean overspray from adjacent surfaces. Repair damaged adjacent surfaces to original condition.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiberglass thermal batt insulation with separate concealed vapor barrier.
   2. Mineral wool thermal batt insulation with separate concealed vapor barrier
   3. Rigid board wall insulation.
   4. Rigid board perimeter and under-slab insulation

B. Related Sections:
   1. 030013 – Building Concrete.
   2. 061000 – Rough Carpentry: Wood blocking.
   3. 133419 – Metal Building Systems: Special metal building batt insulation and exposed vapor barrier system.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C518 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by means of the Heat Flow Meter Apparatus.
   2. C578 - Rigid, Cellular Polystyrene Thermal Insulation.
   3. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
   4. C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   5. D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
   6. E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. International Energy Conservation Code (IECC)
   1. C303.1
   2. C303.2.2

1.3 SUBMITTALS

A. Make submittals under provisions of Section 013300.

B. Product Data: Submit manufacturer's product data and installation instructions for each type of insulation.

C. Shop Drawings: Manufacturer-provided shop drawings of special metal building insulation and vapor barrier systems, showing relationship to existing construction, relationship between components, and quantities and location of hangers and thermal breaks.

1.4 QUALITY ASSURANCE

A. Insulation shall be marked for identification in compliance with C303.1.

PART 2 - PRODUCTS

2.1 STANDARD INSULATION MATERIALS

A. Unfaced Fiberglass Batt and Blanket Insulation: ASTM C665, Type I; preformed unfaced glass fiber roll; flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with ASTM E84; formaldehyde free, Johns Manville Corp. "Unfaced Formaldehyde-free Thermal and Acoustical Fiber Glass Insulation;" Knauf "Eco Batt;"; or Owens Corning "Thermal Batt Fiberglas;" oversize widths for friction-fit between metal framing.

B. Unfaced Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Rigid Extruded Polystyrene Board:
   1. Standard: ASTM C578, Type IV; extruded cellular polystyrene.
   2. Thermal Resistance: Minimum "R" per inch of 5 when tested in accordance with ASTM C518 at 75 degrees F. mean temperature.
   3. Compressive Strength:
      a. Typical: Minimum 25 psi when tested in accordance with ASTM D1621.
      b. At Warehouse Slab: 40 psi when tested in accordance with ASTM D1621; DuPont "Styrofoam Brand Highload 40 XPS" Insulation or approved equal.
   4. Water Absorption: 0.10 to 0.15 percent when tested in accordance with ASTM C272.
   5. Thickness/R-value: 1 inch, R-5.
   6. Size: 24 inch width, 96 inch length, with square edges.
   7. Approved Products:
      a. Styrofoam by The Dow Chemical Company (Midland, MI; 800-441-4369)
      b. Foamular 250 by Owens Corning, (Toledo, OH; 800-438-7465).
      c. "CertiFoam 25 SE" by DiversiFoam Products (Rockford, MN; 763-477-5854).

D. Separate Vapor Barrier for Batt Insulation: Foil scrim kraft FSK 25; flame spread of 25 or less and a smoke developed of 50 or less when tested in accordance with ASTM E84.

E. Tape: To match foil scrim kraft face of vapor barrier; 2 inch minimum width.

F. Impaling Pins: 12 gage pins; length as required with mounting plates for welding or adhesive mounting; include retainer shields.

G. Adhesive:
   1. Type recommended by insulation manufacturer for application; compatible with insulation and substrate.
   2. For interior applications, adhesives shall meet the requirements of the Southern California South Coast Air Quality Management District (SCAQMD) Rule 1168 using the method of dividing the weight of the solvent in the adhesive by the volume of the material, less water).

2.2 ACCESSORIES

A. Related Accessories: Provide other accessories, not specifically described, as required for a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adjacent materials are secure, properly spaced, dry, and ready to receive installation.

B. Verify mechanical and electrical services within spaces to be insulated have been installed and tested.

C. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

D. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION – GENERAL

A. Installation shall comply with the requirements of C303.2.2.

3.3 INSTALLATION – BATT INSULATION AND VAPOR BARRIER SYSTEMS

A. Install batt insulation in accordance with manufacturer's instructions.Instyall fiberglass batts except where mineral wool batts are indicated on the Drawings..

C. Install insulation without gaps or voids.

D. Trim insulation neatly to fit spaces. Use batts free of damage.

E. At metal stud framing, insert the insulation edges tightly into the stud channels for a friction fit. Provide additional supports as necessary to prevent sliding of batts in the stud cavity.

F. Mechanical Fastening:
   1. At locations where no support framing is present, provide metal impaling pins and retainers.
   2. Mechanically or adhesively bond the retaining pins to the substrate in accordance with the manufacturer's recommendations.
   3. Space pins at maximum 24 inches on center along the edges and within the field of the batt. Place edge pins within 6 inches from the edge of the batt.

G. Pack batt insulation in shim spaces at perimeter of window assembly to maintain continuity of thermal barrier.

H. Separate Vapor Barrier Installation:
   1. Install separate vapor barrier over unfaced insulation.
   2. Install vapor barrier toward warm side of building spaces.
   3. Vapor barrier shall be continuous.
   4. At locations where insulation is mechanically fastened by impaling pins, place vapor retarder over impaling pins and hold in position with additional retainers. The installation shall present a tight, continuous, and wrinkle free appearance.
   5. At lightgage support framing, secure to studs with double stick tape or spray adhesive.
   6. Lap joints in vapor barrier 2 inches, except provide tape sealed joints at locations where vapor barrier will remain exposed in the finished work.
   7. Tape seal vapor barrier to adjacent construction at perimeter edges.
   8. Tape and seal tears or cuts in vapor barrier.

I. R value Schedule: As indicated on the Drawings.

3.4 RIGID BOARD INSULATION AT WALLS AND UNDER SLABS

A. Install rigid extruded polystyrene insulation where rigid board insulation is indicated at walls and under slabs.

B. Except as otherwise indicated or specified, install all insulation in accordance with the manufacturer's current installation instructions.

C. Trim insulation to tightly fit between the furring and framing and to fit around penetrations.

END OF SECTION

SECTION 072616 - BELOW-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Subgrade vapor retarder.

B. Related Sections
   1. 030013 – Building Concrete: Concrete slabs.
   2. 072100 - Thermal Insulation: Vapor barrier associated with thermal insulation.
   3. 310000 - Earthwork: Capillary break.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 SYSTEM DESCRIPTION

A. The vapor retarder shall be installed over capillary break, continuous under all interior slabs on grade.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. D1709 - Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
   2. E1745 - Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   3. F1249 - Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 01 30 00.

B. Submit manufacturer's complete product data for each product proposed, including, membrane materials, tapes, adhesives, and accessories.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years experience in the trade; approved by the vapor retarder materials manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Unless otherwise specifically approved by the vapor retarder materials manufacturer, maintain temperatures above 40 degrees F for 24 hours before application.

1.7 WARRANTY

A. Furnish warranty and guarantee under provisions of Section 01 78 00.

B. Manufacturer’s Warranty: Five year manufacturer's material warranty under provisions of Section 017000.

PART 2 - PRODUCTS

2.1 VAPOR RETARDER MATERIALS

A. ASTM E1745 Class A, 20 mil minimum thickness; one of the following:
   1. "Stego Wrap 20 Mil" by Stego Industries, LLC (877-464-7834).
   2. "Vapor Block Plus VB20" by Raven Industries (800-635-3456).
   3. "Permalon L-20 Black" by Reef Industries, Inc. (800-231-6074).
   4. “Perminator 20 Mil” by WR Meadows, Inc. (847-214-2100)
   5. “Florprufe 120” by Grace Construction Products.

B. Tape: Self-adhesive polyethylene tape, as recommended by the vapor retarder manufacturer for the application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 APPLICATION

A. Install vapor barrier at all areas to receive interior floor slabs, including areas to receive slabs as part of future tenant improvement work.

B. Install vapor barrier under slab at Large Vehicle Storage and other locations as indicated on the Drawings.

C. Comply with the manufacturer's instructions. Extend to slab edges, as indicated on the Drawings. Lap joints a minimum of 6 inches and seal with tape. Lap and seal intersections with retaining wall vapor retarder with bonding material.

D. Coordinate with Section 312000 for preparation of capillary break and installation of compactable fill under vapor retarder.

END OF SECTION

SECTION 072700 - WEATHER RESISTIVE BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet air and moisture barrier and weather barrier systems at framed walls.
   2. Filler and membrane systems required to seal joints and penetrations to form a continuous air barrier assembly.
   3. Related air barrier accessories and components.

B. Related Sections:
   1. 061000 – Rough Carpentry: Plywood sheathing.
   2. 076200 - Sheet Metal Flashing and Trim: Flexible flashing provided with separate sheet metal flashing systems.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 DEFINITIONS

A. Air Barrier: An air barrier is an assembly of interconnected components within the exterior envelope of a building which prevents air flow across the assembly, and which is intended to prevent excess moisture transfer across the assembly driven by air pressure differentials.

1.3 SYSTEM DESCRIPTION

A. All voids within air barrier systems shall be closed to prevent air flow across the assembly.

B. The following elements provided under the work of other Sections shall be considered integral parts of the air barrier assembly:
   1. Concrete foundation.
   2. Roof membrane. Plumbing vents and roof drains shall not be considered penetrations.
   3. Exterior windows and doors.

C. For the work of this Section, air barrier systems shall consist of the following:
   1. Connective seal from foundation wall to the building layer at exterior wall.
   2. Connective seal of building wrap to roof membrane.
   3. Sealing of penetrations in the building exterior building air barrier envelope, including windows, doors, plumbing elements, electrical elements, and mechanical components, including duct penetrations at rooftop mechanical unit.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Catalog cuts and installation instructions for specified manufactured products.

1.5 QUALITY ASSURANCE

A. Applicator: Work of this section shall be performed by a single applicator, unless specifically approved otherwise by the Architect.

B. Pre-Installation Conference:
   1. Administer pre-installation conference in accordance with Section 013119.
   2. Schedule meeting prior to installation of air barrier components.
   3. Discuss air barrier components and sequence of installation.
   4. Discuss all joints and penetrations and proposed methods for sealing.
   5. Identify and discuss all special conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Air/Moisture Barrier System: Vaproshield, LLC (Gig Harbor, WA; 866-731-7663);
   1. Weather Resistive Barrier: “Wrapshield SA”.
   2. Flashing:
      a. Liquid Flashing: “VaproLiqui-Flash”.
      b. Sheet Flashing: VaproFlashing
   3. Alternative Self-Adhered Flexible Flashing (SAF):
      a. DuPont Company "Tyvek FlexWrap"
      b. W.R. Grace "Vycor Plus.".
      c. Henry Company "Blueskin" 40 mil thickness.
   4. Tape: VaproShield “VaproTape,” single or double sided, as applicable.
   5. Adhesive: VaproShield “VaproAdhesive.”
   6. Manufacturer and product are specified for construction, quality, performance and/or appearance. Provide specified product or approved equal. Alternate products shall meet or exceed the following requirements:

Construction	Triple layer spunbond polypropylene
Water Vapor Transmission	308.9 grams/m2/24hrs (50 perms)
Air Permeability	0.0095 L/s/m2 or 0.0019 cmf/ft2

B. Air Barrier Sealant: Water-resistive air barrier sealant compatible with sheet membrane shall be Dow Corning “758”, a modified silicon-based sealant tested for compatibility with VaproShield products, or approved..

C. SPF (Sprayed Polyurethane Foam) Sealant: Furnish one- or two-component, foamed-in-place, polyurethane foam sealant with the following characteristics:
   1. Density: 1.5 to 2.0 pcf.
   2. Flame Spread (ASTM E162): 25 or less.
   3. Acceptable Materials: Flexible Products.

D. Sheet Metal Closures:
   1. Minimum 24 gage prefinished galvanized steel.
   2. Custom fabricated to fit the conditions.

E. Accessories: Provide surface conditioners, primers, mastic, tape, and other accessories as specified by or acceptable to the manufacturer of each product.

F. Fasteners: Copolymer coated galvanized steel, or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Coordinate work with other trades as necessary to form a continuous air barrier envelope for the building.

B. Air Barrier Installation:
   1. Apply single layer of air/moisture barrier over solid exterior substrates in accordance with the manufacturer's recommendations.
   2. Tape seal all joints and penetrations with manufacturer's recommended tape.
   3. Coordinate installation of windows, metal head and subsilll flashings lapped into flexible flashings, and other wall penetrations with the installation of flexible flashing and air/moisture barrier.
   4. Secure with staples as recommended by manufacturer.
   5. Sequence with installation of flexible flashing and metal flashing elements as shown and as necessary to form a continuous air and weather barrier.

C. Flexible Flashing:
   1. Install flexible flashing as indicated and as specified below.
   2. Trim flexible flashing so that it will not be exposed in the finished work.
   3. Coordinate installation of flexible flashing with installation of building paper and sheet metal flashing elements.
   4. Install in accordance with the manufacturer's recommendations for each condition.
   5. Provide flexible flashing as indicated and in the following locations to seal joints and penetrations between building paper base layer and the following:
      a. Concrete foundation walls.
      b. Roof membrane.
      c. Pipe, conduit, and electrical box penetrations.
      d. Window and door frames.
   6. Provide flexible flashing at parapet tops as necessary to link to the inner building paper layers on both sides of the parapet walls.
   7. Provide flexible flashing to seal the joint between sheet metal closure angles and building paper base layer.
   8. Provide materials separation where required and do not lap or place flexible flashing in direct contact with roofing membrane.

D. Foam Sealant:
   1. Seal holes in electrical boxes, including around wire openings.
   2. Seal penetrations which cannot be sealed with flexible flashing.
   3. Provide lightgage sheet metal angle edge trim at gypsum board edges to receive sealant.

E. Special Construction:
   1. Provide custom fabricated sheet metal enclosures around recessed light fixtures and similar elements which penetrate building paper air barrier assemblies.
   2. Mechanical Curbs:
      a. Rigid insulation boards at equipment curbs are installed as a part of the roofing subcontract.
      b. Foam seal joints between rigid insulation boards. Cut boards as necessary to allow foam penetration between the boards.
      c. Foam seal joints between rigid insulation board and adjacent curb construction.
      d. After installation of rooftop mechanical unit and ducts, foam seal the joint between the rigid insulation boards and the ducts.

END OF SECTION

SECTION 074216 – SHEET METAL SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ribbed sheet metal siding, including related sheet metal flashing, and accessories directly related to the sheet metal siding system.
   2. Soffit panels

B. Related Sections:
   1. 061000 – Rough Carpentry: Substructure
   2. 061643 - Gypsum Sheathing.
   3. 072700 - Weather Resistive Barriers: Building wrap/air barrier.
   4. 076100 - Sheet Metal Roofing.
   5. 076200 - Sheet Metal Flashing and Trim: Requirements for related sheet metal flashing and trim.
   6. 133419 - Metal Building Systems

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A653 - Steel Sheet, Zinc Coated, (Galvanized), or Zinc-Iron Alloy Coated by the Hot Dip Process.
   2. C518 - Test Method for Steady-State Thermal Transmission Properties by means of the Heat Flow meter.
   3. D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
   4. D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Fifth Edition 1993.

1.3 SYSTEM DESCRIPTION

A. System shall be designed and installed to preclude uncontrolled passage of water through the sheet metal siding assembly.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for all materials and proprietary systems proposed for the work.

C. Shop Drawings:
   1. Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, penetrations, and installation details.
   2. Include manufacturer's installation instructions for manufactured items incorporated in work.

D. Samples: Submit a minimum of 3 samples of [each] proposed siding type, with finish, color, and texture proposed for the work.

1.5 QUALITY ASSURANCE

A. Installer: Company specializing in sheet metal siding installation with minimum three years documented experience in installations of type and scope similar to that of this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with Section 016000.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Protect stored materials from heat and direct sunlight.

D. Prevent contact with materials during storage which may cause discoloration or staining.

1.7 WARRANTY

A. Furnish warranties in accordance with Section 017700.

B. Prior to acceptance of work, furnish written two year warranty covering repairs required to maintain metal siding system and associated flashing in watertight condition. Warrant installed system against defects due to faulty materials and workmanship.

C. Furnish non-prorated 5 year warranty covering loss of film integrity, color change, and chalking. Finish on installed materials shall not show a color change greater than 5 NBS color units, per ASTM D2244, and shall not show chalking in excess of 8, per ASTM D659.

PART 2 - PRODUCTS

2.1 SHEET METAL SIDING SYSTEMS

A. Metal Panels:
   1. Proprietary ribbed metal panels; 36 inch nominal width; depth 1" to 1-1/2" with deep ribs at 12” o.c and intermediate stiffening ribs.
   2. Material: Pefinished galvanized steel; minimum 26 gage core steel with ASTM A653 G90 galvanized coating.
   3. Finish: Minimum 70 percent Kynar 500 fluoropolymer system, manufacturer's standard color, as selected by the Architect from the manufacturer's standard line.
   4. Basis of Design: Nucor “Reverse R Panel” or similar by MBCI, Fabral, Berridge or approved.

B. Soffit Material:
   1. Flush metal panel; 24 gage core steel with ASTM A653 G90 galvanized coating; flat surface smooth (non-embossed) texture. concealed fastener system; single centered rib; 24 inch nominal width.
   2. Vented and unvented, as indicated on the Drawings.

2.2 ACCESSORY MATERIALS

A. Fasteners:
   1. Concealed Applications: Per manufacturer’s recommendations.
   2. Exposed Applications: Galvanized steel with soft neoprene washers, factory prefinished to match metal siding color.
   3. Fasteners sized for insulation thickness at each location.

B. Sealant: As recommended by the siding manufacturer for the application.

C. Touch-up Paint: Manufacturer's special color-matched material, formulated for retouching fluoropolymer finishes.

2.3 FABRICATION

A. Cut and form in accordance with approved shop drawings, using recognized sheet metal practices. Perform cutting with clean, sharp properly aligned shearing tools; do not saw or file edges of sheets.

B. Form pieces in longest practical lengths.

C. Fabricate flashing and sheet metal, including gutters and downspouts, in accordance with the requirements specified in Section 076200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully examine installed work of other trades and verify that such work is complete to the point where work of this section may properly commence, Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that substrate is clean, dry, and smooth, free of depressions, waves, and projections. Verify that items required to penetrate panel system are solidly set.

3.2 VAPOR/AIR BARRIER MEMBRANE

A. Install membrane system over gypsum sheathing in accordance with the manufacturer's recommendations to form a continuous barrier behind the metal siding panels.

B. Prime gypsum sheathing and concrete substrates to receive membrane.

C. Install membrane flashed to weather and tight to substrate surfaces without wrinkling or other surface imperfections.

D. Integrate membrane into other adjacent construction as shown and as necessary to shed water the exterior.

E. Provide mastic seal or membrane flashing at penetrations in wall surfaces.]

3.3 SHEET METAL SIDING INSTALLATION

A. Install metal siding as indicated and in accordance with manufacturer's instructions.

B. Install flashing and sheet metal elements as single continuous lengths to the greatest extent possible. Install in accordance with the requirements specified in Section 076200.

C. Install each siding panel as a single continuous piece. Install systems to allow for expansion of the panels.

D. Screw fasten metal siding panels to Z furring supports

E. Except as otherwise indicated, seal all lapped joints. Prevent squeeze-out of sealants. Immediately remove all excess exposed materials.

F. Touch-up all scratched and damaged surfaces with matching material. Replace all components which cannot be touched up or otherwise repaired with new conforming materials.

END OF SECTION

SECTION 076129 - SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standing seam metal roofing, including sheet metal flashing and accessories directly related to the metal roofing system.
   2. Underlayment, including related flexible flashing

B. Related Sections:
   1. 061000 – Rough Carpentry: Substructure
   2. 074216 - Sheet Metal Siding
   3. 076200 - Sheet Metal Flashing and Trim: Requirements for related sheet metal flashing and trim.
   4. 133419 - Metal Building Systems: Substructure

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A653 - Steel Sheet, Zinc Coated, (Galvanized), or Zinc-Iron Alloy Coated by the Hot Dip Process.
   2. C518 - Test Method for Steady-State Thermal Transmission Properties by means of the Heat Flow meter.
   3. D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
   4. D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Fifth Edition 1993.

1.3 SYSTEM DESCRIPTION

A. System shall be designed and installed to preclude uncontrolled passage of water through the sheet metal siding assembly.

B. Installed system shall be capable of resisting wind uplift equivalent to that required for Underwriters Laboratories, Inc. Class 90.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for all materials and proprietary systems proposed for the work.

C. Shop Drawings:
   1. Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, penetrations, and installation details.
   2. Include manufacturer's installation instructions for manufactured items incorporated in work.

D. Samples: Submit a minimum of 3 samples of each proposed siding type, with finish, color, and texture proposed for the work.

1.5 QUALITY ASSURANCE

A. Installer: Company specializing in sheet metal siding installation with minimum three years documented experience in installations of type and scope similar to that of this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with Section 016000.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Protect stored materials from heat and direct sunlight.

D. Prevent contact with materials during storage which may cause discoloration or staining.

1.7 WARRANTY

A. Furnish warranties in accordance with Section 017700.

B. Prior to acceptance of work, furnish written two year warranty covering repairs required to maintain metal siding system and associated flashing in watertight condition. Warrant installed system against defects due to faulty materials and workmanship.

C. Furnish non-prorated 20 year warranty covering loss of film integrity, color change, and chalking. Finish on installed materials shall not show a color change greater than 5 NBS color units, per ASTM D2244, and shall not show chalking in excess of 8, per ASTM D659.

PART 2 - PRODUCTS

2.1 SHEET METAL ROOFING

A. Metal Roofing Panels:
   1. Roofing System: System shall consist of cleat retained concealed fastener standing seam metal roofing pans; 24" nominal width, ribbed pan; seam height nominal 3".
   2. Material: Pefinished galvanized steel; minimum 24 gage core steel with ASTM A653 G90 galvanized coating.
   3. Finish: Minimum 70 percent Kynar 500 fluoropolymer system, manufacturer's standard color, as selected by the Architect from the manufacturer's standard line.
   4. Basis of Design: Nucor “CFR Standing Seam Roof Panel” or similar by MBCI, Fabral, Berridge or approved.

2.2 ACCESSORY MATERIALS

A. Fasteners:
   1. Exposed Applications: Galvanized steel with soft neoprene washers, factory prefinished to match roofing color.
   2. Nailers, Cleats, and Other Concealed Applications: Hot dip galvanized; sizes as recommended by the roofing materials manufacturer.

B. Underlayment: High-temperature resistant; AEP Span “Underlayment HT” or approved.

C. Sealant: As recommended by the manufacturer of the roofing materials.

D. Flexible Flashing: High temperature resistant; Grace Construction Products (Cambridge MA; 866-333-3726) Grace Ultra," or approved.

E. Touch-up Paint: Manufacturer's special color-matched material, formulated for retouching fluoropolymer finishes.

2.3 FABRICATION

A. Fabricate cleats and starter strips from minimum 20-gage galvanized steel sheet material, unless recommended otherwise by the metal roofing manufacturer.

B. Apply strippable film for protection during shipping, fabrication and installation].

C. Cut and form in accordance with approved shop drawings, using recognized sheet metal practices. Perform cutting with clean, sharp properly aligned shearing tools; do not saw or file edges of sheets.

D. Form pieces in longest practical lengths.

E. Fabricate flashing and sheet metal, including gutters, in accordance with the requirements specified in Section 076200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully examine installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that substrate is clean, dry, and smooth, free of depressions, waves, and projections. Verify that items required to penetrate panel system are solidly set.

3.2 SHEATHING INSTALLATION

A. Where plywood sheathing is indicated, install in compliance with the Structural Drawings and Section 061000.

B. Provide a uniform solid surface as necessary to receive underlayment.

3.3 ROOFING INSTALLATION

A. Underlayment:
   1. Apply underlayment shingle fashion to form a continuous weather barrier.
   2. Fasten each layer securely in position.
   3. Lap each layer a minimum of 2 inches; provide minimum 6 inch side laps; lap a minimum of 2 inches over waterproof membrane.

B. Perform metal roofing work in accordance with roofing manufacturer's instructions.

C. Install starter strips, edge strips, flashing receivers, valley liners, and cleats before starting installation of roofing sheets; nail cleats at 12 inches on center, using two nails per cleat, or, where cleats are continuous, space nails two per foot.

D. Install each roofing pan as a single continuous piece. Install systems to allow for expansion of the panels.

E. Install ridge caps, valley pans, and other flashing and sheet metal as single continuous lengths to the greatest extent possible.

F. Conceal fasteners wherever possible.

G. Seal all joints, except for factory sealed standing seams; seal intersections of standing seams.

H. Install cap flashings into receivers and secure with color matched neoprene gasketed screws at maximum 24" o.c.

I. Coordinate and schedule work such that the membrane roofing is complete prior to installation of the metal roofing system.

J. Touch-up all scratched and damaged surfaces with matching material. Replace all components which cannot be touched up or otherwise repaired with new conforming materials.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet metal flashing and trim.
   2. Requirements for flashing and sheet metal provided in other Sections.

B. Related Sections:
   1. 061000 - Rough Carpentry: Wood framing, blocking, nailers, and grounds.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. A653 - Steel Sheet, Zinc Coated, (Galvanized), or Zinc-Iron Alloy Coated by the Hot Dip Process.
   3. B32 - Solder Metal

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Sixth Edition 2003.

1.3 SYSTEM DESCRIPTION

A. Provide flashing and trim systems to prevent water leakage to the building interior.

B. Fastening systems shall allow for the thermal movement of the materials without buckling, loosening, and leakage.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Catalog cuts and installation instructions for manufactured products.

C. Shop Drawings: Indicate materials, gages, profiles, jointing patterns, jointing details, fastening methods, and installation details.

D. Samples: Submit three samples representative of finish and color of prefinished flashing materials.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with 5 years minimum experience.

B. Unless indicated or specified otherwise, perform work in accordance with the recommendations of SMACNA.

C. Pre-Installation Conference: Attend pre-installation conference as specified in Section 013119.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 GUARANTEE

A. Submit in accordance with Section 017700.

B. Furnish guarantee from the installer of each system that metal flashings will properly shed water to

the roof or to the building exterior, under all weather conditions, for a minimum period of two years from the date of Substantial Completion. Leaks due to failure of flashing materials, and due to improper installation shall be promptly repaired at no expense to the Owner, and that watertightness of the repair will be demonstrated to the Owner.

C. For coil-coated sheet metal materials, furnish from the coatings installer non-prorated 20-year warranty against failure of film integrity, and against fade and chalking.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Prefinished Galvanized Steel Sheet:
   1. ASTM A653 steel sheet with G90 galvanized coating or ASTM A792 steel sheet with AZ60 aluminum/zinc coating; 24 gage unless noted otherwise; factory prefinished with 70 percent resin Kynar 500 or Hylar 5000 coating, standard color as selected by the Architect.
   2. Manufacturers:
      a. AEP-Span, Dallas TX; (214-827-1740; 800-527-2503).
      b. Centria, Moon Township PA (800-759-7474).
      c. Copper Sales, Inc., Minneapolis, MN (612-545-1604; 800-426-7737).

B. Stainless Steel: ASTM A167; Type 304 or 316.

2.2 ACCESSORIES

A. Fasteners:
   1. Furnish bonded stainless steel / neoprene sealing washers for exposed applications.
   2. Finish exposed fasteners to match material being fastened.
   3. Material:
      a. Galvanized Steel Sheet: Use galvanized steel or stainless steel.
      b. Stainless Steel: Stainless Steel.
   4. Use screws when fastening into wood or sheet metal.
   5. Use expansion anchors or drive pins when fastening into concrete or masonry.

B. Sealants:
   1. Lap and Bedding Sealant: Butyl Rubber Type - One of the Following:
      a. "Butyl Sealant" by Tremco, Inc. Sealant/Weatherproofing Division; Beachwood, OH; 800-321-7906; 216-292-5000)
      b. "BP-400" by Adco Global, Inc. (800-248-4010).
   2. Joint Sealant: Polyurethane Sealant - One of the Following:
      a. "Chem-Calk 900" by Bostik Construction Products (Huntington Valley, PA; 800-221-8726; 215-674-5600).
      b. "Dynatrol I" by Pecora Corp. (Harleysville, PA; 800-664-7903; 215-799-7528).
      c. "Sonolastic NP I" by Sonneborn/ChemRex (Shakopee, MN; 800-433-9517; 952-496-6000).

C. Solder: ASTM B32.

D. Cold Galvanizing Compound: ZRC Worldwide, "ZRC Cold Galvanizing Compound," or approved product meeting the requirements of FS DOD-P-21035.

E. Flexible Flashing: "Grace Ultra," by GCP (800-354-5414), or approved.

2.3 FABRICATION

A. General Requirements:
   1. Field measure site conditions prior to fabricating work.
   2. Form sections true to shape, accurate in size, square, and free from distortion or defects.
   3. Fabricate cleats and starter strips of same material as sheet; interlockable with sheet.
   4. Form pieces in longest practical lengths, except as limited by expansion joint requirements.
   5. Non-Moving Joints: Shop fabricate to the greatest practical extent.
      a. Solder all non-moving shop fabricated joints in stainless steel flashing;

b. Prefinished Galvanized Steel: Lap joints 1 inch, minimum; accurately cut and fit as necessary to maintain profile; embed contact surfaces in sealant; rivet with stainless steel or color matched coated steel pop rivets at 3 to 4 inches o.c.

6. Hem exposed edges on underside 1/2 inch; miter and seam corners.
7. Shop fabricate corner sections with non-moving corner joints and 18 inch long legs.
8. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
9. Form seams lapped in the direction of water flow.

B. Fabricate all flashing to detail, in accordance with referenced SMACNA Architectural Sheet Metal Manual details, and as specified below. Use minimum 24 gage prefinished galvanized steel sheet unless indicated or specified otherwise.
   1. Counterflashing and Receivers: Removable type; SMACNA Fig 4-4 snaplock or screw-retained configuration; shop fabricated corners; crimped ends to permit lapping at end-to-end joints; 1 Inch at receivers; 3 inches at counterflashing.
   2. Gutters: Prefinished galvanized steel; 22 gage; SMACNA Figure 1-2, Style A or F; 4 inch width unless indicated otherwise; provide straps or ferrules at 36 inches on center per Fig 1-14; expansion joints at maximum 50 feet in accordance with Figure 1-5; to match color of metal roofing or as approved by Architect.
   3. Downspouts: Prefinished galvanized steel; SMACNA Figure 1-32; 3" x 4" rectangular (Figure 1-32B); to match color of metal siding or as approved by Architect. Locations as indicated.
   4. Lead Drain Flashing: Dimension for minimum 12 inches between edge of drain and edge of flashing, all around; furnish in one continuous piece, including at drain/overflow locations. Furnish to roofer for installation in the roofing system at the drains.
   5. Pipe Penetrations: SMACNA plate Fig 4-15, B or C as applicable; provide two piece flashing at 4-15B. Provide flexible boot pipe flashing at the locations indicated. Furnish to roofer for installation in the roofing system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Coordinate and sequence flashing installation with the work of other Sections. Furnish flashing to other trades as necessary for installation as a part of the work of other Sections.

B. Self-Adhered Flashing:
   1. Use self-adhered flashing in locations indicated, and under all curb flashings.
   2. Install self-adhering flashing wrinkle free. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
   5. Cover within 14 days.

C. Install starter and edge strips, and continuous cleats before starting installation.

D. Fastening:
   1. Secure flashings using continuous cleats whenever possible. Use exposed fasteners only at the backside of copings, and at other locations not exposed to public view, unless otherwise

approved by the Architect.

2. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
3. Insert counterflashings into receivers to form tight fit; where snap fit is not provided, secure in place with stainless steel sheet metal screws, 16" o.c., maximum.

E. Joints:
1. Install metal flashings (including embedded flashings and reglets) with provision for plus or minus 1/16 inch thermal movement at each end; provide expansion joints at 12'-0" o.c., maximum.
2. Seal concealed lap joints in with two parallel beads of butyl sealant; use butyl sealant where bedding sealant is indicated or required.

3.3 FIELD TESTING

A. Upon request of the Architect, demonstrate that installation is completely watertight by hosing with water as directed.

END OF SECTION

SECTION 078400 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Firestopping systems for sealing penetrations through fire-rated construction.

B. Related Sections:
   1. 014500 – Quality Control: Requirements for Owner paid inspections.
   2. Division 22 Mechanical: Penetrating elements.
   3. Division 23 Electrical: Penetrating elements.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. E119 - Method for Fire Tests of Building Construction and Materials.
   2. E814 - Methods for Fire Tests of Through-Penetration Fire Stops.

B. Underwriters Laboratories (UL): 1479 - Fill, Void or Cavity Materials and Through-Penetration Firestop Systems.

1.3 SYSTEM DESCRIPTION

A. Each firestopping system shall be selected to maintain fire rating of the assembly in which it is used.

B. Firestopping systems shall be resilient as necessary to accommodate differential movement between assemblies.

C. Where firestopping is used to seal penetrations through floors with waterproof membranes, system shall be selected for compatibility with membrane material.

1.4 QUALITY ASSURANCE

A. Code Verification: Prior to installation of fire stopping systems obtain approval from the jurisdictional code authorities for the fire stopping systems and applications proposed.

B. Firestopping: Tested in accordance with ASTM E119, [ASTM E814,][UBC Standard 43-6,][UBC Standard 7-1]or UL 1479 to meet the hourly fire ratings of the construction being sealed. Provide F rated assemblies, except where T rated assemblies are required by the code authority.

C. Firestopping systems shall be UL assemblies.

D. Subcontractor Qualifications: Firestopping work shall be performed by a single firestopping subcontractor, specializing in the installation of firestopping systems.

E. Develop and maintain a system to quickly and easily identify each firestop assembly in the Project. The system shall include a graphic picture of each fire rated assembly being used. Make the system readily available to the Building Inspector, the Architect, [and the Owner paid inspector.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.6 ENVIRONMENTAL CONDITIONS

A. Environmental Requirements: Comply with manufacturer's recommendations.

B. Maintain maximum ventilation to remove volatile emissions produced during the installation process.

PART 2 - PRODUCTS

2.1 FIRESTOPPING SYSTEMS

A. Systems meeting the requirements specified and suitable for the conditions indicated as manufactured by one or more of the following.
   1. Tremco Inc.
   2. Hilti USA.
   3. Specified Technologies, Inc.

B. Electrical Box Inserts:
   1. Manufacturer: Rectorseal (Houston TX; 713-263-8001; 800-231-3345).
   2. Fire Rated Pads: "BioFireshield LECTRA-STOP"; 1/4 inch thick intumescent pads; sized to fit electrical boxes; classified by UL; minimum 2 hour rating.

C. Systems with sodium silicate shall not be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION OF FIRESTOPPING

A. Provide firestopping at mechanical, electrical, and plumbing penetrations through fire rated floors, walls, and ceilings, and other locations as indicated on the Drawings.

B. Install firestopping in accordance with the manufacturer's recommendations and as necessary to meet the specified fire rating requirements.

C. Where firestopping is used to seal around penetrations through waterproof membranes, install to maintain integrity of waterproof barrier.

D. For sealing electrical boxes, coordinate installation with Division 16. Comply with manufacturer's recommendations for preparation and installation. Install in locations as required by Code for protection of openings through fire rated partitions.

3.3 PATCHING OF HOLES IN EXISTING CONSTRUCTION

A. Fill open holes which remain after removal of existing mechanical, electrical, and plumbing components. Patch and repair holes as necessary to match the adjacent construction and to maintain the fire rating of the assemblies. Firestopping systems may be used to fill holes which will be concealed in the finish construction.

3.4 CLEANING

A. Trim excess material flush with adjacent surface.

B. Remove spills, leave area in undamaged, clean condition.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleaning and preparation of joint surfaces.
   2. Sealant and backing materials.

B. Related Sections:
   1. 076200 - Sheet Metal Flashing and Trim: Sealants, furnished and installed as part of flashing and sheet metal work.
   2. 088000 - Glazing: Glazing sealants.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C1193 - Guide for Use of Joint Sealants.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for each sealant material used. Include manufacturer's surface preparation, priming, and installation instructions for each proposed sealant.

C. Samples:
   1. Submit cured samples of each sealant type and color proposed for the work.
   2. For each sealant type indicated for "color as selected," or for which no color is indicated, submit color card indicating available stock colors from manufacturer's complete line of pre-formulated colors for each type of sealant.
   3. For custom colors, request color selection from the Architect prior to sample submittal.

D. Quality Control Submittals:
   1. Schedule of sealant types, colors and respective locations.

1.4 QUALITY ASSURANCE

A. Installers:
   1. Use only skilled workmen specially trained in the techniques of sealing, and familiar with the published recommendations of the manufacturers of the sealants being used.

B. Verify that sealants are compatible with the substrates and accessory materials provided under other Sections.

1.5 ENVIRONMENTAL CONDITIONS

A. Unless recommended otherwise by the manufacturer, install sealant systems as follows:
   1. Do not apply sealant when ambient temperatures are below 40 degrees F, or expected to fall below 40 degrees F before sealant cure is complete.
   2. Do not apply sealant to substrates or accessories that are moist.

1.6 GUARANTEE

A. Furnish guarantees in accordance with Section 017700.

B. Furnish a 2 year installer's guarantee covering defects in installation.

C. Furnish Type S sealant manufacturer's standard 20 year warranty.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Type S - Neutral Cure Silicone Sealants:
   1. Dow Corning, 790 Silicone Building Sealant, or "795 Silicone Structural Glazing and Weatherproofing Sealant." or "Contractors Weatherproofing Sealant."
   2. Pecora "890 Architectural Silicone Sealant."
   3. Spectrem 3 by Tremco Incorporated.

B. Type P: ASTM C920, Type M, grade NS, Class 25; Tremco "Dymeric," Chem-Calk 500, Pecora "Dynatrol II," Sonneborn "Sonalastic NP-II", PRC "Permapol RC-2," or approved.

C. Type PT: ASTM C920, Type M, Grade P, class 25; Tremco "THC 900", Sonneborn/ChemRex "Sonolastic SL 2", Pecora "Urexpan NR-200", or approved; standard colors as selected.

D. Type PTNS: ASTM C920, Type M, grade NS, Class 25, Use T; Pecora "Dynatred," Tremco "THC901," Sika "Sikaflex-2c NS TG," or approved; custom colors to match the Architect's samples.

E. Type A: ASTM C834; Tremco "Acrylic Latex Caulk," Pecora "AC-20," Sonneborn/ChemRex "Sonolac," or approved; standard colors to match adjacent construction.

2.2 ACCESSORY MATERIALS

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Closed or open cell foam as recommended by the sealant manufacturer for the application; round profile; thickness approximately 130 percent of joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify joint dimensions and conditions are acceptable to receive the work of this Section.

3.2 PREPARATION

A. Clean and prepare joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

B. Apply masking tightly around joints to protect adjacent surfaces from excess sealant.

C. Prime as required for proper bond to substrate materials.

D. Backing Materials:
   1. Place backer rod to achieve proper sealant width/depth ratios and to prevent sealant sag.
   2. Use bond breaker where there is insufficient depth to use joint filler.

3.3 INSTALLATION

A. Perform work in accordance with ASTM C1193, unless specified otherwise or recommended otherwise by the sealant manufacturer.

B. Apply sealant within recommended temperature ranges.

C. Joint Profile:
   1. Sealant beads shall have a sectional width to depth ratio of 2 to 1, unless specified otherwise or recommended otherwise by the sealant manufacturer.

D. Tooling:
   1. Tool joints concave, unless indicated or specified otherwise. Finish to uniform profile and depth, free of air pockets, embedded matter, ridges, and sags.

3.4 CLEANUP

A. Clean adjacent surfaces free of excess sealant as the work progresses. Use cleaning agents recommended by the sealant manufacturer.

B. Upon completion, remove and dispose of masking.

3.5 PROTECTION

A. Protect sealant in joints subject to dirt, moisture, and traffic during the sealant curing process. Protection shall be able to resist traffic while remaining securely in position.

3.6 SCHEDULE

A. Type S: Provide at all exterior joints, unless specified otherwise; colors as selected from manufacturer's complete line for each type of sealant.

B. Type P: Provide at all exterior joints at concrete or masonry joints, unless specified otherwise; custom colors to match the Architect's samples.

C. Type PT: Provide at all exterior and interior horizontal joints subject to traffic and abrasion, unless specified otherwise;standard colors as selected from manufacturer's complete line of pre-formulated colors.

D. Type PTNS: Provide at all expansion joints in tile; standard colors as selected from manufacturer's complete line of pre-formulated colors.

E. Type A: Provide at all interior joints, unless specified otherwise.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rolled steel doors and frames.
   2. Accessories.

B. Related Sections:
   1. 087100 - Door Hardware.
   2. 087300 - Door and Hardware Installation: Installation of doors and related hardware.
   3. 088000 - Glazing: Glazing in doors and frames.
   4. 099000 - Painting: Field painting of doors and frames.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American National Standards Institute (ANSI): A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.

B. American Society for Testing and Materials (ASTM)
   1. A366 - Specification for Steel, Carbon, Cold Rolled Sheet, Commercial Quality.
   2. A569 - Specification for Steel, Carbon (0.15 Maximum Percent), Hot Rolled Sheet and Strip, Commercial Quality.
   3. A653 - Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C. International Building Code (IBC)

D. National Fire Protection Association (NFPA): NFPA 80 - Fire Doors and Windows.

E. Steel Door Institute (SDI): SDI-105 - Recommended Erection Instructions for Steel Frames.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Literature: Submit manufacturer's published literature for doors and frames.

C. Shop Drawings:
   1. Frames: Indicate configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, fire rating, and finish.
   2. Doors: Indicate elevations, internal reinforcement, closure method, and cutouts for hardware, glazing, fire rating, and louvers.

1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Regulatory Requirements:
   1. Installed frame and door assembly shall conform to NFPA 80 for fire rated class indicated.
   2. Where doors are noted with an hourly fire resistance rating, provide door and frame assemblies labeled by Underwriter's Laboratory, or any other testing laboratory approved by the local code authorities, to meet the hourly fire rating noted. Assemblies shall meet requirements for positive pressure.
   3. Where a hollow metal frame is used as a glazed opening in an interior fire rated wall assembly, the frame shall be labeled to match the fire rating required for a door assembly in the fire rated wall, except in a 1 hour rated exit corridor wall assembly, the glazed frame shall be labeled to a

45 minute rating. In a 1 hour fire rated corridor wall assembly, where the door frame is integral with the glazed frame, the frame shall have a 45 minute rating.

4. Include "S" label on fire rated door assemblies which are located at 1 hour rated exit corridors.

1.5 DELIVERY, STORAGE AND HANDLING

A. In accordance with Section 016000.

B. Protect doors and frames with. factory installed protective packaging. Maintain protective packaging until installation commences.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Members of the Steel Door Institute and of the National Association of Architectural Metal Manufacturers, subject to compliance with the specified requirements.

2.2 MATERIALS

A. Steel Sheet: Cold rolled ASTM A366, or hot rolled pickled and oiled sheet conforming to ASTM A569.

2.3 DOORS

A. ANSI A250.8; Seamless.

B. Minimum 18 gage face sheets for interior doors; minimum 16 gage face sheets for exterior doors.

C. Core:
   1. Interior Doors: Vertical steel stiffeners with sound deadening fill between stiffeners, or resin impregnated kraft paper honey comb core.
   2. Exterior Doors: Polystyrene or polyurethane foam core.

D. Provide continuously welded seamless edges.

E. Close top edges of exterior doors flush with steel filler cap; seal joints watertight.

F. Cut mortises for butts using appropriate templates; universal non-handed preparation of doors is not acceptable.

2.4 FRAMES

A. Design: Double rabbet, unless indicated otherwise; fully welded. Fabricate frames with throat dimensions as indicated.

B. Gages:
   1. Exterior Frames: Minimum 14 gage.
   2. Interior Frames: Minimum 16 gage for frames of door openings up to and including 4 feet in width; 14 gage for frames greater than 4 feet in width.

2.5 ACCESSORIES

A. Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamperproof screws.

2.6 FINISH

A. Exterior Units:
   1. A60 hot dip galvannealed coating conforming to ASTM A653.
   2. Include reinforcing and other internal components.
   3. Use zinc rich primer to touch-up galvanized coatings damaged during fabrication.
   4. Apply modified epoxy ester baked-on primer to receive epoxy/urethane coating system specified in Section 099000.

B. Interior Units: Manufacturer's standard rust inhibitive primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION OF FRAMES

A. Install frames in accordance with SDI-105 and in accordance with labeling requirements.

B. Coordinate with wall construction for anchor placement.

C. Install accessories.

D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

E. Installation Tolerances; Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

F. Door and hardware installation is specified in Section 087300.

END OF SECTION

SECTION 081400 - WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood doors.
   2. Door accessories.

B. Related Sections:
   1. 064000 - Architectural Woodwork: Wood door frames.
   2. 081113 - Hollow Metal Doors and Frames: Steel frames.
   3. 087100 - Door Hardware.
   4. 087300 - Door and Hardware Installation.
   5. 088000 - Glazing: Vision lites.
   6. 099000 - Painting: Finish coatings.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. Architectural Woodwork Institute (AWI): Architectural Woodwork Quality Standards, Guide Specifications, and Quality Certification Program; current edition.

B. International Building Code (IBC)

C. [Window and Door Manufacturing Association (WDMA): Industry Standard I.S.1-A current edition.]

1.3 SUBMITTALS

A. In accordance with Section 013300.

B. Product Data: Submit manufacturer's product literature for each type of door.

C. Shop Drawings: Indicate door sizes and thickness, materials, stile and rail reinforcement, internal blocking for hardware attachment, cutouts for glazing and louvers, louver details and glazing stops.

D. Samples: Submit two 8 x 10 inch samples of each transparent finish species and finish combination proposed. Quality Control Submittal: Submit certification that the wood core and wood veneer products meet certified wood requirements. Include manufacturer’s Forest Stewardship Council chain-of-custody certificate number.

1.4 QUALITY ASSURANCE

A. Urea-Formaldehyde Free: All materials used to manufacture the door shall be urea-formaldehyde free.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. In accordance with Section 016000.

B. Package, deliver, and store doors in accordance with AWI requirements.

1.6 WARRANTY

A. Furnish manufacturer's standard warranty under provisions of Section 017700.

PART 2 - PRODUCTS

2.1 DOORS

A. Solid Core Flush Doors:
   1. Approved Manufacturers: One of the following.
      a. Lynden Door (Lynden, WA; 800-.631-3667)
      b. Vancouver Door (Puyallup, WA; 253-845-9581
      c. Marshfield Door Systems (Marshfield, WI 800-869-3667).
      d. Eggers Industries (Two Rivers, WI; 920-793-1351).
   2. AWI Section 1300, PC-5 or PC-7 (5 or 7 ply construction; bonded core); Premium grade.
   3. Core: Solid particleboard, unless required otherwise for fire labeling requirements; formaldehyde free.
   4. Furnish labeled doors as required to meet the hourly fire rating indicated.
   5. Face Veneer:
      a. Paint Grade Veneer: Medium density overlay or paint grade birch.
   6. 1-3/4 inch thick, unless scheduled otherwise.
   7. Provide matching plastic laminate edging at plastic laminate doors; apply before face veneer.

2.2 ACCESSORIES

A. Glass Stops: Wood type, except as required to conform to labeling requirements; finished to match door finish.

B. Non-Rated Louvers: Roll formed steel or extruded aluminum material, factory primed for field painting as specified elsewhere; Inverted 'V' blade design; [30]percent free area; tamperproof fasteners.

2.3 FABRICATION

A. Fabricate doors to the configurations indicated, in accordance with the AWI standards specified, and to fire rated labeling requirements. Attach fire and smoke rating labels.

B. Bevel lock and hinge edges 1/8 inch in 2 inches on single acting doors.

C. Bond edge banding to solid core with hot melt or RF cured adhesive.

D. Prefit and premachine doors in accordance with AWI 1300-S-6. Premachine for hardware specified in Section 087100, and locate as specified in Section 087300.

E. Doors shall be factory prefinished unless allowed otherwise.
   1. Opaque Finish: AWI System OP-8 Premium Grade UV Cured Acrylated Polyurethane, OP-4 Premium Grade Conversion Varnish, or OP-7 Polyester.

F. Doors may be field finished or shop finished in accordance with the requirements of Section 099000, at the Contractor’s option.

G. Provide metal astragals to meet fire rating requirements for double fire doors. Finish to match door.

H. Factory pre-glaze doors.

I. Flush Door Blocking: For flush doors, provide solid lock blocks and special blocking as required for the hardware components specified elsewhere. Blocking for fire rated doors shall meet the door manufacturer's labeling requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors as specified in Section 087300, in accordance with manufacturer's instructions, and the fire rated labeling requirements.

3.2 INSTALLATION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 ADJUSTING AND CLEANING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 083100 - ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire resistive rated and non-rated access doors and frames and accessories.

B. Related Sections:
   1. 061000 – Rough Carpentry: Adjacent framing.
   2. 092200 – Lightgage Metal Support Framing: Adjacent framing.
   3. 092900 - Gypsum Board: Finishes for concealed access doors.
   4. 099000 - Painting: Field paint finish.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data. Include sizes, types, finishes, scheduled locations, and details of adjoining work.

1.3 QUALITY ASSURANCE

A. Where an access door is required in fire rated construction, the access door assembly shall be labeled by Underwriter's Laboratory, Warnock Hersey, or any other testing laboratory approved by the local code authorities, to meet the hourly fire resistance rating of the construction in which the access door is installed.

PART 2 - PRODUCTS

2.1 WALL AND CEILING ACCESS DOORS

A. Acceptable Manufacturers:
   1. Milcor LP. (Lima OH; 800-441-6899).
   2. The Williams Brothers Corporation of America (Front Royal, VA; 800-255-5515).
   3. Nystrom Products Co. (Minneapolis MN; 612-781-7850).
   4. Karp Associates, Inc. (Maspeth NY;718-784-2105).
   5. JL Industries (Bloomington, MN; 612-835-6850)

B. Door Types:
   1. Fire Rated Metal Access Door:
      a. Flush type design.
      b. 16 gage frame; minimum 20 gage welded pan door panel insulated with non-combustible filler
      c. Self closing and self latching, with interior latch release
      d. Fully concealed pin type hinges or continuous piano hinge, 175 degree opening.
      e. Key operated cylinder lock.
   2. Non Rated Concealed Drywall Access Door:
      a. Flush type design, with integral attachment flange and drywall bead for flush installation.
      b. Minimum 16 gage frame; minimum 14 gage door panel.
      c. Fully concealed pin type hinges or continuous piano hinge, 175 degree opening.
      d. Key operated cylinder lock.

C. Sizes: Approximately 12" x 12" size for hand access, 22" x 22" size for man entry, unless indicated otherwise; furnish custom sizes as necessary.

D. Finish: Galvanized steel with wiped coat finish; prime units with manufacturer's standard primer to receive paint coatings as specified in Section 099000. Provide stainless steel access doors at restrooms, and other moist locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

A. Install access doors of sizes and in locations as indicated. Provide access doors for access to balancing and fire dampers, trap primers, valves, fans, terminal units, and other equipment requiring periodic inspection through finished walls and ceilings, whether indicated or not. Coordinate access requirements with other trades.

B. Provide concealed access doors at all gypsum board locations, except where fire rated doors are required.

C. Install frames plumb and level in wall and ceiling openings, with plane of door surface in accurate alignment with plane of wall or ceiling surface.

D. Secure rigidly in place in accordance with manufacturer's instructions.

END OF SECTION

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Overhead coiling doors.
   2. Support framing.

B. Related Sections:
   1. Division 26 - Electrical: Installation of key operated push button station, conduit, and wiring; connection of alarm and detection system to fire rated door assemblies.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SYSTEM DESCRIPTION

A. Overhead coiling door assembly includes curtain, curtain guides, brackets, counterbalance, hood, motor operators as specified, push button stations, steel structural supports and other accessories required for a complete installation.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit manufacturer's complete product literature indicating specified items and method of installation.

C. Shop Drawings: Indicate details and dimensions of installation, including tracks, supports, connection points and details, and locations of operating components.

1.4 QUALITY ASSURANCE

A. Installers: Trained and authorized by the door manufacturer.

B. Pre-Installation Conference:
   1. Conduct in accordance with Section 013119.
   2. Require in attendance the General Contractor, the Architect, the overhead door subcontractor, the electrical subcontractor, the metal framing subcontractor, and others as may be affected by the work of this Section.
   3. Agenda: Address coordination, existing conditions, switch locations, connection points, baffle installation, access requirements, motor locations, and field testing procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Overhead Door Corporation is specified as the standard of approval, similar and equal products from The Cookson Company, Wayne-Dalton Corporation, Cornell Iron Works, Inc., and McKeon Rolling Door Company may be used.

2.2 PREMANUFACTURED DOOR ASSEMBLIES

A. Motorized Insulated Non-Rated Doors:
   1. Overhead Door Type “625 Stormtite”; motorized operation.
   2. Factory finished, in color as selected by Architect.
   3. Motor Operator: Heavy duty gear head motor operator; 3 phase power; verify voltage.

4. Reversing footpiece; provide concealed self-winding electrical cord reel; located directly above connection point on bottom-bar. Bottom-bar switch shall be detailed and mounted so as not to overhang the bottom-bar angle.
5. Weatherstripping at exterior doors.
6. Keyed push button station with "open", "close", and "stop;" ADA compliant visual and horn annunciator system.

2.3 SUPPORT FRAMING

A. Provide tube steel framing as indicated or as required to support the overhead coiling doors.

B. The support framing shall be Contractor designed.

C. Provide bracing, attachments, and anchors to adjacent structure to maintain the installation firmly in position.

D. Framing shall be designed to accommodate deflection from the structure above without transmission of the load to the structure below.

E. Design framing system to meet the seismic requirements of The International Building Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that openings are prepared with headers level, jambs plumb, floor level, without projections, and are correctly dimensioned to receive door.

3.2 INSTALLATION

A. Install door assemblies as indicated in accordance with manufacturer's installation instructions.

3.3 FIELD QUALITY CONTROL

A. Verify that moving parts operate smoothly, coiling doors are free from warp, twists, or distortion, doors remain in required position, and safety features function properly.

B. Repair damage to overhead coiling doors to match manufacturer's original finish. Replace components which cannot be properly repaired.

3.4 ADJUST

A. Adjust mechanism so moving parts operate smoothly.

END OF SECTION

SECTION 084113 – ALUMINUM STOREFRONT WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum and glass windows

B. Related Sections:
   1. 079200 - Joint Sealants: Perimeter sealants.
   2. 087100 – Door Hardware: Hardware not specified in this Section.
   3. 088000 - Glazing: Glass and glazing.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. B209 - Aluminum and Aluminum Alloy Sheet and Plate.
   3. B221 - Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   4. E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
   5. E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   6. E331 - Test Method for Water Penetration of Exterior Windows, Curtainwalls, and Doors by Uniform Static Air Pressure Difference.

B. American Architectural Manufacturers Association (AAMA)
   1. 2605-02 -Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.3 SYSTEM DESCRIPTION

A. Performance:
   1. System shall provide for expansion and contraction caused by a cycling temperature range of -20°F to +160°F without causing detrimental effects to components, sealing systems, and surrounding construction.
   2. Design system with provisions to drain moisture to the exterior of the system.
   3. Air Infiltration:
      a. Fixed Glazing: Limit air infiltration through assembly to 0.06 cfm/sf of assembly surface area, measured at a reference differential pressure across assembly of 6.24 psf as measured in accordance with ANSI/ASTM E283
      b. Ventilators: Limit air infiltration through assembly to 0.1 cfm/sf of vent area, measured at a reference differential pressure across assembly of 6.24 psf as measured in accordance with ANSI/ASTM E283
   4. Water Infiltration; Storefront System: No water penetration at a test pressure of 6.24 lb/sf when measured in accordance with ASTM E331.

B. Thermal Transmittance:
   1. Storefront Windows:
      a. Fixed: Maximum U=0.34 when tested in accordance with NFRC requirements. Provide systems with certification stating that they have been tested in accordance with NFRC to meet the specified requirements using glass which matches the glass to be used in the Project.
      b. Operable: Maximum U=0.36 when tested in accordance with NFRC requirements. Provide systems with certification stating that they have been tested in accordance with NFRC to

meet the specified requirements using glass which matches the glass to be used in the Project.

c. Solar Heat Gain Coefficients:
   1) At Projection Factor > 0.5: Maximum SHGC 0.61.
   2) At Projection Factor < 0.5 and >0.2: Maximum SHGC 0.46;
   3) At Projection Factor < 0.2, Maximum SHGC 0.38

C. System Structural Design:
   1. Design and size members and anchorages to withstand positive and negative wind loads as required by the jurisdictional code authorities, and to resist pivot and closer reaction forces.
   2. Limit mullion deflection to 1/175, or flexure limit of glass with full recovery of glazing materials, whichever is less.

D. Dynamic Movement: System shall accommodate the following without damage to system components or performance.
   1. Movement within the system.
   2. Application and release of design live loads.
   3. ±5/8" maximum deflection of structural support framing between head and sill.

E. Profiles: Framing member profiles, as indicated in the Drawings, indicate proportions and intent. Minor variations in profiles, assemblies, and connections which are indicated on the shop drawings will be accepted, provided that, in the opinion of the Architect, they do not substantially alter the intended appearance.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Shop Drawings:
   1. Include wall opening dimensions, component dimensions, tolerances required, anchorages and fasteners, relationship to adjacent construction, installation details, flashings, and sealant locations.

C. Quality Control Submittals:
   1. Submit either of the following to verify that the proposed systems meet the structural performance requirements specified.
      a. Shop drawings signed and sealed by a Professional Engineer registered in the State where the Project is located.
      b. Certified test report data verifying structural compliance of systems similar to those to be provided.
   2. Test Reports: Submit copies of test reports which verify that each aluminum framed glazing system meets the air and water infiltration performance requirements specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company authorized by system manufacturer, one installer for total system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.7 GUARANTEE AND WARRANTY

A. Furnish in accordance with Section 017700.

B. Manufacturer's Warranty: Furnish three year written warranties executed to the Owner, from the manufacturers of the storefront and aluminum window systems, against defects in materials and workmanship.

C. Installer's Guarantee: Furnish three year written guarantee against defects in installation.

PART 2 - PRODUCTS

2.1 STOREFRONT SYSTEMS

A. Acceptable Manufacturers:
   1. Basis of Design: Apogee Architectural Metals (Wausau, WI; 800-866-2227)
   2. Alternative Manufacturers meeting design and performance requirements as approved: Kawneer Co. Inc, Arcadia, OBE/Vistawall, CRL/US Aluminum Corporation, or approved.

B. Fixed Windows:
   1. Apogee EFCO “FX45 Window;”
   2. Fixed configuration
   3. 2-1/2” nominal face width X 4-1/2” frame depth;
   4. Double glazed per Section 088000.

C. Furnish spacers and adapters as necessary for a complete installation.

2.2 MATERIALS

A. Extruded Aluminum: ANSI/ASTM B221; 6063-T5 Alloy and Temper.

B. Sheet Aluminum: ASTM B209, minimum .019 inch thickness for flashings, minimum .062 inch thick for brake formed trim applications.

C. Fasteners: Stainless steel, or zinc-plated in accordance with ASTM A164.

D. Glazing: Furnished under Section 088000. Provide shop glazed units at Contractor's option.

E. Miscellaneous Accessories: Furnish reinforcing, attachment hardware, aluminum flashings, and other items as necessary.
   1. Low energy doors shall conform to the currently enforced edition of ANSI A156.19.]

2.3 FABRICATION

A. Field verify openings prior to fabrication.

B. Fabricate frames allowing for shim spacing around perimeter of assembly, yet enabling installation.

C. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal joints with sealant.

D. Provide drainage holes to allow water to flow to exterior.

E. Prepare components to receive anchorage devices. Fabricate anchorage items.

F. Form bent components accurately to line, without deformation of component profiles. Fabricate in lengths consistent with finisher's capacity to handle bent shapes. Prefit all clips and mating components to ensure secure fit at time of assembly.

G. Provide internal reinforcement in mullions with members to maintain rigidity. Provide reinforcing at all door strike jambs.

H. Fabricate storefront system to accommodate hardware using templates furnished from Section 087100.

I. Furnish thermally broken aluminum backing plates at head and jambs to receive sealant and backing rod; provide partial closures at ends of jambs and mullions to receive sealant.

J. Fabricate custom extrusions, closures, and sheet materials to the shapes indicated; fabricate for attachment with concealed fasteners to the greatest possible extent.

2.4 FINISHES

A. Finish for Exposed Aluminum Surfaces: Minimum 70 percent resin Kynar 500 or Hylar 5000 PVDF system complying with AAMA 2605; custom non-exotic color selected by Architect.

B. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A123 to minimum 1.7 oz/sf.

C. Apply two coats of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify wall openings are ready to receive work of this Section.

B. Notify Architect of unacceptable conditions, prior to installation. Do not install window units until such conditions have been corrected.

3.2 INSTALLATION

A. Install frames and hardware in accordance with manufacturer's instructions.

B. Install sill pan in rough opening with end dams tight to the jamb framing members. Provide solid blocking and ensure that the sill pan is sloped to drain. Coordinate installation

C. Where compensating head channels are used, screw channels to structure with center of channel fixed and other fasteners through slotted holes.

D. Screw attach end dams to sub-sill ends; seal joints between dam and sub-sill. Fasten the sub-sill securely into the openings. Cap seal tops of fasteners.

E. Install sealant to vertical leg of sub-sill and to end dams and set framing into sealant. Fasten the storefront framing into the sub-sill. Use manufacturer’s standard interlocking anchors which engage the sub-sill and allow fastening of the storefront without penetrating the horizontal pan of the sub-sill.

F. Install preformed gasket at top of sub-sill against back of storefront sill.

G. Align frames plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

H. Install under sill aluminum flashings and water diverters. Seal all frame joints, and penetrations in flashings.

I. Perimeter sealant is provided under Section 079200.

3.3 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Retouch damage to PVDF finish with matching air-dry material as recommended by the finish coating manufacturer.

END OF SECTION

SECTION 085659 - TRANSACTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flush mount interior transaction windows.

B. Related Sections:
   1. 079200 - Joint Sealants
   2. 088000 - Glazing.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Proposals for alternate products and methods for applications indicated may be considered by the Architect, subject to requirements of Section 016000, system performance requirements, and applicable PART 1 requirements of this Section. Requests for substitution of security window system shall be accompanied by a complete operating security window sample.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. B209 - Aluminum and Aluminum Alloy Sheet and Plate.
   2. B221 - Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.

C. Shop Drawings: Indicate materials, elevations and sizes of frames, adjacent materials and components, fastening methods, relevant field dimensions, and relationship to adjoining construction.

D. Samples: Submit manufacturer's samples of standard finishes.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Manufacturer's Project References: Submit list of successfully completed security window projects, including project name and location, name of architect, and type and quantity of security windows installed.

G. Operation and Maintenance Manual: Submit manufacturer's operation and maintenance manual, including operation, maintenance, adjustment, and cleaning instructions, trouble shooting guide, and parts list.

H. Contract Closeout Submittals:
   1. In accordance with Section 017700

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Approved by the materials manufacturer.

B. Manufacturer Qualifications: Actively engaged in the fabrication of specified items for a minimum of 5 years prior to the bid date.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.6 WARRANTY

A. Submit in accordance with Section 017700.

B. Manufacturer's Warranty: Manufacturer's standard one-year unlimited warranty against defective materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. QuikServ, Inc., (Houston, TX; 800-388-8307) or approved.

2.2 FLUSH-MOUNT TRANSACTION WINDOWS

A. Self-Closing Manual Opening Window; “SC-4040”.
   1. Service Panel Type: Horizontal Slider.
   2. Frame: Extruded aluminum, ASTM B 221, Alloy 6063-T6.
   3. Aluminum Sheet: ASTM B 209, Alloy 5005-AQ-H34.
   4. Galvanized Steel Sheet: ASTM A 653, G90.
   5. Security: Manufacturer’s standard medium security locking.
   6. Fasteners: Stainless steel rivets and hex-head zinc-plated self-threading machine screws.
   7. Glazing: Nominal 1/4 inch thick laminated glass.
   8. Silicone Glazing Sealant: Dow Corning 999A, aluminum.

2.3 ACCESSORIES

A. Fasteners: Include shields and tamper-resistant fasteners as necessary to securely anchor the frames within the opening.

2.4 ALUMINUM FINISH

A. Anodized: Clear, AA-M10-C12-C22-A31, ASTM B 680.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive security windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive security windows are plumb, level, square, accurately aligned, correctly located, and in tolerance.

3.3 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Install windows plumb, level, square, true to line, and without warp or rack.

C. Install window components weathertight.

D. Anchor windows securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.

E. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

F. Joint Sealants: Install joint sealants as specified in Section 07920 (07 92 00).

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

A. Adjust window to function properly and for smooth operation without binding.

3.5 CLEANING

A. Clean security windows promptly after installation in accordance with manufacturer's instructions.

B. Remove excess joint sealant in accordance with sealant manufacturer's instructions.

C. Do not use harsh cleaning materials or methods that would damage glazing or finish.

3.6 PROTECTION

A. Protect installed windows to ensure that, except for normal weathering, security windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finish hardware requirements.
   2. Requirements for bidder-supplied hardware schedule.

B. General Requirements:
   1. Contractor shall provide complete hardware schedule including all pieces of hardware required at each opening as specified herein and indicated in the Drawings.
   2. Allowed hardware manufacturers shall be as directed by Owner. Where specific model numbers are provided, it is for the purpose of establishing basis for quality and design only. Contractor shall provide alternate products or functions as necessary to meet requirements of Drawings and specifications.
   3. Manufacturer substitutions are not permitted.
   4. Obtain each type of hardware from single manufacturer.
   5. Review Drawings, Door Schedule, and requirements of this Section thoroughly and provide required hardware for all openings, including openings which may have been inadvertently omitted from Door Schedule.
   6. Should an opening be omitted or an opening not indicated in Door Schedule, provide hardware of same quality, design and function as specified for similar openings.
   7. Furnish hardware complete with brackets, plates, fittings, and other accessories required for installation.
   8. Provide screws, nuts, bolts, through-bolts, washers, grommets, and other fastening devices necessary for proper installation of hardware; match finish of hardware being attached. Non-ferrous or corrosion resistant type required where exposed to exterior atmosphere.

C. Related Sections:
   1. 017700 - Closeout Procedures: Submittal of keys.
   2. 081113 - Hollow Metal Frames.
   3. 081400 - Wood Doors.
   4. 083100 – Access Doors and Panels
   5. 084228 – All-Glass Partition Systems
   6. 087300 - Door and Hardware Installation.

D. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

E. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Manufacturer's Data: Submit 3 copies of manufacturer's data for each item of finish hardware.

C. Samples: Within 35 days after award of the Contract, submit 3 samples each of Push Plates and Kick Plates in colors as selected for approval.

D. Schedules: Upon award of hardware contract, submit 3 copies of the finish hardware schedule, organized into "hardware sets" and indicating complete designation of every item required for each door or opening. List in vertical form. Review of hardware schedules does not fulfill project requirements in accordance with Contract Documents.

E. Templates: Furnish hardware templates to door and frame fabricators, and hardware installers. Upon request, check shop drawings of such other work to confirm that adequate provisions were made for the proper installation of hardware.

1.3 QUALITY ASSURANCE

A. Supplier Qualifications: Finish hardware shall be supplied by recognized builders' hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than two years. The supplier's organization shall include a member of the American Society of Architectural Hardware Consultants who is available at all reasonable times during the course of the work to meet with the Owner, Architect or Contractor for project hardware consultation.

B. Regulatory Requirements:
   1. Conform to requirements of the jurisdictional code authorities.
   2. Where openings are noted with an hourly fire resistance rating, provide hardware components labeled by Underwriter's Laboratory, or other testing laboratory approved by the local code authorities, to meet the hourly fire rating noted.
   3. Hardware shall conform to NFPA 80 for fire rated class indicated.
   4. Comply with provisions of Americans with Disabilities Act (ADA),including ADA Accessibility Guidelines and ANSI A117.1, and additional accessibility requirements of the jurisdictional code authorities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver all hardware in manufacturers' original unopened undamaged packages, clearly identifying manufacturer, brand name, and contents.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Mark each item of hardware as to description and location of installation in accordance with approved hardware schedule.

D. Protection: Use all means necessary to protect the finish on hardware before, during and after installation.

1.5 GUARANTEES

A. Furnish 5-year unconditional guarantees for all door closers, under provisions of Section 017700.

1.6 MAINTENANCE

A. Factory representatives for door closers, exit bolts, and locksets shall be available during the construction to instruct the Contractor on the proper method of installation of their materials. They shall inspect and adjust their materials at the completion of the work, and supply proper maintenance manuals to the Owner.

B. Furnish two (2) sets of special tools for installation and maintenance of hardware. Tools for maintenance and adjustments are to be delivered to the Owner upon completion of the work.

PART 2 - PRODUCTS

2.1 HARDWARE

A. Furnish hardware items as scheduled in approved bidder-supplied hardware schedule.

B. Except as listed in the following paragraphs, no substitutions of materials will be allowed unless approved by the Architect.

2.2 HARDWARE MATERIALS AND FABRICATION

A. Furnish fasteners for installation with each hardware item. Furnish Phillips head fasteners, countersunk oval, flat head, or undercut head as appropriate for material to be installed. Furnish door closers and exit devices applied to wood composite or mineral core doors with sex bolts sized to the thickness of the door.

B. Compatibility: Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fastener.

2.3 HARDWARE FINISHES

A. General: Unless specifically indicated otherwise in the Landlord's "Tenant's Design and Construictiojn Manual", provide architectural hardware in the following finishes.
   1. General: US26D, Satin Chrome Plated, except:
   2. Push Plates, Door Pulls, Kickplates: US32D, Satin Stainless Steel
   3. Door Closers: 689/Sprayed Aluminum.

2.4 KEYING

A. All locksets and deadbolts shall be keyed as directed by the Owner.

B. Construction master-key all locksets and cylinder items; provide 12 construction masterkeys.

C. Locksets, exit devices, deadlocks, padlocks, and cylinders (all standard cylinder items) shall be:
   1. Grand masterkeyed and/or masterkeyed in sets as required.
   2. Individually keyed in strict accordance with Owner's instructions.
   3. Keying shall be established specifically for the Owner by the manufacturer.

2.5 HARDWARE GROUPS

A. As indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of doors and hardware is specified in Section 087300.

END OF SECTION

SECTION 087300 - DOOR AND HARDWARE INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation of hardware specified in Section 087100.
   2. Installation of hollow metal doors.

B. Related Sections:
   1. 081113 - Hollow Metal Doors and Frames.
   2. 083100 - Access Doors and Panels.
   3. 083323 - Overhead Coiling Doors.
   4. 087100 - Door Hardware.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

1.2 REFERENCES

A. Hollow Metal Manufacturer's Association (HMMA): 840 - Installation and Storage of Hollow Metal Doors and Frames.

B. National Fire Protection Association (NFPA): 80 - Fire Doors and Windows.

C. American National Standards Institute (ANSI): A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.

D. The Door and Hardware Institute (DHI): Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

1.3 QUALITY ASSURANCE

A. Installers of doors and finish hardware shall be skilled mechanics experienced in this type of work.

B. Fire rated doors and hardware shall be installed in accordance with the labeling requirements.

1.4 ENVIRONMENTAL CONDITIONS

A. Do not subject wood doors to abnormal heat, dryness, or humidity, or sudden changes thereof. Condition doors to average prevailing humidity prior to hanging.

PART 2 - PRODUCTS

2.1 DOORS, FRAMES, AND HARDWARE

A. Doors, frames and hardware are specified in other sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 DOOR INSTALLATION

A. Install doors in accordance with the door manufacturer's printed instructions.

B. Install doors plumb and square in associated frames maintaining specified clearances.

C. Except where specified otherwise in the respective door sections, maintain clearances of 1/8 inch at jambs and heads, 1/8 inch at meeting stiles for pairs of doors, and 1/2 inch from bottom of door to top of decorative floor finish or covering, except where threshold is shown or scheduled provide 1/4-inch clearance from bottom of door to top of threshold.

D. Install hollow metal doors in accordance with ANSI A250.8 and HMMA 840.

E. Install fire rated doors in accordance with NFPA 80.

F. Install doors to operate freely, but not loosely, free from hinge bound conditions, sticking or binding. Do not install in frames which would hinder operation of doors.

G. Ensure doors are free from rattling when in latched position.

3.3 FINISH HARDWARE INSTALLATION

A. Install hardware plumb, level and true to line in accordance with manufacturer's templates, printed instructions and Project conditions.

B. Install fire rated hardware in accordance with NFPA 80.

C. Where cutting and fitting is required on substrates to be field painted or similarly finished, install, fit, remove and store hardware prior to finishing. Reinstall hardware after finishing operations are completed.

D. Do not install surface mounted items until finishes have been completed on the substrate.

E. For substrates which are not factory prepared for hardware:
   1. Mortise work to correct size and location without gouging, splintering or causing irregularities in exposed finish work.
   2. Fit faces of mortised components snug and flush without excessive clearance.

F. Coordinate installation of electronic hardware with electrical service and fire alarm system as applicable.

G. Electrified Hardware
   1. Installation Of Automatic Operators:
      a. Automatic operators and activators shall be installed by factory authorized personnel. Installation shall include all wiring connections.
      b. All wire, junction boxes, and conduit and the like are to be provided by the electrical subcontractor, based on complete riser and wiring diagrams furnished by the hardware supplier. Installation of and connections to access control systems specified elsewhere are not included in this section.
   2. Factory Representative Services Required
      a. Provide for local representatives of specified electrical hardware manufacturer(s) to assist in the supervision of installation of one of each type of electrified hardware items.
      b. Provide for supervision of final checkout and adjustment of electrified hardware.
      c. Provide for continued maintenance site visits during the 1 year warranty period.]

H. Hardware Locations: The following is a general listing and may contain items which do not apply to this Project.
   1. Butt Hinges:
      a. Top: 5 inches from inside head of frame down to top of hinge.
      b. Bottom: 10 inches from finish floor to bottom of hinge.
      c. Intermediate: Equally spaced between top and bottom hinges.
   2. Locksets and Latchsets: 38 inches from finish floor to centerline of knob or lever.
   3. Dummy Trim: Backset and height to match locks and latches.
   4. Deadlocks and Deadlatches: 48 inches from finish floor to centerline of cylinder.
   5. Push/Pull Latches: 45 inches from finish floor to centerline of latchbolt.
   6. Exit Devices: 38 inches from finish floor to centerline of cross bar or touch bar.

7. Emergency Access Door Stops: 60 inches from finish floor to centerline to stop.
8. Door Closers:
   a. Degree of door swing as indicated in Hardware Schedule approved by Architect, or if not indicated, locate to permit maximum door swing.
   b. Locate on interior side of exterior doors.
   c. Locate on stair side of doors at stairways.
   d. Locate on room side for doors in public areas, corridors and other similar areas.
9. Door Pulls (Mounted Independently): Centerline of grip at 42 inches above finish floor, centered between door edge and glazed opening, or centerline of pull 3 inches from door edge if door is not glazed.
10. Push Plates (Mounted Independently): Centerline 45 inches above finish floor, centered between door edge and glazed opening, or 2 inches from plate edge to door edge if door is not glazed.
11. Wall Stops: Place on adjacent wall at height to contact knob, lever or pull.
12. Wall Stop/Holders: Place on adjacent wall immediately above base materials positioned such that door will strike bumper and prevent door hardware from hitting wall. Place within 3 inches of latch edge of door.
13. Floor Stops and Floor Stop/Holders: Place to permit maximum swing of door and to prevent door hardware from hitting wall. Place within 3 inches of latch edge of door, and out of foot traffic.
14. Kick Plates and Armor Places: Mount on push side, 1/8 inch above bottom edge and centered.
15. Stretcher Plates: Mount on push side, top edge 36 inches above finish floor and centered.
16. Mop Plates: Mount on pull side, 1/8 inch above bottom edge and centered.
17. Electrical Strikes: Installed to position lockset knob or lever 38 inches above finish floor.
18. Existing Frames: Hardware locations to match existing conditions where new doors are installed in existing frames.

3.4 ADJUSTMENT AND CLEANING

A. Adjust and check each operating item of hardware and each door to ensure proper operation of function of every unit.

B. Lubricate moving parts with graphite type lubricant unless otherwise recommended by the hardware manufacturer.

C. Ensure weatherstripping and seals do not inhibit closing and positive latching of door.

D. Replace defective materials or units which cannot be adjusted to operate as intended. Reinstall items found improperly installed.

E. Replace or re-hang doors which are hinge bound and do not swing or operate freely.

F. Remove and replace doors which are warped, twisted or which are not in true planes.

G. Replace factory finished doors damaged during installation. Refinish or replace field finished doors damaged during installation.

H. Prior to date of Substantial Completion, readjust and relubricate hardware items as necessary.

3.5 FINAL ADJUSTMENT

A. Wherever hardware installation is made more than 30 calendar days prior to date of Substantial Completion of a space or area, return to the work during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment, spring power, back check, closing and latching speeds, and handicap requirements.

B. Instruct Owner's personnel in proper adjustment of hardware during the final adjustment of hardware.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass for hollow steel doors.
   2. Glass for wood doors
   3. Requirements for glazing at aluminum storefront windows
   4. Glazing schedule at the end of the Section.

B. Related Sections:
   1. 081113 - Hollow Metal Doors and Frames: Doors and frames to receive glazing.
   2. 081400 - Wood Doors: Doors to receive glazing

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American National Standard (ANSI): Z97.1 - Performance Specifications and Test Methods for Safety Glazing Materials in Buildings.

B. American Society for Testing and Materials (ASTM):
   1. C1036 - Standard Specification for Flat Glass.
   2. C1048 - Standard Specification for Heat Treated Flat Glass, Kind HS, Kind FT (Coated and Uncoated).
   3. E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
   4. E774 - Specifications for Sealed Insulating Glass Units.

C. Glass Association of North America (GANA): Glazing Manual.

D. National Fire Protection Association (NFPA): NFPA 80 - "Standard for Fire Doors and Windows, 1999 Edition."

E. National Fenestration Rating Council Inc. (NFRC).

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Submittals specified in this Section shall be incorporated into submittal specified in other Sections, where glass is to be provided in those Sections.

C. Product Data: Submit product data on glass, glazing materials, and insulating glass system.

D. Shop Drawings: Show size and thicknesses of glass, proposed "bites" in frames, sizes and locations of blocking, spacers, beads, stops, and edge treatments. Note quality, type, and strength of each light.

E. Warranty:
   1. Submit draft of manufacturer's and fabricator's warranty for Architect's review. Draft of warranties shall be submitted concurrent with glass analysis submittal and shall include all specified inclusions.
   2. Furnish ten year manufacturer's warranty, including coverage of units for seal failure, interpane dusting or misting, and replacement of same, under provisions of Section 017700.
   3. Furnish manufacturer's warranty, including coverage of units against seal failure, or interpane dusting or misting; term of warranty as follows.
      a. Vertical Applications: Ten years.

1.4 QUALITY ASSURANCE

A. Comply with pertinent recommendations in the GANA "Manual of Glazing."

B. Qualifications of Glass Manufacturer: Provide glass produced by a nationally recognized manufacturer of high efficiency glass.

C. Qualifications of Glazers: Provide personnel thoroughly trained and experienced in the skills required, and at least one person completely familiar with the referenced standards and the requirements of this Work, who shall personally direct installation of glazing materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable provisions of Section 016000.

B. Provide cushions at edges of glass to prevent impact damage during shipment and storage.

C. Keep vacuum cups free from foreign material that could scratch glass.

D. Comply with insulating unit fabricators requirements for limits on exposure to reduced barometric pressure during shipment.

1.6 WARRANTY

A. Submit warranties under provisions of Section 017700.

B. Reflective Coating Warranty: Furnish ten year warranty from the glass manufacturer agreeing to replace glass units which have defective reflective coating. Defective coating is defined as peeling, discoloration, or other forms of deterioration to the reflective coating.

PART 2 - PRODUCTS

2.1 GLASS

A. Furnish the following glass in combinations as scheduled at the end of this Section:
   1. Clear Glass: ASTM C1036, Type I, class 1 (clear), quality Q3 glazing select.

2.2 ACCESSORIES

A. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness; 4 inches long x 1/4 high x width as required for application indicated.

B. Weather Glazing Sealant: Compatible with insulating glass seal.

C. Butt Glazing Sealant: Dow-Corning "999A;" clear.

D. Glazing Tape (Interior): Norton "V-980," PTI "303," or approved. Size: 1/8 inch by 1/2 inch.

E. Butyl Tape: As manufactured by Tremco.

2.3 FABRICATION

A. Tempered and Heat Strengthened Glass:
   1. Tempered Glass: ASTM C1048, FT; glass which has been heat treated to strengthen glass in bending to not less than 4 times the annealed strength; certified safety glass in accordance with ANSI Z97.1.
   2. Heat Strengthened Glass: ASTM C1048, HS ; glass which has been heat treated to strengthen glass in bending to not less than 2 times annealed strength.
   3. Fabricate tempered and heat strengthened glass units so that principle distortion will be in the horizontal direction in the finished installation.
   4. Unless otherwise approved by the building official, provide manufacturer's label on each light, indicating type and thickness of glass.
   5. Comply with IBC requirements for identification and labeling of safety-glazing materials in hazardous locations subject to human impact loads.

6. Fabrication Process: Horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Insulating Glass Units:
   1. Dual lite units fabricated from glass as scheduled; 1/2 inch nominal airspace; dual seal system.
   2. Twin seals; polyisobutylene primary seal and silicone secondary seal. Outer seal shall be compatible with glazing system.
   3. Spacer Bar: Mill finish aluminum; fill with desiccant; corners shall be partially miter cut and bent (not cut through), or formed with corner keys ultrasonically soldered in place.
   4. Certified through the Insulating Glass Certification Council (IGCC) in accordance with ASTM E773 and E774; certified to level CBA.
   5. Each piece shall bear certification number, date, and manufacturer's identification mark.

C. Laminated Glass (PVB):
   1. Two layers of glass as scheduled with a minimum .030 inch thick vinyl interlayer. Use .060 thick vinyl interlayer at skylight conditions with heat treated glass.
   2. Film:
      a. Manufacturer: Solutia Inc. (St. Louis, MO; 877-674-1233; 314-674-1000).
      b. Type: Polyvinyl butyral sheets, uniform in color, specifically manufactured for use in fabrication of laminated glass sheets, ultraviolet stabilized, uniform thickness as specified.
      c. Translucent Laminating Film: C003 "Pure White" minimum 0.030 inch thickness.

D. Low E Coating: High performance type; applied by using sputtered deposition technology.
   1. Basis of Design: PPG (Pittsburgh PA; 412-434-2858) "Solarban 60."
   2. Acceptable Substitution: Viracon (Otawana MN; 800-533-2080) "Solarscreen 2000."

E. Edge Treatment:
   1. Glass Edges to be Exposed in the Finished Work: Pencil edge, polished.
   2. Glass Edges Indicated for Exposed Silicone Sealant Treatment: Ground edge, seamed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.

3.2 PREPARATION

A. Clean contact surfaces and wipe dry.

B. Seal frame corner joints, and other leakage points with sealant. At insulating glass units the sealant shall be compatible with the seal of the unit. Do not plug weep holes.

C. Prime surfaces scheduled to receive sealant, unless otherwise recommended by the sealant manufacturer.

3.3 INSTALLATION

A. Setting Blocks: Place setting blocks in frames for support of glass. Place at quarter points unless approved otherwise.

B. Set glass tightly in position with proper clearances in accordance with the referenced standards.

C. Perimeter glass clearances within setting frame shall be in accordance with GANA recommendations, and as required by the glass manufacturer to provide for wind, earthquake drift, and thermal expansion.

D. Unless specified otherwise, glaze units with gaskets furnished with the framing systems specified in other sections.

E. Glazing for Interior Non-Rated Doors and Windows, Where Gaskets Are Not Furnished:
   1. Glaze with glazing tape.
   2. Pre-measure and cut tapes to required lengths; adhere to fixed stops, setting horizontal tape at heads and sills before vertical tape.
   3. Install tape with tight butt joints; no overlaps will be accepted. Set tape with straight lines level with frame sight line.
   4. Position glass, uniformly sealing against tape. Install inside removable stops and place tape in stops forming a uniform seal against glass, level with sight lines.

F. Glazing for Fire Rated Doors and Windows: Glaze in accordance with NFPA 80, unless required otherwise by the labeling requirement of the frame.

G. Butt Glazing: Install butt glazing sealant as indicated; tool to a smooth concave configuration; remove excess sealant. Provide joint width of 3/8 inch plus or minus 1/8 inch.

H. Adjust glazing materials to form a uniform sight line.

3.4 CLEANING

A. Clean excess glazing materials from adjacent finished surfaces.

B. Remove labels after work is completed.

3.5 GLASS TYPE SCHEDULE

A. The following are the glass types as indicated on the Drawings:
   1. IGU-1:
      a. Insulating glass unit with 1/2 inch air space between two panes of glass as follows:
         1) Exterior Pane: 1/4 inch clear glass with low e coating on #2 surface.
         2) Interior Pane: 1/4 inch clear glass.
   2. GL-1: Minimum nominal 1/4 inch thick clear glass.

B. Provide tempered or laminated glass in hazardous locations to meet the requirements of the jurisdictional code authorities.

3.6 GLASS LOCATION SCHEDULE

A. IGU-1: All exterior locations unless otherwise indicated

B. GL-1: All interior applications unless otherwise indicated.

END OF SECTION

SECTION 089100 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior architectural metal louvers.

B. Related Sections:
   1. 061000 - Rough Carpentry: Support framing
   2. 079200 - Joint Sealants: Perimeter joint fillers.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. Air Movement and Control Association (AMCA)

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of AMCA certified louvers with minimum three years experience.

B. Structural Design: Design louvers and anchorage systems to resist wind loads as indicated on the structural drawings, but in no case less than 25 psf acting perpendicular to the plane of the louver assembly, without permanent deformation or damage. Design for a maximum deflection of 1/180 the span.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Shop Drawings. Show louver configurations, and details indicating relation to adjacent construction.

C. Submit product data on preassembled louvers describing design and performance characteristics, free area, materials, and finishes.

D. Certification: Submit certification that the louver systems have been designed to meet the structural requirements specified.

1.5 PROTECTION

A. Protect louvers and finishes from damage during delivery and installation.

B. Protect adjacent surfaces, finishes and materials from damage during installation of louvers.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Approved Manufacturers, subject to the specified requirements:
   1. The Airolite Company (Marietta OH; (740-373-7676).
   2. The C/S Group / Construction Specialties Inc. (Cranford NJ; (908-272-5200).
   3. Ruskin Manufacturing Div of Philips Industries, Inc.(Grandview MO (816-761-7476).
   4. Airline Products Company, Hagerstown, MD (302-745-8833).

B. Description:
   1. Fixed continuous louver design with hidden mullions; drainable. Provide blade braces as necessary for a straight non-sagging louver blades.
   2. Storm rated.
   3. Minimum 0.081" thick extruded aluminum blades and frames. Provide additional thickness as necessary to meet structural requirements.

4. 4 inch blade depth.
5. Free Area: Minimum 50% for 4 x 4 ft. unit.
6. AMCA certified rating.
7. Maximum 0.01 oz/sq ft. water penetration at 700 fpm air velocity, when tested in accordance with AMCA Standard 500.

2.2 ACCESSORIES

A. Insect Screen: 16 x 18 mesh fiberglass insect screen, set in aluminum frame. Furnish with provision for screw attachment.

B. Fasteners: Aluminum or stainless steel.

C. Concealed Supports: Prefinished aluminum or hot-dipped galvanized steel.

D. Operating Hardware: Non-ferrous; select hardware for a smooth operating and secure installation.

2.3 FABRICATION

A. Fabricate louvers to the special shapes as indicated on the drawings.

B. Finishes: 70 percent Kynar 500 or Hylar 5000 resin coating; manufacturers standard color as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that openings affecting this work are properly prepared and that opening dimensions are as required.

3.2 INSTALLATION

A. Install louvers in openings properly aligned and level. Install in accurate alignment with other exterior cladding elements.

B. Secure louver rigid with semi-concealed fasteners. Flash exterior louvers to drain.

C. Secure bird screen behind the open portions of each louver.

D. Clean surfaces and joints.

E. Coordinate with Section 079200 for installation of sealants.

END OF SECTION

SECTION 092843 - GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Gypsum sheathing.

B. Related Sections:
   1. 061000 - Rough Carpentry: Stud Framing.
   2. 092900 - Gypsum Board: Interior gypsum products.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C1177 - Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   2. C1278 - Standard Specification for Fiber Reinforced Gypsum Panel

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Product literature on gypsum sheathing and screw fasteners.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gypsum Sheathing: One of the following:
   1. G-P Gypsum Corporation "Dens-Glass Gold"; glass mat faced; ASTM C1177; 5/8 inch thickness.
   2. Certainteed. "GlasRoc"; glass mat faced; ASTM C1177; 5/8 inch thickness.
   3. USG "FIBEROCK® Brand Sheathing with Aqua-Tough™"; ASTM C1278; 5/8 inch thickness.

B. Exterior Sheathing Screws: Complying with ASTM C1002, C954, and the following:
   1. Self-drilling, self-tapping, Type S-12, bugle head, minimum length of 1-1/4 inch for 1/2 inch and 5/8 inch boards.
   2. Organic-polymer, ceramic, or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   3. Approved Product: Hilti (www.us.hilti.com) 6 x 1-1/4 inch “PSH SD HCR Sheathing Screws”, item No. 00413489.

C. Joint and Penetration Sealant: Dow Corning 795 Building Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that framing is ready for installation of sheathing.

3.2 GYPSUM SHEATHING INSTALLATION

A. Install boards parallel or perpendicular to framing. Install boards parallel to framing at fire rated walls. Apply sheathing with joints staggered. All edges shall be firmly supported.
   1. Maximum span: 24 inches.
   2. Maximum cantilever: 2 inches..

B. Install sheathing with coating towards exterior.

C. Screw to framing. Space fasteners 8 inches o.c. in field and 4 inches o.c. at ends along each framing member.

D. Do not bridge expansion or seismic joints.

E. Coordinate with Division 26 work for cutouts for electrical penetrations.

F. If sheathing is not to be covered by finish material within 6 months after purchase, cover the material as necessary to maintain the manufacturer's warranty.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.

B. Related Sections:
   1. 061000 – Rough Carpentry: Support framing for gypsum board.
   2. 072100 - Thermal Insulation.
   3. 092200 – Lightgage Metal Support Framing Support framing for gypsum board; tolerance requirements.
   4. 098100 - Acoustic Insulation.
   5. 099000 – Painting and Coating

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
   2. C1002 - Steel Drill Screws for the Application of Gypsum Board.
   3. C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
   4. C1395 - Specification for Gypsum Ceiling Board
   5. C1396 - Specification for Gypsum Board
   6. D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

B. Gypsum Association (GA):
   1. GA-214 - Recommended Levels of Gypsum Board Finish.
   2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

C. Northwest Wall and Ceiling Bureau (NWCB): LFGB-398 - Recommended Levels for Finishing of gypsum Board.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Submit complete manufacturer's product literature and installation instructions for each of the materials used.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Registered with the Northwest Wall and Ceiling Bureau.

B. Perform work in accordance with GA 216, unless specified otherwise, or required otherwise to meet fire rating requirements.

C. Regulatory Requirements:
   1. Provide assemblies meeting the hourly fire ratings indicated and specified. Assemblies shall be approved by the local jurisdictional authorities.
   2. Fire rating requirements take precedence over the construction requirements indicated. In the event of conflict, notify the Architect, and do not begin construction in the area of conflict until the conflict has been resolved.

D. Assembly Instructions: Contractor shall keep at the site and make available to installers a copy of the following:
   1. Installation requirements for each fire rated assembly.
   2. GA 216.

E. The work of this Section is subject to special fire rated construction joint assembly requirements specified in Section 078500.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD MATERIALS

A. Furnish boards of maximum permissible length for type of installation indicated, tapered edge for boards to be exposed, taped and finished; square edge for boards in concealed applications; 5/8 inch thick unless noted or specified otherwise; furnish type X for fire rated partitions.

B. Types:
   1. Standard Board, Backing Board, Exterior Water Resistant Soffit Board: ASTM C1396; 5/8 inch thickness unless otherwise indicated.
   2. Ceiling Board: ASTM C1395; sag resistant.

2.2 ACCESSORIES

A. Resilient Channels: Unimast Inc. "RC Deluxe Resilient Channel"; 25 gage x 1/2" x 2-1/2"; provide 3/8" x 3" slots at 4 inches o.c. in web.

B. Interior Gypsum Trim:
   1. Conform to GA 216, unless indicated or specified otherwise.
   2. Concealed flange crimp-on or tape-on type; metal or PVC at Contractor's option.
   3. Control Joint Trim: USG 093 or approved.
   4. Reveal Moldings: Fry Reglet Co. , Pittcon Industries, Inc., Gordon Inc, or approved; aluminum extrusions with taping flanges; shapes as indicated.

C. Joint Compound, Tape, and Finishing Compound: ASTM C475; furnish setting type joint compound for use at water resistant board.
   1. Typical: USG "SHEETROCK Brand Taping, All-Purpose, and/or Topping Compound," or approved.
   2. Setting Type: USG "SHEETROCK Brand Easy Sand Setting-Type Joint Compound," or approved.

D. Proprietary Skim Coat: USG "Tuff-Hide Sheetrock Brand Primer-Surfacer."

E. Screws: ASTM C1002; galvanized or polymer coated at exterior locations; maximum 1 inch length for attachment to resilient channels.

F. Fire Rated Joint Compound: As specified in Section 078500.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin work until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA 216, and fire rated assembly requirements.

B. Resilient Channels: Install channels at 24 inches o.c. with screws through pre-punched holes into framing.

C. Erect wallboard so that edges and corners are firmly supported.

D. Use screws to fasten gypsum board to metal furring or framing. Adhesive application of gypsum board may be used if it is in accordance with the manufacturer's recommendations and meets fire rating requirements.

E. For screwing wallboard into resilient furring, use 1 inch screws. Do not drive screws into framing.

F. Double Layer Applications:
   1. Use backing board or standard board for first layer.
   2. Offset joints of second layer from joints of first layer.

G. Trim:
   1. Use longest practical lengths, with no piece less than 2 feet long for continuous runs greater than 8 feet. Securely fasten and align trim ends at joints.
   2. Place concealed flange corner beads at external corners. At angles other than 90 degrees, bend the flange to conform to the angle.
   3. Place concealed flange type L trim where gypsum board abuts dissimilar materials.
   4. Use J trim at exposed gypsum board edges, (including light coves) and at joints where sealant is indicated.

H. Allow a 1/2 inch gap where gypsum board extends to overhead structure and deflection provisions are incorporated into lightgage metal framing. Do not fasten gypsum board to top runner. [Where the ceiling is exposed in the finished work, finish top edge with a casing bead, and caulk with acrylic sealant as specified in Section 079200.

I. Sealant Joints:
   1. Coordinate installation of firestopping and sealants at concealed joints between partitions and structure at fire rated and acoustically insulated partitions.
   2. Where sealant joints are indicated at ends or edges of wallboard, install for uniform 1/8 inch joint, unless otherwise indicated. Installation of sealant in exposed locations is specified in Section 079200.

J. Provide water resistant gypsum board at walls in restrooms, toilets, shower rooms, janitor closets and other areas subject to similar damp conditions.

K. Install required number of layers of wallboard behind panel boards, fire extinguisher cabinets, and other recessed elements as necessary to maintain fire rating of walls.

L. Fire Rated Construction:
   1. At heads of fire rated metal stud and gypsum board partitions, install gypsum board in accordance with the fire rated assemblies specified in Section 078500.
   2. Fill joints between gypsum board surfaces and adjacent construction with fire rated joint compound in accordance with the requirements of the fire rated construction joint assembly manufacturer.
   3. Provide continuous fire rated assemblies. Where adjacent construction interrupts fire rated assemblies, provide additional construction as necessary to maintain the continuity of fire rated assemblies.

3.3 CONTROL JOINTS

A. Discontinue gypsum board and use control joint trim at control joints.

B. Coordinate with the framing installer to ensure that framing is installed immediately on either side of each control joint.

C. Space control joints as indicated. When not indicated, locate as follows:
   1. At maximum 30 foot intervals along continuous wall planes.
   2. At maximum 50 foot intervals at continuous ceilings with perimeter relief.
   3. At maximum 30 foot intervals at continuous ceilings without perimeter relief.

4. At locations where expansion or control joints occur in the building structure.
5. Locate control joints to form rectangular or square sections, in "L," "U," "T," or other irregularly shaped areas.
6. Position control joints to intersect light fixtures, air diffusers, door openings, and other areas of stress concentration.
7. Coordinate with Section 092200 for special requirements at fire rated assemblies.

D. Verify location with the Architect prior to installation. Give the Architect a minimum of 48 hours notice.

3.4 FINISHING

A. Provide finishing in accordance with GA 214.

B. Where necessary to sand, do so without damaging the face of the gypsum board.

C. Levels of Finish:
1. Level 5: Not Used
2. Level 4: Typical, unless indicated or specified otherwise.
3. Level 3: Provide at the following locations:
   a. Surfaces to receive fabric wall covering.
   b. Surfaces to receive textured finishes.
4. Level 2: Provide at the following locations:
   a. Storage rooms.
   b. Mechanical rooms.
   c. Janitors closets.
   d. Surfaces to receive tile or other thick finish materials applied to gypsum board surfaces.
5. Level 1: Provide at the following locations:
   a. Surfaces of fire rated assemblies concealed from view in the finished work (“fire-taping”).
   b. Surfaces of acoustical assemblies concealed form view in the finished work
6. Level 0: Provide at surfaces of non-fire rated assemblies concealed from view in the finished work, including surfaces to be covered by casework, wood paneling,

D. Level 4 finishes: Return to the site after primer is applied, and touch-up surface defects.

E. Patch and finish existing gypsum board surfaces to match new surfaces. Finish to nearest joint, corner, or other break line.

3.5 TOLERANCES

A. Install gypsum board with 1/8 inch in 10 feet maximum variation from plane in any direction.

END OF SECTION

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior wall tile.
2. Interior floor tile.
3. Reinforced waterproof membranes.
4. Crack isolation membranes.
5. Tile backing board.
6. Screeds.
7. Sealer.

B. Related Sections:
1. 030013 - Building Concrete: Substrate.]
2. 079200 - Joint Sealants: Expansion joint fillers.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
1. A108.1 - Ceramic Tile Installed with Portland Cement Mortar.
2. A108.5 - Installation of Ceramic Tile With Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
3. [A108.6 - Installation of Ceramic Tile With Chemical-Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.]
4. A108.10 - Installation of Grout in Tilework.
5. [A108.13 - Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.]
6. [A118.3 - Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy.]
7. A118.4 - Latex-Portland Cement Mortar.
8. [A118.10 - Standard for Load Bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.]
9. A137.1 - Ceramic Tile

B. American Society for Testing and Materials (ASTM):
1. C144 - Aggregate for Masonry Mortar.
2. C150 - Portland Cement.
3. C206 - Finishing Hydrated Lime.
4. C207 - Hydrated Lime for Masonry Purposes.]

C. Tile Council of North America (TCNA):
1. Handbook of for Ceramic Tile Installation, current edition.
2. 137.1- Recommended Standard Specifications for Ceramic Tile.

1.3 DEFINITIONS

A. Expansion Joints: Unless otherwise detailed, expansion joints in tile fields are sealant-filled joints to accommodate expansion and contraction of tile and possible substrate movement at slab control and construction joints.

B. Reinforced Waterproofing Membrane: Proprietary waterproofing membrane system installed in combination with tile application, as part of the ceramic tile work.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for each type of [tile], grout, adhesive, additive, accessory, and membrane specified.

C. Shop Drawings: Indicate general layout, surrounding construction, location of expansion joints in substrates and tile fields, edge details, and special conditions.

D. Samples:
1. Tile: Submit samples of each type and color of tile. Include representative range of colors and finishes to be expected.
2. Grout: Submit cured samples of each grout color. [Furnish 2 cured samples of approved grout colors to the expansion joint sealer installer for color matching.]
3. [Screeds: Submit samples of each type and finish of screed; minimum 3 inch length.]
4. [Slip Resistance Treated Tiles] Three samples of each type of tile proposed for treatment, with treatment applied.]

E. Schedule: Submit a schedule of each tile type, grout, and joint width combination proposed.

F. Certifications: For each type of tile specified, submit master grade certificates prior to the arrival of the shipment to the job site.

1.5 QUALITY ASSURANCE

A. Conform to ANSI Standard Specifications for the Installation of Ceramic Tile.

B. Mock-Up
1. Provide mock-up in accordance with 014500.
2. [Floor Tile Mock-up: Commence installation of one approximately 5 x 5 foot section of interior floor tile in a location as directed by the Architect.]
3. [Approved mock-ups may be incorporated into the work.]

C. Pre-Installation Conference:
1. In accordance with Section 013119, schedule and administer a meeting to review and discuss the tile installation a minimum of one week (7 calendar days) prior to start of setting tile.
2. Require in attendance, the Architect, the tile installer, and other parties affected by work of this Section.
3. Agenda: Address installation scheduling and procedures, coordination, preparation and protection requirements, grout and expansion joint locations, tile quantities required, material and installation tolerances, overage required for waste, overage for maintenance stock, sealant joint locations.

D. [Tile backing board shall be in compliance with City of Los Angeles Research Report 23950 or 24566, or as otherwise accepted by the City of Los Angeles.]

E. [Tile backing board shall be in compliance with applicable City of Los Angeles Research Report(s) as indicated on the Drawings, or as otherwise accepted by the City of Los Angeles.]

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.7 [GUARANTY

A. In accordance with Section 017700, furnish from the tile installer, a two year written guaranty, executed to the Owner, against defects in workmanship and materials.]

1.8 MAINTENANCE

A. Extra Stock: Furnish minimum [1][ ]percent of the quantity of each type of tile used in the work,

B. Leave extra stock at site where directed, in clearly marked sealed cartons.

C. Tile which is used to satisfy extra stock requirements shall be free of damaged tiles, seconds, or tile which is not in conformance with these specifications.

PART 2 - PRODUCTS

2.1 TILE

A. Tile Types: Types as indicated on the drawings.

B. Special Shapes: Unless otherwise indicated or specified, furnish special shapes as standard with the tile manufacturer for uniform transitions and concealed edges in the finished installation. Special shapes include bullnoses, double bullnoses, corner bullnoses, and cove assemblies.

2.2 ACCESSORY MATERIALS

A. Setting Materials:
1. Thinset Mortar: Latex modified; "Kerabond" with "Universal Keralastic" by Mapei Corp., "211 Crete Filler Powder" with "4237 Latex Thin-set Mortar Additive," by Laticrete International, Inc., ["317 Floor and Wall Thin Set Mortar" with "3701 Latex Mortar Admix," by Laticrete International, Rapid-Set Thin Bed Mortar: Latex modified; "Grani/Rapid" with "KER 318" Flexible Admixture" by Mapei Corp., Hydroment "Single Flex FS," by Bostik, or "211 Crete Filler Powder" with "4237 Latex Thin-set Mortar Additive" and "101 Rapid Set Latex"(proportions as recommended by the manufacturer for the setting time required)," by Laticrete International, Inc..
2. Medium Bed Mortar: "Grani/Rapid" by Mapei Corp., Hydroment "Medium Bed Mortar" by Bostik, or "226 Thick Bed Mortar Mix" with "3701 Latex Mortar Admix," by Laticrete International, Inc., or approved.
3. Rapid Set Medium Bed Mortar: "Grani/Rapid" by Mapei Corp., or "211 Crete Filler Powder" with "3701 Latex Mortar Admix" and "101 Rapid Set Latex"(proportions as recommended by the manufacturer for the setting time required), by Laticrete International, Inc., or approved.
4. Thick bed Mortar:
   a. Cement: ASTM C150, Type I.
   b. Hydrated Lime: ASTM C206, Type S, or ASTM C207, Type S.
   c. Sand: ASTM C144.
   d. Water: Clean and free from amounts of matter deleterious to setting bed materials.
   e. Proportioning: In accordance with TCNA Handbook.
5. Epoxy Mortar: Hydroment "Color-Poxy" by Bostik, or "Latapoxy 300" by Laticrete International, Inc., or approved; ANSI A118.3.

B. Cementitious Sanded Grout:
1. Fast Setting: "Ultra/Color" by Mapei Corp., "Floor Joint and Grout Filler" with "3701 Latex Mortar Admixture" and "101 Rapid Set Latex", by Laticrete International, Inc. (proportions as recommended by the manufacturer for the setting time required); sanded, except unsanded at joints scheduled at 1/16 inch wide.
2. Standard Grout: ["Ultra/Color" by Mapei Corp.], "Keracolor S" by Mapei Corp., or "1500 Series Sanded Grout" with ["1776 Grout Admix Plus"]["101 Rapid Set Latex"], by Laticrete International, Inc., Hydroment"Ceramic Tile Grout /Joint Filler" with "425 Flexible Grout Admixture" by Bostik; sanded, except unsanded at joints scheduled at 1/16 inch wide.
3. Colors: As selected by the Architect from the manufacturer's standard line.

C. Cementitious Unsanded Grout:
1. Standard Grout: "Keracolor U" by Mapei Corp., or "1600 Series Unsanded Grout" with ["1776 Grout Admix Plus"]["101 Rapid Set Latex"], by Laticrete International, Inc., Hydroment "Ceramic Tile Grout /Joint Filler" with "425 Flexible Grout Admixture" by Bostik.
2. Colors: As selected by the Architect from the manufacturer's standard line.

D. Epoxy Grout: Mapei "Kerapoxy," Bostik Hydroment “100% Solids Epoxy Grout,” Laticrete International Inc. "Latapoxy SP100," or approved. Colors as selected from manufacturer's standard.

E. Tile Waterproofing Membrane: Conform to ANSI 118.10; one of the following.
1. "NobleSeal TS," by The Noble Company; reinforced CPE sheet membrane.

2. "DalSeal TS." By Dal-Tile Corp.
3. "Mapelastic" ("PRP 315") by Mapei Corp.
4. "Laticrete 9235," by Laticrete International.
5. "RedGard Waterproofing and Crack Prevention Membrane" by Custom Building Products
6. [Mer-Krete B.F.P. by Mer-Kote Products, Inc.]

F. Crack Isolation Membrane: One of the following.
1. "NobleSeal CIS," by The Noble Company; reinforced CPE sheet membrane; 36" width; NobleBond 21 adhesive.
2. "Dal-Seal CIS." By Dal-Tile Corp.
3. "ECB Membrane," by N.A.C. Products Inc.; self bonding reinforced modified asphalt sheet membrane; 36" width.
4. "Mapelastic SM" by the Mapei Corp.

G. Tile Backing Board and Accessories:
1. Cementitious Backing Board: 1/2 inch nominal thickness aggregated portland cement panel, reinforced with glass fiber mesh; "Durock Brand Cement Board" by USG (800-874-8968, "Wonderboard" by Custom Building Products (800-272-8786)], or approved.
2. Gypsum Backing Board: Georgia Pacific (800-225-6119) "DensShield,"or approved; 5/8 inch thickness.
3. Joint Tape: Open weave glass mesh joint tape, self-adhesive; 2-1/2 inches wide.
4. Fasteners: As recommended by the backing board manufacturer; thread forming self-drilling wafer head screws; polymer coated or zinc plated; USG "Durock Screws," "Rock-On," or approved.

H. Metal Screed: As manufactured by Schlüter Systems, Inc. (800/225-8902), Ceramic Tool Company, (800/236-5230), or Blanke Corporation (800/787-5055); [solid brass][clear][brass][anodized aluminum]tile edging trim; sizes as required for installation of top of screed flush with top of tile, as detailed.]

I. [Reinforcing Mesh: 2" x 2" x 16/16 gage welded wire mesh or approved.]

J. [Vapor Barrier: Minimum 4 mil polyethylene.]

K. [Curing Paper: Fortifiber "All Purpose Building Paper," or approved; [available from Zellerbach, Seattle, WA (206/764-5000)]; do not use polyethylene or products containing bituminous materials.]

L. [Fasteners: Cadmium plated, type as required for application indicated.]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify that locations of expansion joints, control joints, and construction joints in substrate correspond to tile expansion joint locations.

D. Where cementitious backing board is indicated as substrate for wainscot, shim as necessary to align with gypsum board above.

3.2 PREPARATION

A. Clean substrate surfaces free of grease, dirt, dust, organic impurities, and other materials which would impair bond. Where curing agents have been used mechanically abrade or shotblast substrate surface.

3.3 TILE BACKING BOARD INSTALLATION

A. Use cementitious backing board, except where gypsum backing board is indicated.

B. Install in accordance with the manufacturer's installation instructions.

C. Install units with edges firmly supported.

D. Screw attach units with 1 inch long drywall screws spaced 6 inches on center along framing.

E. Install fiberglass reinforcing tape at joints between panels. Completely embed in a thin set mortar bed. Trowel mortar smooth with adjacent surfaces.

F. Where cementitious tile backing board is indicated as substrate for wainscot, ensure that backing board has been properly shimmed to align with gypsum board above.

3.4 CRACK ISOLATION MEMBRANE

A. Install crack isolation membrane in accordance with the manufacturer's instructions, unless indicated or specified otherwise.

B. Provide crack isolation membrane at following locations:
   1. At control and construction joints in concrete floors.
   2. At changes in substrate materials.
   3. On each side of building floor joint cover assemblies installed in grouted pockets; extend a minimum of 12 inches beyond grouted pocket.
   4. Shrinkage cracks 1/16 inch or larger in slabs as directed by the Architect

C. Extend a minimum of 12 inches each side of crack or joint.

D. Do not apply crack isolation membrane at joints which will be reflected as expansion joints in the tile.

E. Omit crack isolation at floors indicated for waterproof membrane.

F. Substrate Examination:
   1. Substrates are subject to examination by the Owner and the Architect prior to installation of tile or slab leveling materials. Furnish a minimum of 7 days notice.
   2. The examination will determine the need for additional crack isolation membrane at shrinkage cracks and other special conditions.
   3. Provide additional crack isolation membrane in locations as directed.

3.5 SLAB LEVELING

A. Prior to installation of thinset floor tile, where local irregularities in the substrate surface would prevent level installation of the tile, the substrate shall be brought to plane surface with variations not to exceed 1/8 inch in 4 feet (cumulative) and 1/4 inch in 10 feet (non-cumulative). Smooth abrupt changes in plane.

B. Use thinset mortar or other filler for slab leveling. Other fillers are subject to endorsement by the setting mortar manufacturer. Submit manufacturer's letter of approval to the Architect, and the Owner's Representative.

C. Screed or float to appropriate thickness and specified surface tolerance. Allow to set prior to proceeding with installation. Do not exceed the maximum thicknesses for thin bed mortar as recommended by the manufacturer.

3.6 TILE WATERPROOF MEMBRANE INSTALLATION

A. Install waterproof membranes in strict accordance with manufacturer's installation instructions and in accordance with ANSI A108.13.

B. Install waterproof membranes at [ ].

C. At slab on grade locations, install waterproof membranes only along the perimeter of tile areas. Extend the membrane up the wall and a minimum of 6 inches out onto the floor surface.

D. At above grade locations, install waterproof membrane completely over floor surfaces indicated, and up the wall.

E. Where the waterproof membrane is extended up the wall, extend to one tile height. Do not expose the waterproof membrane to view.

F. Protect waterproof membrane from damage until after tile installation is complete.

G. [Install waterproof membrane into clamping ring of floor drain]

3.7 INSTALLATION OF TILE

A. Interior Floor Application - Thinset over Concrete Substrate and Concrete Substrates with Waterproof Membrane.
   1. TCNA System: F113 or F122 at Waterproof Membranes.
   2. Installation Standard: ANSI A108.5.
   3. Setting Materials: Thinset mortar; 3/32 inch minimum thickness.

B. Interior Floor Application - Thickset Over Concrete Substrate:
   1. TCNA System: F112.
   2. Installation Standard: ANSI A108.1.
   3. Bond Coat: Thinset mortar over thickset mortar bed; 3/32 inch minimum thickness.
   4. Slope the mortar bed evenly to the floor drains.

C. Interior Floor Application - Thinset Epoxy System:
   1. TCNA System: F131
   2. Installation Standard: ANSI A108.6.
   3. Bond Coat: Epoxy mortar.
   4. Slope the mortar bed evenly to the floor drains.
   5. Use this system where tile type F is indicated, except at depressed floor slabs.
   6. Use epoxy grout.

D. Interior Floor Application - Thickset Epoxy System:
   1. TCNA System: F132
   2. Installation Standard: ANSI A108.6.
   3. Bond Coat: Epoxy mortar over thickset mortar bed.
   4. Slope the mortar bed evenly to the floor drains.
   5. Use this system where depressed floor slabs are indicated.
   6. Use epoxy grout.

E. Interior Floor Application: Thinset Epoxy System Over Metal Substrate (Base at walk-in coolers and freezers.):
   1. TCNA System: F131.
   2. Installation Standard: ANSI A108.6.
   3. Bond Coat: Epoxy mortar; minimum 1/8 inch thickness.
   4. Prior to installation clean metal substrate with a mild solution of TSP, and rinse.
   5. Use epoxy grout.

F. Wall Application - Gypsum Board Substrate:
   1. TCNA System: Similar to W243.
   2. Installation Standard: ANSI A108.5.
   3. Setting Materials: Thinset mortar.

G. [Wall Application - Gypsum Board Substrate:
   1. TCNA System: W223.
   2. Installation Standard: ANSI A108.4.
   3. Setting Materials: Organic adhesive.]

H. Wall Application - Tile Backing Board:
   1. TCNA System: Similar to W244.
   2. Installation Standard: ANSI A108.5.
   3. Setting Materials: Thinset mortar.

4. Use vapor barrier behind tile backing board; overlap at joints a minimum of 2 inches; overlap waterproof membrane at base 3/4 inch.

I. [Special Requirements for Thick Mortar Bed:
   1. Apply setting and mortar beds to thicknesses required for ultimate proper alignment of tile surfaces with adjacent floor materials. At carpet, tile shall align with carpet crush line elevation. Compensate for indicated pitches, tile thicknesses, and bond coat thickness.
   2. Install reinforcing mesh at mid depth of thick mortar beds at floors and decks. At ramps formed by tapered setting beds, terminate mesh near low end of ramp; maintain 1/4 inch mortar cover.]

J. Joint Pattern:
   1. Lay out tile pattern prior to commencing tile installation.
   2. Accurately locate grout joints on lines indicated; where not indicated, adjust grout joints within specified tolerances to minimize use of cut tiles at field edges.
   3. Where cut tiles are necessary, position tile such that cut tile at each edge of each rectilinear field is not less than half of a full size unit, unless indicated otherwise.
   4. [Align tile joints across changes in plane, including wall to floor intersections.]

K. Tiles shall be blended as required to avoid pattern repeats and "patches" of adjoining tiles of distinctive color or character within each field area. [Coordinate distribution of tiles with the Architect.]

L. [Tiles which exhibit directional patterns shall be set with grain direction as indicated on the shop drawings, or, if not indicated, as directed by the Architect.]

M. [Install tiles aligned with adjacent finishes, where indicated. Provide mortar fill as necessary for proper alignment.]

N. Except as otherwise indicated, install bullnose tiles at exposed tile edges, including edges adjacent to carpet, edges of planters, external corners, and tops of bases.

O. [Ceramic Tile:]Install coved transition pieces to match horizontal surface tile colors [in restrooms], at intersections of floor tile with walls.]Install tile for square corners at vertical inside corners.

P. Clean joints of mortar to minimum depth of 1/4 inch to allow subsequent grout installation.

Q. [Provide temporary setting buttons and shims as necessary to maintain wall tiles in position until setting mortar has set.]

R. Tolerances:
   1. Joint Width Variation: Plus or minus 25% of the proposed joint width.
   2. Taper: Plus or minus 25 percent from one end to the other.
   3. No portion of a tile surface shall vary more than 1/16 inch above or below an adjacent tile surface.
   4. Install tile fields level to within tolerance specified for finished substrate.
   5. [Tile set on thick mortar beds shall be installed level within 1/8 inch in 10 feet when tested with a straightedge in any direction across the tile field.]

S. Special Requirements for Large Format Tiles (8 x 8 inch size or larger):
   1. Wash backs of each tile to remove dust and soil that would compromise adhesion.
   2. Dampen substrate as necessary to prevent excessive suction.
   3. Key the mortar into the substrate with the flat side of the trowel.
   4. Comb mortar over the previously keyed substrate in one direction using the notch side of the trowel.
   5. Firmly press each tile into the mortar. Press down and move the tile back and forth perpendicularly across the ridges approximately 1/8 to 1/4 inch to flatten the ridges and fill in the valleys of the combed mortar.
   6. Set tiles in accurate alignment.

T. [Ungauged Stone Tile:
   1. Apply mortar to back of each tile by using the box screed method.
   2. A box screed is a jig used to apply mortar to the backside of ungauged stone tile of varying thickness in order to achieve a uniform unit of thickness of the tile and mortar combined.

3. Press and push the tile into the mortar ridges using a slight movement perpendicular to the notched mortar ridges.]

U. Screed Installation:
1. Install screeds at tile field edges at the locations indicated.
2. Accurately cut to length for flush tightly butted joints. Provide miter cut angle joints. Remove burrs at field cuts.
3. Install in longest possible lengths, except that no screed section shall be longer than 12 feet or shorter than 4 feet in length for continuous runs greater than 16 feet.
4. Install screeds free from waves and variations in height, flush with top of adjacent tile surfaces.
5. Set screeds directly in setting bed as the tile installation proceeds. Comply with screed manufacturer's instructions to achieve mortar tightly compacted between screed and tile edge.
6. Grind screed joints as necessary to correct minor misalignment and to ease sharp outside corners.

V. Special Requirements for Restroom Tile:
1. Provide coved base at intersection of floor with walls. Base shall match floor tile color.
2. Provide squared vertical inside corners, with appropriate coved inside angle at base.
3. Provide bullnose at outside corners with appropriate coved outside angle at base.
4. Provide bullnose at exposed edges and top of wainscot.
5. Provide all other special shapes as required for complete and finished installation.

3.8 EXPANSION JOINTS

A. Place expansion joints at maximum 30 foot intervals for interior installations[, and at maximum 15 foot intervals for exterior installations].

B. Place expansion joints at control and expansion joints in concrete slabs, and at intersections with walls and columns.

C. Joint Sizes: Set to match width of typical grouted joint[; but in no case less than 1/4"].

D. Leave expansion joints free of mortar.

E. Sealant materials and installation are specified in Section 079200.

3.9 [POST INSTALLATION SLIP RESISTANCE TREATMENT

A. Schedule: [Treat surfaces as indicated on the Drawings.][Treat [stone] [tile] [_____] [flooring] [and] [paving] at [exterior locations,] [vestibules,] [lobby,] [and] [_____].

B. Preparation
1. Protection: Mask or protect adjacent construction which is not to be treated or which may be damaged by treatment.
2. Surface Preparation: Strip existing waxes and sealers and degrease floors if required. Surfaces shall be "squeaky" clean and thoroughly rinsed.

C. Application
1. Spray apply in accordance with manufacturer's instructions to obtain [specified slip resistance.] [minimum slip resistance of [0.7] [1.0].]
2. Thoroughly rinse chemicals from surface after treatment with water. Drain or extract chemicals and water and allow treated surfaces to dry.
3. Remove masking and protection from adjacent construction.

D. [Field Quality Control: Test treated surfaces in accordance with ASTM C1028. Conduct one test for every [5,000 sq. ft.][_____]treated. [Comply with applicable requirements of Section 014500.]]]

3.10 GROUTING

A. Comply with provisions of ANSI A108.10.

B. Mix grouts in accordance with manufacturer's instructions.

C. Grout joints, except expansion joints, in accordance with the manufacturer's recommendations. Float joints to a slightly concave profile.

D. Remove excess grout from tile surfaces in accordance with the grout and tile manufacturer's recommendations. Do not use excess amounts of water.

E. Protect adjacent surfaces from damage caused by cleaning agents. Do not use cleaners which would damage tile or grout surfaces.

F. Do not grout joints indicated to receive sealants, including inside right angle corner joints between floors and walls of column bases. Grout joints perpendicular to expansion joints shall be finished flush with tile edges.

G. Cured grout joints shall be made free of efflorescence, prior to sealing.

3.11 CURING

A. [Cure installation in accordance with the grout manufacturer's recommendations. Protect tile and grout during curing operations.]

B. [Immediately after grouting and cleaning, wet cure installation with curing paper for a minimum period of 72 hours.]

C. Protect tile surfaces during curing. Keep traffic off tile surfaces for a minimum of 4 days, unless recommended otherwise by the grout or mortar manufacturer.]

D. [Do not allow the operation of walk-in coolers and freezers for a minimum of 14 days after tile installation in these areas.]

E. [Test cured grout, in the presence of the Architect, to confirm complete and proper hydration. Remove and replace with new, grout which fails to cure properly.]

3.12 PROTECTION

A. Protect tile installations from damage, in accordance with Section 015000.

B. Replace damaged tiles.

3.13 CLEANING

A. In accordance with Section 015000 and Section 017700.

B. Coordinate final cleaning with work of Section 079200. Do not begin cleaning operations until tile expansion joints sealants are fully cured.

C. [Prior to substantial completion, w]Wash and thoroughly rinse tile. Leave tile surfaces clean.

3.14 TILE SEALING

A. Apply stain repellent sealer to floor tile, including those with previous treatments, in accordance with the manufacturer's recommendations to achieve maximum penetration into tile body and grouts.

B. Apply sealer at earliest possible date allowed by grout and sealer manufacturer.

C. Wipe tile surfaces after application as necessary to remove visible sealer residue.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspended acoustical ceilings.

B. Related Sections:
   1. 092200 – Lightgage Metal support Framing: Adjacent overhead structure.
   2. 092900 - Gypsum Board: Adjacent wall and ceiling surfaces.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000. Requests for substitution of ceiling panels shall be accompanied by samples of each proposed panel.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A641-98 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   2. C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   3. C636 - Recommended Practice for the Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
   4. E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. International Building Code (IBC)

C. Ceilings & Interior Systems Construction Association (CISCA)
   1. Recommendations for Direct Hung Acoustical Tile and Lay-in Panel Ceilings – Seismic Zones 0-2.
   2. Guidelines for Seismic Restraint Direct Hung Acoustical Tile and Lay-in Panel Ceilings – Seismic Zones 3&4.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Complete published product literature.

C. Samples:
   1. Submit a sample of each type of major suspension system component and acoustical panel.

1.4 QUALITY ASSURANCE

A. Conform to the requirements of IBC, seismic design category D, CISCA 3-4, and the requirements of the jurisdictional code authorities.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature of 60 degrees F, minimum, and humidity of 70 percent, maximum, prior to, during, and after installation.

1.6 SEQUENCING/SCHEDULING

A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Schedule installation of acoustic units after interior wet work is dry.

PART 2 - PRODUCTS

2.1 SUSPENSION SYSTEMS

A. ASTM C635, heavy duty classification; direct hung; exposed "T" design; factory baked on finish to match acoustical panels.
   1. Wall Moldings: 2 inch flange.
   2. Furnish stabilizer bars, splices, edge moldings, and other items as necessary to complete suspended ceiling grid system.

2.2 ACOUSTICAL PANELS

A. Basis of Design: Armstrong Ultima High NRC; 24x48 and 24x24 as indicated.

2.3 ACCESSORIES

A. Suspension Accessories:
   1. Hanger Wire: ASTM A641; soft temper; prestretched; 12 gage; zinc coated.
   2. Carrying Channels: 16 ga x 1-1/2" cold rolled steel; galvanized.
   3. Direct Hang Clip: Similar to Armstrong (877-276-7876) "CBSX Channel Beam Splice"; length as appropriate to application.
   4. Edge Trim: Basis of Design: Armstrong Axiom 2” Edge trim white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

A. Coordinate the location of hangers with other work. Ensure hangers are located to accommodate fittings and units of equipment which are to be placed after the installation of ceiling grid system.

3.3 INSTALLATION OF SUSPENDED CEILING SYSTEMS

A. Install after major above-ceiling work is complete.

B. Install system in accordance with ASTM C636, IBC 1621.2.5 and CISCA 3-4, the manufacturer's instructions, and as supplemented in this Section.

C. Install grid to produce finished ceiling true to lines and levels indicated, within the specified tolerances.

D. Install suspension systems in a manner to support all superimposed loads, with maximum permissible deflection of 1/270 of span. At locations where partitions extend to ceiling, only, install supplementary diagonal bracing to structure at maximum 8'-0" o.c. along length of partition, and above each door hinge and strike jamb

E. Hang system independent of walls, columns, ducts, pipes and conduit. Where ducts or other equipment prevent the regular spacing of hangers, provide secondary carrying members for indirect support of the suspension system, or reinforce the nearest adjacent hangers and related carrying channels as required to span the required distance.

F. Center system on room axis according to reflected ceiling plans.

G. Anchorage:
   1. Provide all anchors required for the installation of the ceiling system.

2. Do not fasten to the upper flutes of metal decking. Do not use fasteners in steel deck which penetrate more than 1 inch.

H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Fabricate edge moldings to fit the surfaces encountered.

I. Form expansion joints as detailed. Maintain visual closure.

J. Fit acoustic lay-in panels in place, free from damaged edges or other defects detrimental to appearance and function. Fit border units neatly against abutting surfaces. Scribe and mill recessed tegular edge into partial border units supported at edge by wall molding.

K. Adjust sags or twists which develop in the ceiling system and replace parts which are damaged or defective.

L. Install hold-down clips to retain panels tight to grid system within 20 ft of an exterior door.

M. Tolerances:
1. Variation from Flat and Level Surface: 1/8 inch in 12 ft.
2. Variation from Plumb of Grid Members Caused by Eccentric Loads: Two degrees maximum.

3.4 CLEAN-UP

A. Remove fingerprints and soil from ceiling materials. Use cleaning materials recommended by the manufacturer of the ceiling materials.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient tile flooring.
   2. Resilient base.

B. Related Sections:
   1. 030013 - Building Concrete: Substrate.
   2. 061000 – Rough Carpentry: Substrate.
   3. 096813 – Tile Carpeting.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. F710 - Preparing Concrete Floors to Receive Resilient Flooring.
   2. F1066 – Standard Specification for Vinyl Composition Floor Tile.
   3. F1861 - Standard Specification for Resilient Wall Base.
   4. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.3 SUBMITTALS

A. Make submittals in accordance Section 013300.

B. Product Data:
   1. Resilient flooring.
   2. Resilient base.
   3. Accessories.

C. Samples:
   1. Each type and color of resilient flooring material; not less than 8"x10" in size.
   2. Each type and color of resilient base scheduled; not less than 12 inches in length.
   3. Submit samples, not less than 12 inches in length, of each type of transition strip required for the work.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers:
   1. Use only skilled and experienced resilient flooring installers for preparation of substrate and installation of resilient flooring.
   2. Helpers and apprentices used for such work shall be under full and constant supervision at all times by thoroughly skilled resilient flooring installers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain minimum 70 degrees F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.

B. Store flooring materials in area of application. Allow three days for material to reach equal temperature as area.

1.7 EXTRA STOCK

A. Deliver 5 percent of each color and pattern of floor material required for project, for maintenance use.

B. Clearly identify each box or roll.

PART 2 - PRODUCTS

2.1 RESILIENT FLOORING

A. Resilient Tile Flooring:
   1. Basis of Design: Tarkett LVT, Wear Layer 32 mil.
   2. Color as selected by Architect from manufacturer's full line.

2.2 RESILIENT BASE

A. Products:
   1. RB-1: Johnsonite Exhibit 4.25" MW-XX-FS 0.25" thick, color as selected by Architect;
   2. RB-2: ASTM F1861, Type TP Thermplastic rubber; 1/8 inch thick; roll stock; coved base; 4 inch height, unless otherwise indicated on the Drawings; by one of the following:
      a. Johnsonite
      b. Roppe Rubber Corp.
      c. Burke Flooring Products / Burke Industries.

2.3 ACCESSORIES

A. Subfloor Filler: Portland cement based latex filler, mixed with water to produce a self leveling underlayment, or cementitious paste, as appropriate to project requirements.

B. Adhesives:
   1. Types recommended by resilient flooring and base manufacturers for specific application.
   2. Adhesives shall meet the requirements of the Southern California South Coast Air Quality Management District (SCAQMD) Rule 1168. (maximum VOC content of 50 grams/liter for floor covering and resilient base adhesives; 60 grams/liter for rubber flooring adhesives).

C. Transition Strips: Aluminum, clear anodized finish; Schluter Transitions or approved alternate.

D. All other materials not specifically described, but required for a complete and proper installation of resilient flooring, shall be only as recommended by the manufacturer of the material to which it is applied and shall be subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site conditions and verify that the work of this Section may properly commence. Notify the Architect in writing of unsatisfactory conditions.

B. Moisture Testing of Concrete Slabs:
   1. Test at all concrete slabs indicated to receive resilient flooring, to determine the vapor emission rate.
   2. Perform tests in accordance with ASTM F1869.
   3. Notify the Architect if tests results show a vapor emission rate which exceeds 3 lbs per 1000 sf in a 24 hour period.
   4. Test kits are available from VAPRECISION 800-449-6194.

C. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

A. Prepare floors in accordance with ASTM F710. Install subfloor filler to fill low spots, cracks,

construction joints, holes and other defects, and as required to adjust level to meet adjacent finishes. Feather to maximum slope of 1/8 inch in 1 foot; float to smooth, flat, hard surface. Prohibit traffic over filler.

3.3 FLOORING INSTALLATION

A. Install all resilient flooring where scheduled in accordance with the manufacturer's recommendations.

B. Unless indicated otherwise, install resilient flooring with joints and seams parallel to building lines.

C. Terminate resilient flooring at centerline of door at door openings where adjacent floor finish is dissimilar, and where no threshold is indicated.

D. Install edge strips at unprotected or exposed edges where flooring terminates.

E. Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints.

F. Clean substrate. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation. Spread only enough adhesive to permit installation of flooring before initial set.

G. Set flooring in place, press with heavy roller to ensure full adhesion.

H. Special Requirements for Resilient Tile:
   1. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.
   2. Unless indicated otherwise, lay tiles parallel to building lines to produce symmetrical tile pattern.
   3. Install with minimum tile width 1/2 full size at room or area perimeter.
   4. Arrange to square grid pattern with all joints aligned.

I. Seal joint between flooring and adjacent materials at restrooms, bathrooms, kitchens, and other moist areas with clear silicone sealant.

3.4 BASE INSTALLATION

A. Adhesive install base materials in accordance with the manufacturer's recommendations.

B. Install base in maximum practical lengths, with minimum number of joints in each run. Fit joints tight, vertical, and in accurate alignment.

C. Install base to walls, columns, and to casework toe kicks in all areas where resilient base is scheduled, and where no other base finish is specifically noted or detailed.

D. Coordinate installation of base with work of Section 096800.

E. Fit joints tight and vertical, in accurate alignment. For straight runs greater than 48 inches, maintain minimum 18 inches between joints.

F. Score back of base material with grooving tool, at all outside corners; maintain minimum leg length 18 inches where wall length permits. Mount base so that scored groove is accurately aligned with corner, and with base tightly adhered to wall at both sides of corner, with no visible gaps at top of base. Where cove base is formed around outside corners, stretch toe of cove for smooth transition around corner, with toe in uniform contact with the finish flooring.

G. Miter or cope inside corners for accurate fit.

H. Scribe and fit to door frames, stairs, and other obstructions.

I. Install straight and level to maximum variation of plus or minus 1/8 inch over 10 feet.

3.5 PROTECTION

A. Unless recommended otherwise by the adhesive manufacturer, prohibit traffic from resilient flooring for 48 hours after installation.

3.6 CLEANING

A. Upon completion of the installation, immediately remove all surplus adhesive from adjacent surfaces.

B. As soon as possible after installation, and in accordance with the timing recommended by the manufacturers, clean the entire resilient flooring surface using the materials recommended for that purpose by the manufacturers of the materials being cleaned.

END OF SECTION

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Seamless polymer flooring system.

B. Related Sections:
   1. 030013 – Building Concrete: Substrate slab finishing; curbs.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C307 - Test Method for Tensile Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
   2. C579 - Test Methods for Compressive Strength of Chemical-Resistant Resistant Mortars and Monolithic Surfacings.
   3. D635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   4. D638 - Test Method for Tensile Properties of Plastics.
   5. D2240 - Test Method for Rubber Property -- Durometer Hardness.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300, unless specified otherwise.

B. Product Data: Submit product data and manufacturer's installation instructions.

C. Samples: Provide one minimum 1"x3" size sample of flooring material, applied to a suitable substrate, indicative of material and finish proposed for the finished work.

D. Submit letter from the manufacturer stating that the installer is approved by the flooring system manufacturer.

E. Maintenance Data: In accordance with Section 017700, furnish manufacturer's instructions covering care and maintenance of flooring.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Acceptable to the primary materials manufacturer, regularly engaged in the installation of polymer floor systems, with minimum three years experience; able to demonstrate successful completion of at least five projects of similar size and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Storage: Store materials in a protected location in strict accordance with the manufacturer's recommendations. Maintain temperature of storage area between 60°F and 90°F.

1.6 ENVIRONMENTAL CONDITIONS

A. Unless otherwise required by the flooring manufacturer, maintain surface and ambient temperature between 60°F and 90°F during installation and for 24 hours after flooring has cured.

B. Maintain ventilation to remove volatile emissions produced during the installation process.

C. Provide uniform and sufficient lighting in areas of installation.

PART 2 - PRODUCTS

2.1 SEAMLESS FLOORING SYSTEM

A. Approved Systems:
   1. "Stoneshield HRI," by Stonhard, Inc.
   2. "Cheminert CFS," by Dex-O-Tex.

B. Flooring System Performance: The installed system shall have the following physical characteristics:
   1. Compressive Strength: ASTM C579; 10,000 psi, minimum.
   2. Tensile Strength: ASTM C307; 2,000 psi, minimum.
   3. Hardness: ASTM D2240/Shore D Durometer; 85-90.
   4. Bond Strength: ACI 503; >400 psi.
   5. Flammability: ASTM D635; self-extinguishing.
   6. Service Temperature: 200°F, minimum, for intermittent service.

C. Topcoat: Manufacturer's standard high performance two component clear epoxy.

D. Aggregate: Proprietary quartz aggregate.

E. Color and Finish: To match Stonehard Standard Texture ["Tweed" 203S].

2.2 ACCESSORIES

A. Cove Strip: 1/4" radius screed with attachment flange for top edge of cove.

B. Sealant: Manufacturer's standard elastomeric urethane sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Moisture Testing of Concrete Slabs:
   1. Perform calcium chloride tests to determine the vapor emission rate from the concrete slab [including slabs above grade]. Notify the Architect if tests results show a vapor emission rate which exceeds [3]lbs per 1000 sq. ft. in a 24 hour period.
   2. Perform a minimum of 3 tests for the first 1000 square feet, and one additional test for each additional 1000 square feet or fraction thereof. Perform no fewer than 2 tests for each separate area to receive flooring.
   3. Test kits are available from VAPRECISION 800-449-6194.

3.2 PREPARATION

A. Shotblast all concrete floor surfaces to receive seamless polymer flooring. Areas not accessible to equipment shall be mechanically scarified.

3.3 INSTALLATION

A. Apply flooring in strict accordance with manufacturer's recommendations. Finish surface shall be smooth and even with no deviations from plane greater than 1/8 inch in 10 feet, and free of depressions subject to puddling. Transitions shall be smooth and gradual.

B. Thickness: 3/16" inch nominal, with minimum thickness 5/32".

C. Pitch to floor drain, with adjoining surface level with grating.

D. Install cove strip 6 inches above finish floor; bed in sealant and screw through to studs. Detail cove base at all wall intersections in accordance with the manufacturer's recommendations; form uniform 1 inch to 2 inch radius cove.

E. After application of base, undercoat, and aggregate, and after undercoat has cured, thoroughly broom clean the floor to remove excess aggregate. Squeegee and backroll sealer in accordance with manufacturer's instructions for "Medium Texture" finish.

F. Seal around equipment bases and floor penetrations.

3.4 CLEAN-UP

A. After installation, clean up excess materials and rubbish.

B. Prior to Substantial Completion, clean the floor surface with cleaning agents recommended by the flooring system manufacturer.

3.5 PROTECTION

A. Adjacent Surfaces: Protect adjacent surfaces and materials from damage. Repair all damage to surrounding surfaces and materials to the satisfaction of the Architect.

B. Protect the installation from damage until final acceptance of the work.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Carpet tiles, glued down to substrate.

B. Related Section: 030013 – Building Concrete: Substrate; slab level tolerances.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing & Materials (ASTM):
   1. D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   2. E648-78 - Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

B. American Association of Textile Chemists & Colorists (AATCC): 134-1975 - Electrostatic Propensity of Carpet.

1.3 SUBMITTALS

A. Make submittals in accordance with provisions of 013300 and 017700, as applicable.

B. Product Data: Submit carpet manufacturer's material specification and installation instructions.

C. Samples: For each color and type of carpet tile proposed for the work, submit two full size carpet tiles.

D. Maintenance Manuals: Furnish Owner with 2 printed copies of the manufacturer's recommendation for the care, cleaning, and maintenance of the carpet, including detailed instructions pertaining to the cleaning and removal of stains.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Specialist in carpet installation employing only skilled craftsmen.

B. Measurement Verification: Measurements shown on the Drawings are approximate. The Contractor's shall verify all dimensions and job site conditions; order sufficient carpet tiles to fully carpet areas as indicated and to fill overage requirements as specified.

C. All carpet of the same type shall be from the same dye lot.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Delivery: Deliver carpet tiles to site in manufacturer's original packages clearly labeled with the manufacturer's name, brand, and related information. Upon receipt of materials, inspect for in transit damage and replace if necessary.

C. Storage: Store in dry, clean, well ventilated space; protect from damage, soiling, fading and moisture.

1.6 JOB CONDITIONS

A. Precondition: Leave carpet tiles in area to be tiled for 48 hours prior to installation.

B. Environmental Conditions: Maintain temperature in space in accordance with carpet or adhesive manufacturer's recommendations, but in no case less than 60 degrees F for 24 hours prior to, during, and after installation. Permit no traffic over newly laid adhesive applied carpet for a minimum of 24 hours after installation.

1.7 WARRANTY

A. Installed carpeting shall be warranted by the manufacturer for a period of ten years from the date of purchase, against wear in excess of ten percent of face weight, backing delamination, edge ravel, and change in dimension, and cup, dome, or dish.

1.8 MAINTENANCE

A. Extra Stock: Furnish extra uncut carpet tile in the amount of 5 percent of the installed quantity of each type and color of carpet tile. Deliver to the Owner in clearly market cartons; store where directed.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis of Design:
   1. Tarkett “Ethos Series” Carpet Tile,
   2. Tarkett Meadowsweet 11365 Stellar's Jay 67508
   3. 18 inch X 36 inch format.

B. Backing: As standard with manufacturer for specified product.

2.2 RELATED MATERIALS

A. Adhesive: W.W. Henry Company "Peach Glue", 3M Company "Blue Glue", or approved waterproof, non-flammable carpet adhesive as recommended by the carpet tile manufacturer for compatibility with carpet backing. Carpet adhesive shall be release type, allowing carpet tiles to be removed and replaced at a later date without damaging or removing the adjacent tile pieces.

B. Floor Transition Strips: Unless otherwise indicated, floor transition strips at all transitions where carpet abuts concrete shall be stainless steel. Furnish Phillips head stainless steel countersunk screws and lead expansion anchors as necessary for anchorage.

C. Latex Underlayment: White premix latex filler, mixed with water to produce cementitious paste. Dependable Chemical Co., Inc. "Dependable White Skimcoat Underlayment" with "Latex Liquid Additive" or W.W. Henry Company "#335 Underlayment Powder" with #336 Latex Liquid Additive."

D. Miscellaneous: Furnish incidental and accessory materials, tools, and equipment required for installation of carpet.

E. Protection Paper: Fortifiber Corporation "Seekure 892," or approved heavy, reinforced, non-staining kraft laminated paper.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Do not start work under this Section until work of other trades, including painting, is substantially completed. Inspect surfaces to receive carpet; do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work constitutes acceptance of surfaces.

B. Preparation: Surfaces shall be dry, firm, sound and free from oil, dirt, paint, joint compound, bond-breaking or curing compounds, or other foreign matter. Surfaces shall be free from unusual roughness and sharp edges such that the installed carpet will present an even, smooth appearance. Damp mop floors with warm water and vacuum after mopping.

C. Cracks: Fill cracks, indents and other imperfections which could interfere with satisfactory installation with latex underlayment, mixed and applied in accordance with the manufacturer's printed instructions. Trowel to smooth surface. Allow underlayment to fully dry before applying carpet adhesive.

D. Moisture Test: Prior to commencement of carpet tile installation, and unless otherwise recommended

by the carpet adhesive manufacturer, conduct standard 16-hour moisture test on concrete floors in accordance with ASTM D4263, at each area to receive carpet tile.

3.2 INSTALLATION

A. Floor adhesive shall be applied in accordance with adhesive manufacturer's recommendations using a roller to ensure 100 percent contact.

B. Installation: Place all carpet tiles in accordance with manufacturer's recommended procedures. Carpet tiles shall be adhesively applied to concrete slab. All carpet tile shall be oriented in the same direction and shall lay completely flat.

C. Lay out area such that cut perimeter tiles will be not less than 8 inches wide. Commence laying tile in center of room or space and work toward perimeters; cut border tile after field tiles have been installed. Cut carpet evenly and accurately to fit neatly at walls, columns, and projections. Lay tile square with area of installation. Joints shall be tight and unnoticeable upon completion.

D. All cutting of carpet for telephone and electrical outlets shall be the responsibility of the carpet installer.

E. Carpet tile installation shall be rolled and rerolled on the day following installation to assure complete transfer of adhesive.

F. Install floor transition strips at terminations where required. Secure strips to substrate with specified anchors, spaced 6" o.c., maximum.

3.3 CLEANING AND PROTECTION

A. Cleaning: Remove all spillage and adhesive from the face of the installed carpet immediately. Use recommended cleaning materials. On completion of installation, the entire carpet area shall be cleaned with an upright beater-type vacuum cleaner.

B. All defective and damaged carpet tiles, improperly cut tiles, and carpet tiles on which there are stains which cannot be completely removed to the satisfaction of the Architect or Owner, shall be replaced with new. The entire installation shall be left clean and free from imperfections.

C. Protection: Following cleaning and vacuuming, protect the carpeting from soiling and damage until final acceptance. In areas where painting or other wet work is to be performed subsequent to carpeting installation, protection shall be accomplished using specified protection paper. Lap edges of paper 6 inches and secure with non-staining tape. The covering shall be kept in repair and damaged portions replaced during the construction period.

END OF SECTION

SECTION 097733 - REINFORCED PLASTIC PANEL WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforced plastic panel wall covering.
   2. Adhesives, sealants, and related accessories.

B. Related Sections:
   1. 092900 - Gypsum Board: Substrate.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM): E84 - Test Method for Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data:
   1. Product literature on adhesives and sealants to be used in conjunction with panel system installation.
   2. Manufacturer's product literature for system components.

C. Samples:
   1. Three samples of wall paneling material proposed for the work; 3 x 4 inch minimum size.
   2. One each of each cap, corner, and division molding proposed for the work; minimum 4 inches in length.

1.4 QUALITY ASSURANCE

A. Panel system shall be USDA approved for use in food preparation and service areas.

1.5 SUBCONTRACTOR GUARANTEE

A. Furnish Subcontractor Guarantees in accordance with Section 017700.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 016000.

1.7 ENVIRONMENTAL CONDITIONS

A. Maintain a minimum temperature of 60 degrees F and relative humidity as prescribed by the adhesive manufacturer, during installation, and until installed adhesive is fully cured.

B. Allow no containers of adhesive to be opened until all potential sources of flame or spark have been shut down or extinguished and until warnings against their ignition during adhesive application have been posted.

C. Provide ventilation to disperse fumes during application of solvent based adhesive.

PART 2 - PRODUCTS

2.1 PANEL SYSTEM COMPONENTS

A. Panel Material:
   1. Manufacturer/Type:
      a. Marlite Brand Class I/A Fire Rated FRP by Marlite (Dover, OH 330/343-6621); color as scheduled in the Finish Legend.
      b. Fire-X Glasbord with Surfaseal, by Kemlite Company (Joliet, IL 800/435-0080); color as scheduled in the Finish Legend.
   2. Panel Type: Fiberglass reinforced polyester panels, with smooth textured face.
   3. Thickness: 3/32 inch.
   4. Size: 48 inches x length required for conditions indicated.
   5. Fire Rating: Maximum 25/450 flame spread / smoke developed in accordance with ASTM E84.

B. Moldings: Manufacturer's standard PVC cap, corner, and division moldings; color to match panels.

C. Adhesive:
   1. For Panel Installation: Marlite Brand C-375 or C-551 Construction Adhesive by Marlite, or 444 Non-Flammable F.R.P. Panel Adhesive by W. W. Henry Company,
   2. For Molding Installation: Marlite Brand C-375 C-551 Adhesive by Marlite, or 444 Non-Flammable F.R.P. Panel Adhesive by W. W. Henry Company.
   3. Furnish adhesive spreaders with 3/16 inch V-notches, 5/16 inch apart for application of adhesive to panels.

D. Sealant: Flexible waterproof sealant for bedding panel edges, Marlite Brand Silicone Sealant MS-251 by Marlite, or Silicone Sealant S255C by Kemlite Company.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

A. Substrate: Verify that drywall substrate is clean, dry, solid, straight, and free from projections.

B. Where conditions require installation of paneling prior to installation of flooring, coordinate with other trades to establish accurate location of top of base.

C. Do not start work until other work requiring penetration of wall covering has been completed, or accurately located.

D. Commencement of plastic paneling wall covering work constitutes installer's acceptance of the substrate.

3.2 CUTTING AND FITTING

A. Cut panels accurately to size with proper allowance for expansion and moldings.

B. Sand or file all edges smooth without chipping.

C. Cut openings for penetrations in accurate location with approximate 1/8 inch clearance around penetrations.

3.3 INSTALLATION

A. Install base molding to wall at proper elevation, in solid bed of adhesive. Allow adhesive to set thoroughly prior to installation of paneling.

B. Seal base molding to top of wall base.

C. Establish centerline of each distinct flat area to be covered. Trim division moldings to mate with base moldings; install in solid bed of adhesive, either on centerline, or offset 24inches from center, as necessary to maximize panel widths at corners. Molding shall be installed straight and plumb.

D. Cut top cap and division or corner moldings to shape, with edges trimmed to fit to adjacent moldings.

E. Apply sealant into installed moldings in sequence with panel installation.

F. Apply adhesive to backs of panels in accordance with the manufacturer's recommendations.

G. Maintain lines and levels of panel edges and moldings.

H. Allow 1/8 inch gap between top cap, corner, or division molding posts, and panel edge; all edges shall be firmly bedded to the moldings in sealant.

I. Promptly remove sealant squeeze out with a damp cloth, as work progresses; remove adhesive with appropriate solvent.

J. Install sealant behind flanges and at penetrations through paneling, and between top cap of panel and substrate.

3.4 CLEANING

A. Inspect surfaces of paneling and remove excess adhesive from face of laminate using solvent recommended by manufacturer.

B. Promptly remove unused cut pieces from the site.

C. Prior to substantial completion of each area where reinforced plastic panel wall covering is installed, clean all surfaces of plastic panels, using procedures recommended by the manufacturer.

END OF SECTION

SECTION 098100 - ACOUSTIC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustical insulation in walls.
   2. Acoustical sealant.

B. Related Sections:
   1. 061000 – Rough Carpentry: Support framing.
   2. 072100 - Thermal Insulation: Thermal batt and blanket insulation.
   3. 078400 - Firestopping: Fire rated penetration seals.
   4. 092200 – Lightgage Metal Support Framing: Support framing.
   5. 095123 – Acoustical Panel Ceilings.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   2. E84 - Test Method for Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Batt Acoustical Insulation: ASTM C665, Type I; unfaced glass fiber batts, blankets, or rolls; minimum fire hazard classification rating of 25/50 per ASTM E84; minimum 3-inch thick, unless required otherwise to meet the STC requirements; widths to friction-fit between studs, where indicated for installation in stud walls; formaldehyde free.
   1. Certainteed "Noise Reducer Sound Attenuation Batts"
   2. Johnson Manville “Sound Control Batts”
   3. Owens Corning “Thermafiber SAFB”.

B. Acoustical Sealant: Non-hardening, low-shrinkage; for use in conjunction with gypsum board; similar to USG "Sheetrock Brand Acoustical Sealant," Tremco "Acoustical Sealant 30CTG," Quiet Solution (Sunnyvale CA; ; 408-541-8000) "QuietSeal QS-350," or approved; maximum VOC content 250g/L.

C. Accessories: Furnish other accessories such as fasteners and retainers, not specifically described, but required for a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

A. Verify that adjacent materials are secure, properly spaced, dry, and ready to receive installation.

B. Verify that mechanical and electrical services within spaces to insulated have been installed and tested.

C. Furnish acoustical insulation to hollow metal installer for installation in hollow metal frames in acoustical partitions.

3.3 INSTALLATION

A. Install insulation in stud cavities in accordance with manufacturer's instructions, and as indicated. Coordinate with other trades as necessary to complete acoustical barriers at wall penetrations.

B. Install insulation without gaps or voids.

C. Trim insulation neatly to fit spaces. Use insulation materials free of damage.

D. Sealant:
   1. Install acoustical sealant continuously around perimeter of all acoustically insulated partitions; one continuous bead at each side of framing member interface with substrate.
   2. Where double layer of gypsum board is indicated, provide sealant at butt joints between boards , including corner joints, and additional bead at perimeter of base layer prior to installation of finish layer.
   3. Except for penetrations in fire rated construction to receive firestopping or fire rated construction joint assemblies, seal all penetrations through acoustical assemblies, including cutouts for lighting fixtures, cabinets, pipes and plumbing, HVAC ducts, and electrical boxes.

END OF SECTION

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Site applied paint coatings.

B. Related Sections:
1. 051200 - Structural Steel: Preprimed metal surfaces.
2. 064000 - Architectural Woodwork: Shop finished materials.
3. 081113 - Hollow Metal Doors and Frames: Preprimed metal surfaces.
4. 092900 –Gypsum Board: Substrate.
5. 099600 - High Performance Coatings: Structural steel coatings

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. Steel Structures Painting Council (SSPC).

1.3 DEFINITIONS:

A. Sheen: Degree of luster of the dried paint film. Where terms such as "gloss," "semi-gloss," "low-gloss," "matte," "satin," "eggshell," or "flat," are used, it shall be subject to the Architect's interpretation, regardless of manufacturer's nomenclature for any particular sheen level. The Architect reserves the right to select from any of manufacturer's published sheen levels for each paint system, if sheen of initial paint finish sample is not approved.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Materials List: Organize to indicate painting systems to be used with each substrate. Include proposed dft for each coat and manufacturer's product data as required to verify compliance with the specified requirements. Do not include MSDS sheets.

C. Samples:
1. Paint Samples:
   a. Submit three samples of each paint finish on an 8"x10" card. Reference manufacturer, type of paint, color, sheen, substrate, and application.
   b. Furnish additional samples until all paint finishes are approved.
2. Transparent Finish Samples:
   a. Submit samples of each wood species and transparent finish combination.
   b. If, in the judgment of the Contractor, the wood species or finish method selected indicate that color variations may be inevitable, submit samples in sets of 3 or more illustrating the possible range of these variations.
   c. When approved, the finished sample or sets shall become the standard for approval.

D. Contract Closeout Submittals: Record Paint Samples: In accordance with Section 017700, submit three 8"x10" samples of each paint and color used, indicating paint manufacturer and formula number; bind in identical sets. Deliver to on site location as directed.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in commercial painting and finishing with a minimum of three years documented experience.

B. Environmental Requirements for Solvent Based Paints: Comply with the Environmental Protection Agency (EPA) requirements for volatile solvents content limitations, as applicable to each classification of coating.

C. Visual Standards: Each distinct area of the finished work shall be free of variations in color and sheen, orange peel, runs, sags, blistering, checking, cracking, scratches, dust, dirt, bugs, and other contaminants.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Delivery: Deliver paint materials to the jobsite in sealed, original, labeled containers, each bearing manufacturer's name, type of paint, brand name, color designation, and instructions for mixing and/or reducing.

C. Storage: Store paint materials at a minimum ambient temperature of 45 degrees F. in a well ventilated area.

D. Toxic, acidic, and combustible materials: Take all necessary precautionary safety measures as recommended by the material manufacturers and governing regulations.

E. Place cotton waste, cloths, and material which may constitute a fire hazard in closed metal containers and daily remove from the site.

1.7 SITE CONDITIONS

A. Weather Conditions:
1. Do no exterior work on unprotected surfaces when raining, or other moisture is present or expected, or before applied paints can dry or attain proper cure.
2. Allow wetted surfaces to dry and attain temperatures and condition specified hereinafter before proceeding with previously started work.

B. Temperature:
1. Do no painting work when surface and air temperatures are below 40 degrees F or below those temperatures recommended by the manufacturer for the material type used.
2. Minimum temperatures for latex finishes: 45 degrees F for interior work and 50 degrees F. for exterior work, unless approved otherwise.

C. Lighting: Maintain a lighting level of minimum 50 foot-candles on the surfaces to be painted or finished.

D. Ventilation: Provide adequate continuous ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Unless specified otherwise, furnish manufacturer's highest grade coating systems by one of the following manufacturers:
1. The Pittsburgh Paints Company.
   a. (Exclusive Distributor of PPG PMC)
2. Benjamin Moore Paint Company.
3. The Sherwin-Williams Company.

2.2 EXTERIOR PAINT SYSTEMS

A. Finish Coats at Exposed Structural Steel: In compliance with Section 099600.

B. Finish Coats for Ferrous Fabrications Primed under Other Sections including structura steel not exposed to the weather: Acrylic/Polyurethane System (Low VOC):
1. Pittsburgh Paints
   a. Solvent Primer: Pittsburgh Paints "Multiprime 4360"; single component multipurpose

primer; color similar but not identical to finish coat.
b. Finish: Pittsburgh Paints "Pitthane Ultra LS." 2-component, high-performance, aliphatic acrylic polyurethane finish, formulated for application as part of total finish system; low-sheen sheen; color match as scheduled.

2. Tnemec Coatings
a. Acrylic Primer: Tnemec "Series 1029 Enduratone"; single component self-crosslinking acrylic primer; color similar but not identical to finish coat.
b. Finish: Tnemec "Series 1081 Endura-Shield W.B." 2-component, high-performance, waterborne acrylic polyurethane finish, formulated for application as part of total finish system; semi-gloss sheen; color match as scheduled.

2.3 INTERIOR PAINT SYSTEMS

A. Interior Latex Paint System – Gypsum Board Substrate: One of the following.
1. Manufacturer: Pittsburgh Paints
a. Primer: Speedhide Zero Interior Latex Sealer
b. Finish: Pure Performance Interior Eggshell 9-300XI
2. Manufacturer: Benjamin Moore Paint Company:
a. Primer: Ultra Spec Primer N534
b. Finish: Ultra Spec 500 (– sheen as indicated)
3. Manufacturer: Sherwin-Williams
a. Primer: Multi-Purpose Interior/Exterior Latex Primer/Sealer
b. Finish: SuperPaint Interior Acrylic Latex; Eggshell sheen

B. Interior Trim Systems – Metal Substrate: One of the following.
1. Manufacturer: Pittsburgh Paints
a. Metal Primer: Pitt-Tech Plus EP Primer (2 – 4.0 mils dft 50 g/l VOC)
b. Metal Primer: Seal Grip Gripper Interior/Exterior Acrylic Latex Primer
c. Finish: Pitt-Tech Plus EP 90 Series
2. Manufacturer: Benjamin Moore Paint Company:
a. Metal Primer: *HP1100 Acrylic Metal Primer
b. Metal Primer: DTM Acrylic Enamel (Sheen as Indicated)
c. Finish: *Ultra Spec 500 T546 - Semi-Gloss”
3. Manufacturer: Sherwin-Williams
a. Metal Primer: “Pro Industrial Pro-Cryl B66” Universal Acrylic Primer (2.5 – 5.0 mils dft 138 g/l VOC)
b. Metal Primer: Multi-Purpose Interior/Exterior Latex Primer/Sealer
c. Finish: :SuperPaint Interior Acrylic Latex

C. Interior Trim Systems – Opaque Finish Wood Substrate: One of the following.
1. Manufacturer: Pittsburgh Paints
a. Primer: Seal Grip Gripper Interior/Exterior Acrylic Latex Primer
b. Finish: Pitt-Tech Plus EP 90 Series
2. Manufacturer: Benjamin Moore Paint Company:
a. Primer: 046 Fresh Start High Hiding Multi-Purpose Primer
b. Finish: Ultra Spec 500 T546 - Semi-Gloss”
3. Manufacturer: Sherwin-Williams
a. Primer: Premium Wall & Wood Primer
b. Finish: SuperPaint Interior Acrylic Latex

D. Interior Latex Dry-Fall System: One of the following; color matches as scheduled.
1. Manufacturer: Pittsburgh Paints
a. Finish: "Speedhide SuperTech Acrylic Semi-Gloss."
2. Manufacturer: Benjamin Moore Paint Company
a. Finish: Coronado Super Kote 5000 Dry Fall Latex Semi-Gloss (112)
3. Manufacturer: Sherwin-Williams
a. Finish: "Waterborne Acrlic Dryfall (B42 Series)" Egg-Shell finish.

E. Interior Traffic Striping – Concrete Substrate: One of the following.
   1. Pittsburgh Paints "ZoneLine Waterborne Acrylic Traffic Marking Paint"; yellow (8 mils dft).
   2. The Sherwin-Williams Company "TM2173 Setfast Acrylic Aisle Marking Paint"' yellow (5 mils dft).
   3. Benjamin Moore & Company Insl-X Acrylic Fast-Set Traffic Paint (TP-23xx) yellow (4-8 mils dft).

F. Acrylic Wall Size: One of the following.
   1. Pittsburgh Paints Seal Grip Gripper Interior/Exterior Acrylic Latex Primer 17-921XI
   2. Sherwin-Williams "Harmony Primer 0 VOC" B11W900 .
   3. Benjamin Moore Paint Company Super Spec Latex vapor Barrier Primer Sealer (0260)
   4. Zinsser Co, Inc. (Somerset NJ; (732) 469-8100) "Shieldz Universal Pre-Wall Covering Primer"; acrylic primer/sealer

G. Materials not specifically noted and otherwise required for the work, such as linseed oil, shellac, thinners and the like shall be of a quality not less than that required by manufacturers of the finish materials used in the work.

H. Products for each general purpose shall be compatible. Each system shall be products of one manufacturer where ever possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Perform adhesion tests on factory primed items. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 MOISTURE CHECK

A. Check for excess moisture using an electronic moisture meter. Do not paint materials with moisture levels which would impair the bonding of finish coatings.

3.3 PROTECTION

A. Adequately protect surfaces not to be painted, from spills, drips, over painting, and other damage caused by this work. Include surfaces within the paint storage and preparation areas.

B. Hardware and Miscellaneous Items:
   1. Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, surface hardware, and fittings prior to starting work.
   2. Store, clean and reinstall these items upon completion of work in each area. Use materials and techniques as necessary to prevent damage to finishes on such items.

3.4 SURFACE PREPARATION

A. Prepare surfaces by removing dirt, dust, grease, oil, moisture, and other contaminants which would impair finish adhesion.

B. Ferrous Metal Shop Primed under other Sections: Solvent clean to remove oil and grease. Remove loose rust, and blistered and peeling paint to bare metal by scraping, sanding, and wire brushing in accordance with SSPC-SP2 and SP3. Immediately retouch damaged or abraded surfaces with compatible primer. Lightly sand all shop prime painted surfaces to receive paint finish.

C. Galvanized Ferrous Metal: Clean in accordance with paint manufacturer's requirements for substrate preparation. Abrade surface with 3M "Scotchbrite Heavy Duty" (brown) pad, or as necessary to achieve sufficient profile for paint adhesion.

D. Unprimed Ferrous Metal:
   1. Solvent clean in accordance with SSPC SP-1.
   2. Commercial blast per SSPC SP6.

E. Wood - Opaque paint finish:
   1. Spot coat knots, pitch streaks, and sappy sections with sealer.
   2. Fill all nail holes and cracks. Sand filler smooth and level with wood surface.

F. Wood - Transparent Finish: Fill all exposed finish nail holes and cracks with matching color filler after prime coat is applied. Sand filler smooth and level with adjacent surfaces.

G. Existing Finished Surfaces To Be Repainted:
   1. Remove loose, blistered, scaled, or crazed finishes to bare substrate; feather new work into existing work. Prepare surfaces to the nearest break line if necessary to blend new finishes with old finishes.
   2. Wash and rinse surfaces with trisodium phosphate and water or other solution required to remove remaining film, wax, oil, grease, or foreign matter which would impair bond or cause bleed through.
   3. Lightly sand, or apply a liquid deglosser on existing semi-gloss and high-gloss finishes before refinishing.

3.5 GENERAL APPLICATION REQUIREMENTS

A. Unless specified or indicated otherwise, follow paint manufacturer's label directions for general application procedures and coverage rates.

B. Do not apply finishes on surfaces that are not sufficiently dry. Make sure each coat of finish is dry and hard before a following coat is applied unless the manufacturer's directions state otherwise.

C. Tint filler to match stain when clear finishes are specified; work filler well into grain and, before it has set, working perpendicularly to the grain, wipe the excess from the surface.

D. Opaque Finishes:
   1. Apply number of coats scheduled for each application, except that additional finish coats shall be applied as necessary for complete hiding of substrate colors.
   2. Apply primer coats untinted. Where more than one coat of paint is required, tint each succeeding coat up to the final coat similar in tint, but slightly lighter in value (shade).
   3. Sand lightly between coats if necessary to achieve required finish; sand between all coats applied to wood substrates.

E. Rollers for application and backrolling of latex paints shall have a nap of 3/8 inch or less.

F. Where roller texture is scheduled for application to gypsum board surfaces, finish coats may be roller-applied, or spray applied and backrolled at Contractor's option.

G. Factory Primed Surfaces: Apply scheduled finish system, less primer coat, except as necessary for patching damage to factory prime coating.

H. Except where scheduled or indicated otherwise, the intent is to paint all new rooms and areas. Existing areas which have not been remodeled or do not have patched surfaces are not to be repainted. Where existing surfaces have been remodeled or patched the entire room is to be repainted, including the associated access panels, electrical panels, hollow metal doors and frames (both sides), and similar elements within the room.

3.6 EXTERIOR PAINTING SYSTEMS

A. Ferrous Fabrications Primed under Other Sections: Acrylic/Polyurethane System:
   1. System: Retouch welds and damaged galvanized coatings with zinc primer; apply one coat acrylic urethane primer, and two acrylic urethane finish coats in accordance with the

manufacturer's recommendations. Verify compatibility with shop applied primer. Spot apply epoxy primer over damaged shop applied primers.
2. Sheen: Semi-gloss or satin, unless indicated otherwise.
3. Application: Exterior pre-primed metal surfaces.

3.7 INTERIOR PAINTING AND FINISHING SYSTEMS

A. Gypsum Board - Latex System:
1. System: Three coats - first coat latex primer sealer (untinted), second and third coat latex paint.
2. Sheen: Roller texture, satin sheen, except provide flat sheen at light coves, ceilings, skylight areas, clerestory areas, interior fascias, and other light sensitive surfaces. Verify locations of each sheen with Architect before proceeding with work.
3. Application:
   a. Use on all exposed gypsum board, plaster, and GFRG surfaces, including the exposed portions of wall surfaces between adjacent fabric covered panels and mirrors.
   b. Provide prime coat only behind permanently mounted mechanically anchored mirrors, fabric panels, and similar elements.
   c. Do not apply primer or paint coatings to surfaces to receive adhesively mounted mirrors or tile.

B. Wood - Opaque Finish Latex System:
1. System: Three coats; first coat latex wood primer, and second and third coat latex enamel.
2. Sheen: Semi-gloss, unless indicated otherwise.
3. Application: Use on all wood surfaces indicated to receive opaque coating, including wood windows.

C. Ferrous Metal Trim - Acrylic System:
1. System: Three coats; first coat acrylic DTM primer; second and third coats latex finish. The primer may be omitted at factory primed surfaces, except as necessary to recoat damaged or abraded preprimed surfaces.
2. Sheen: Semi-gloss, unless indicated otherwise.
3. Application: Interior ferrous metal surfaces, unless otherwise indicated, including hollow steel metal doors and frames, access doors and panels, and fire extinguisher cabinets.

3.8 CLEANUP

A. As the work proceeds and on completion of the work, promptly remove all sealers, primers, paints and finishes where spilled, splashed or splattered in a manner not to damage the surface from which it is removed.

B. Remove masking.

C. Clean, or replace with new, all lamps and electrical fixtures damaged by overspray; replace with new identical components all lighting fixture louvers and reflectors damaged by overspray.

3.9 COLOR SCHEDULE

A. Provide paint colors to match those indicated on the drawings. Where a paint color is listed from a specific manufacturer, paint products from other approved manufacturers may be used, provided the color exactly matches the specified color, and the paint system meets the specified requirements. Where no paint color is indicated, provide color and sheen as selected by the Architect.

END OF SECTION

SECTION 099600 - HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High performance coatings at exposed structural steel

B. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

C. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
   2. D3359-02 Standard Test Methods for Measuring Adhesion by Tape Test

B. National Paint and Coatings Association (NPCA) - Guide to US Government Paint Specifications.

C. Steel Structures Painting Council (SSPC): Guide to Good Painting Practices Vol. I & 2

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 01 30 00.

B. Product Data: Provide Manufacturer's published product data on exterior coating products including physical properties and performance characteristics.

C. Manufacturer's Installation Instructions: Indicate special surface preparation procedures, and substrate conditions requiring special attention.

D. Manufacturer's maintenance and recoat instructions.

E. Samples: 3 drawdowns of each color proposed for the work.

F. Quality Control:
   1. Recycled Content: Submit product data and certification letter indicating percentage by weight of pre-consumer and post-consumer recycled content and costs (exclusive of labor and equipment) for each product having recycled content.
   2. Low-Emitting Materials, Adhesives & Sealants: Submit product test reports for adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content indicating that products comply with the testing.
      a. South Coast Air Quality Management District (SCAQMD) Rule #1168, effective date July 1, 2005 and rule amendment date January, 2005.
   3. Submit product data for interior paints, primers and coatings indicating chemical composition and VOC content.

1.5 QUALITY ASSURANCE

A. Comply with provisions of Section 01 40 00.

B. Coating materials shall be applied evenly in accordance with SSPC ‘Good Painting Practices’ Vol. I & 2, manufacturer's directions, and these specifications. Where these may be in conflict the more stringent shall apply. Provide a monolithic pinhole free film free of runs, drips, curtains and sags.

C. Qualifications
   1. Manufacturer's Qualifications: Company with at least 10 years experience specializing in the manufacture of high performance architectural coatings equal to those specified in this section
   2. Applicator Qualifications:
      a. Specialty coating contractor with a record of successful in-service performance and application of special coatings similar to the material, design, and extent of the work described in this section.
      b. Able to submit resume with at least 3 successful projects of the similar scope and nature, including the type of coating system specified herein.
      c. Technicians Qualifications: Thoroughly skilled and specially trained in the techniques for applying high performance coatings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 50 00.

B. Deliver products to site in Manufacturer's original sealed containers with labels intact and legible; inspect to verify acceptability. Provide invoices to determine proper material usage.

C. Container labels shall include manufacturer's name, type of material, brand name, lot/batch number, brand code and color designation

D. Store materials at minimum ambient temperature of 45° F and a maximum of 90° F, in ventilated area and as required by manufacturer's storage instructions.

E. Store flammable materials to protect from fire hazards and spontaneous combustion.

F. Remove materials and empty containers from the area of work at the close of each day.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply coatings to wet or damp surfaces, or when relative humidity is outside the ranges required by the product manufacturer or when rain is imminent.

B. Minimum Application Temperatures: 45°F, minimum and 90°F, maximum; unless required otherwise by the manufacturer.

C. Provide additional lighting if needed to illuminate the substrate surface during coating application

1.8 WARRANTY

A. Submit in accordance with Section 017000.

B. Installer's Guarantee: 2 year unlimited guarantee against defects in materials and workmanship, including failure of materials to pass specified adhesion test.

C. Manufacturer's standard 5-year limited warranty against coating failure, including chalking, peeling, and change of color.

D. Manufacturer's Warranty: Furnish manufacturer's standard 5 year limited warranty against::
   1. Change in color.
   2. Checking, cracking, flaking, or blistering.
   3. Excessive chalk.

1.9 MAINTENANCE

A. Upon request, furnish touch-up quart of each color and type.

B. Deliver to Owner at a location on site, as directed, in clearly marked sealed containers.

PART 2 - PRODUCTS

A. Ferrous Steel Substrate:
   1. Manufacturer: Tnemec Company

a. Zinc Primer: Tnemec Series "394 PerimePrime;" single component moisture cured primer; minimum 62 percent solids by volume.]
b. Intermediate Coat: "Hi-Build Epoxoline II" Series N69.
c. Polyurethane Finish Coats: Series 1095 "Endura-Shield II; Acrylic Polyurethane Enamel; semi-gloss or satin sheen.

2. Manufacturer: Benjamin Moore Paint Company
   a. Zinc- Rich Primer: Corotech Organic Zinc Rich Primer (V170)
   b. Intermediate Coat: Corotech Polyamide Epoxy Primer (V150)
   c. Urethane Finish Coats: Corotech Waterborne Urethane Gloss (V540)
3. Manufacturer: Sherwin Williams
   a. Primer: Two Component Zinc Rich Epoxy Primer.
   b. Intermediate Coat: Recoatable Epoxy Primer
   c. Finish: Acrolon EG-120
4. Manufacturer: PPG PMC
   a. Zinc Rich Primer: PPG Paints. Amercoat 68HS VOC. Applied Dry Film Thickness: 4.0 mils min.
   b. Intermediate Coat: PPG PMC. Amerlock 2 VOC Fast Dry, High Solids Epoxy Coating, Semi-Gloss, AK2V-3 Series. Applied Dry Film Thickness: 4.0 mils min.
   c. Topcoat: PPG PMC. Amershield VOC Low VOC Gloss Polyester Acrylic Polyurethane, AMV-3 Series. Applied Dry Film Thickness: 3.0 mils min.

B. Galvanized Steel Substrate:
1. Manufacturer: Tnemec Company
   a. Epoxy Primer: "Hi-Build Epoxoline II" Series N69.
   b. Finish Coats: Series 1095 "Endura-Shield II; Acrylic Polyurethane Enamel; semi-gloss or satin sheen.
2. Manufacturer: Benjamin Moore Paint Company
   a. Epoxy Primer: Corotech Polyamide Epoxy Primer (V150)
   b. Finish Coats: Corotech Waterborne Urethane Gloss (V540)
3. Manufacturer: Sherwin Williams
   a. Epoxy Primer: Recoatable Epoxy Primer
   b. Finish Coats: Acrolon EG-120
4. Manufacturer: PPG
   a. Epoxy Primer: PPG PMC. Amerlock 2 VOC Fast Dry, High Solids Epoxy Coating, Semi-Gloss, AK2V-3 Series. Applied Dry Film Thickness: 4.0 mils min.
   b. Finish Coats: PPG PMC. Amershield VOC Low VOC Gloss Polyester Acrylic Polyurethane, AMV-3 Series. Applied Dry Film Thickness: 3.0 mils min.

C. Finish Coats for Ferrous Fabrications Primed under Other Sections:
1. Tnemec Company:
   a. Primer: Tnemec "Series 1029 Enduratone"; single component self-crosslinking acrylic primer; color similar but not identical to finish coat.
   b. Finish: Tnemec "Series 1081 Endura-Shield W.B." 2-component, high-performance, waterborne acrylic polyurethane finish, formulated for application as part of total finish system; semi-gloss sheen; color match as scheduled.
2. Benjamin Moore Paint Company
   a. Primer: Corotech “Acrylic Metal Primer” Flat (V110)
   b. Finish: Corotech Waterborne Urethane Gloss (V540)
3. The Pittsburgh Paints Company:
   a. Solvent Primer: PIT "Multiprime 4360"; single component multipurpose primer; color similar but not identical to finish coat.
   b. Finish: PIT "Pitthane Ultra LS." 2-component, high-performance, aliphatic acrylic polyurethane finish, formulated for application as part of total finish system; low-sheen sheen; color match as scheduled.
4. Primer shall be applied where shop primer is damaged or removed, or where shop-applied primer is incompatible with specified finish coat.

D. Materials shall not be altered except for reducing in accordance with the recommendations of the manufacturer

E. Colors: Colors shall be custom tinted by the manufacturer for each finish product specified. Furnish color matches as indicated, or where not indicated, as directed by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating system and which cannot be put into acceptable condition by the preparation work specified herein. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of substrate conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION - SURFACES TO RECEIVE HIGH PERFORMANCE COATING

A. Prepare substrate in accordance with manufacturer's application instructions, these specifications and referenced standards. Where these may be in conflict the more stringent shall apply.

B. Surface Appointments: Remove or mask hardware, trim, escutcheons, and fittings prior to preparing surfaces or finishing. Store and protect from damage and reinstall after completion of the work.

C. Clean exterior surfaces to be coated of dirt, dust, oil, grease, oxidized, loose and scaling paint, mildew, rust on metal and other foreign matter. Use specified surface cleaner.

D. Remove contamination in accordance with SSPC SP-1 Solvent Cleaning followed by SP-3 Power Tool Cleaning for abrasions, welds, and rusted areas. Using a brown metal finish pad, thoroughly abrade existing coating to develop profile. Clean particulates from abraded existing coating. Remove areas where existing coating has blistered or has been damaged from past cleaning practices. Apply primer to exposed bare metal surfaces only, within six to eight hours following preparation.

3.3 APPLICATION

A. Batch-mix multiple containers of a single color to assure a continuous balance of ingredients.

B. Clean surfaces free of loose particles using a tack cloth just prior to applying coatings.

C. Field-apply products in accordance with manufacturer's instructions.

D. Do not apply finishes to surfaces that are not dry. Allow each coat to dry before subsequent coat is applied. Do not exceed recoat window listed on product data sheet.

E. Apply coatings as follows
   1. Spot Primer: 2.5 to 3.5 mils DFT.
   2. Finish: 2 to 3 mils DFT.
   3. Apply number of coats as determined by mock-up.

3.4 FIELD QUALITY CONTROL

A. The coating subcontractor shall field inspect the work upon initial completion. Non-complying work shall be corrected as required.

3.5 PROTECTION

A. Protect adjacent materials and surfaces including landscaping and roofing from damage during work including cleaning, preparation, and application of exterior coating materials. Notify owner of any on-site or adjacent property such as parked vehicles, bicycles, landscaping, etc, which may be damaged from coating operations. Provide protection of grade-level horizontal surface to the extent possible.

B. Coating Contractor shall replace materials in kind that are damaged during work of this section.

C. Touch-up and restore damaged or defaced coated surfaces that occur as a result of the work of this section.

3.6 CLEANING

A. Remove spills and overspray from adjacent surface.

B. Legally dispose of debris in accordance with local, state, and federal regulations.

END OF SECTION

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Code required signage.
   2. Room signage.
   3. Building signage.
   4. Monumental signage.

B. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

C. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A36 - Structural Steel.
   2. B209 - Aluminum and Aluminum Alloy Sheet and Plate.

1.3 SYSTEM DESCRIPTIONS

A. Accessibility Signage:
   1. Provide acrylic plastic reverse silk screened signs with international symbol of accessibility, raised letters, and Braille, at the following locations:
      a. Accessible toilet and bathing facilities.

B. Room Signs:
   1. Provide signs at each room or specified area, stating the following in accordance with require applicable code requirements.
   2. The room number or designation (1 inch high letters with 1/4 inch stroke).
   3. Room name or designation (1 inch high letters with 1/4 inch stroke).
   4. A tactile name or designation, which includes raised letters and Braille, and which complies with ANSI A117.1)
   5. Color to be selected by the architect for the manufacturer’s full line of color samples.

C. Accessibility Signage:
   1. Provide acrylic plastic reverse silk screened signs with international symbol of accessibility, raised letters, and Braille, at the following locations:
      a. Accessible areas of refuge.
      b. Accessible toilet and bathing facilities.
   2. Provide painted metal international symbol of accessibility at the following locations:
      a. Accessible parking locations.
      b. Accessible passenger loading zones.
   3. Provide directional signage at the following in accessible areas to indicate the direction to the nearest similar accessible area:
      a. Inaccessible building entrances.
      b. In accessible public toilet and bathing facilities.
      c. Inaccessible elevators and exit stairs.
   4. Each door to an exit stairway shall have a tactile sign stating EXIT, which includes raised letters and Braille, and which complies with ANSI A117.1.

D. Fire Door Signage: At the following fire doors, provide sign with 1 inch letters which reads:

FIRE DOOR
DO NOT OBSTRUCT

1. Locations
   a. All 90-minute doors, as scheduled

E. Building Signage:
1. Design Intent: 5'x10' finished aluminum backing plate mounted to building with finished cut logo and dimensional letters stud welded on 1-inch aluminum or stainless steel standoffs.
2. Drawing file for logo available from Architect.

F. Monumental Signage:
1. Design Intent: Dimensional characters with 1-inch aluminum or stainless steel standoffs mounted on concrete wall per Drawings. Building address shall be 4-inch minimum height.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Samples:
1. Submit samples of each general sign type proposed for the Work.
2. At dimensional letter signage, submit sample letter of same size and construction as will be used in the finished work.

C. Schedule: Submit schedule of signage. List text, location, size, and type for each sign to be provided.

D. Shop Drawings – Building and Monumental Signage:
1. Indicate kinds and quantities of material, methods of joining and anchoring, field dimensions as appropriate, and relationship to adjoining materials.
2. Indicate requirements for standoffs, cutting, and blocking required to facilitate installation of the work.
3. Show full size sections of all extrusions, corners, retainers, complex details, and connections, clearly indicating fabrication and erection techniques.
4. Indicate colors and finishes of all surfaces.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Fabricator Qualifications: Signage manufacturer with five years documented experience in work of similar type and scope.
2. Installer Qualifications: Use only installers skilled and experienced in the installation of graphics of the type scheduled.

B. Regulatory Requirements: Signage shall conform to the requirements of the jurisdictional code authorities.

C. Installer Qualifications:
1. Skilled and experienced in the installation of signs similar to those required for the work.
2. Helpers and apprentices shall be supervised at all times by thoroughly skilled installers.

D. Preinstallation Conference:
1. Administer preinstallation conference as specified in Section 013120.
2. Attendees: Contractor, Architect, Owner’s Representative, sign fabricator, sign installer.
3. Review installation procedures and proposed locations. Perform mock-up installations in locations as approved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Sheet: 1/8 inch thick acrylic sheet; low gloss finish.

B. Double Stick Tape: 3M Scotch brand #665 double-stick, double-coated tape, 1/4" wide.

C. Steel Shapes, Plates, and Bars: ASTM A36.

D. Aluminum Sheet:
   1. ASTM B209, 5005-H32 alloy and temper.
   2. 0.125 inch aluminum sheet for backplate and dimensional letters.

2.2 BUILDING SIGNAGE

A. Backplate: Aluminum sheet

B. Finish:
   1. Backplate: Baked-Enamel or Thermoset Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect

2.3 DIMENSIONAL LETTERS

A. Cutout Characters: Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles.

B. Finish: Baked-Enamel or Thermoset Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect

2.4 FABRICATION – INTERIOR SIGNAGE

A. Signs shall be free of rough edges, irregular surfaces, non uniform finishes, and similar imperfections.

B. Unless specified otherwise, interior signage shall be silk screened to the backside of clear plastic sheet, unless approved otherwise. Provide solid color background over silk screened text. Apply images with uniform colors, sharp definition of line, and accurate configuration. Unless specified otherwise, text shall be 1 inch high Helvetica medium.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. All graphics shall be mounted level and plumb and in accurate alignment, unless indicated otherwise.

B. Mounting:
   1. At interior surfaces, clean surfaces as necessary to accept mounting tape.
   2. Use double stick tape for mounting unless approved otherwise.

3.3 SIGNAGE SCHEDULE

A. Signage is scheduled on the Drawings.

END OF SECTION

SECTION 102246 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manually operated paired panel operable wall system.

B. Related Sections:
1. 055000 - Metal Fabrications: Track support beam.
2. 092200 – Lightgage Metal Support Framing: Coordination; plenum sound partitions.
3. 092900 - Gypsum Board: Coordination; plenum sound partitions.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
3. E557 - Standard Guide for The Installation of Operable Partitions

1.3 SYSTEM DESCRIPTION

A. Complete system shall consist of a horizontal sliding paired panel folding partition system, including tracks, and panel finishes as specified.

B. Acoustical performance shall have been tested at a laboratory accredited by the U.S. Dept. of Commerce, National Institute of Standards and Technology, under the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Partition system shall have obtained an STC rating of 50, or better.

C. Complete, unaltered written test report is to be made available upon request.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Equivalent panel system shall have been tested in an independent acoustical laboratory in accordance with ASTM E90 test procedures to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557**.**

1.5 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

C. Shop Drawings: Indicate locations and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

D. Samples: Three samples of finish proposed for door curtain.

E. Closeout Submittals:
   1. In accordance with Section 017700.
   2. Operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Store partitions and components in accordance with the manufacturer's recommendations, and as necessary to prevent damage.

1.7 WARRANTY

A. Submit in accordance with Section 017700.

B. Manufacturer's Warranty: Manufacturer's standard one-year limited warranty against defects in materials and workmanship, including seal integrity, acoustical performance, and smooth operation..

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Modernfold, Inc.(Greenfield, IN; 800-869-9685).

B. Acceptable Option (subject to compliance with Contract Document requirements and Architect's approval of color and conformance to design intent.): Hufcor, Inc. (Janesville WI; 800-542-2371).

C. Panel Folding Door System: #932; top supported; paired panel configuration; bi-parting configuration.
   1. Panels shall be nominally 3 inches thick, x 48 inches in width.
   2. All panel horizontal and vertical framing members shall be fabricated from minimum 18-gauge formed steel with overlapped and welded corners. Top channel shall be reinforced to support suspension system components. Frame shall be designed so that full vertical edges of panels are of formed steel and engage the edges of the panel skin.
   3. Panel faces shall be of gypsum laminated to appropriate substrates to meet the specified acoustical performance criteria; Class A fire rated.
   4. Vertical interlock between panels shall be in a tongue and groove configuration. Design to provide panel-to-panel interlock. Horizontal Top Seals: Continuous contact multi-ply vinyl.
   5. Horizontal Bottom Seals: Retractable, provide 1-3/4 inches nominal operating clearance, and exert downward force when extended.
   6. Hinges: Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Suspension System: #17 or approved
   1. Suspension Tracks: Minimum 11-gauge, 0.12 inch roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 3/8 inch diameter threaded rods.
   2. Exposed Track Soffit: Steel, integral to track; and pre-painted off-white.
   3. Each panel shall be supported by one 4-wheeled carrier with harden steel ball bearings.

E. Finishes
   1. Face: Modernfold Carnegie polypropylene fabric, Topknot 7358A, color as selected by Architect.

F. Available Accessories/Options
   1. ADA compliant pass door of the same thickness and finish as the basic panels.
      a. Automatic door closer
      b. Lever handle with corridor lock
      c. Inset illuminated exit sign

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Require correction of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Install door and closing system as indicated in strict accordance with ASTM E557 and the manufacturer's instructions.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.3 CLEANING

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.4 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, or malfunction, throughout entire operational range.

B. Lubricate hardware and other moving parts.

3.5 DEMONSTRATION

A. Installer shall demonstrate proper operation and maintenance procedures to owner’s representative.

END OF SECTION

SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner guards.

B. Related Sections:
   1. 061000 – Rough Carpentry: Wood blocking and backing.
   2. 064000 – Architectural Woodwork: Plywood panel wainscoting.
   3. 092900 - Gypsum Board: Substrate.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300, unless specified otherwise.

B. Product data.

C. Samples:
   1. Wall guard; minimum 12 inch length.
   2. Corner guard; full length.
   3. Each trim piece proposed for the work.
   4. Submit samples in exact colors proposed for the work.

D. Contract Closeout Submittals: Submit in accordance with Section 017700.
   1. Maintenance and cleaning instructions.

1.4 ENVIRONMENTAL CONDITIONS

A. Lighting: Maintain a minimum light level of 15 foot-candles at surfaces to receive components.

B. Provide ventilation to remove volatile emissions produced during the installation process.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Stainless Steel Corner Guards (SSCG): Model WCG by Wilkinson-Hi-Rise, LLC (866-424-8837) or CG-50 by Pawling Corporation (800-431-3456); 1/8 inch radius corner bend; 16 ga type 304 stainless steel; 3-1/2” wings with returned edges; 48" length unless otherwise indicated. Furnish cement and related accessories as required for adhesive installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect, in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install components plumb and level and in strict accordance with the manufacturer's recommendations, unless indicated otherwise.

END OF SECTION

SECTION 102813 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal and plastic toilet accessories.
   2. Grab bars for accessible toilet enclosures.
   3. Rough-in frames furnished to other sections.
   4. Attachment hardware.

B. Related Sections:
   1. 061000 - Rough Carpentry: Blocking.
   2. 092200 – Lightgage Metal Support Framing: Metal backing and support framing.
   3. 105113 – Metal Lockers: Locker Room bench.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. American National Standards Institute (ANSI): A117.1 - Accessible and Usable Building Facilities (2003)

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data:
   1. Submit for each toilet accessory.
   2. Include complete blocking and mounting instructions for fold down baby counters.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

1.5 COORDINATION

A. Verify locations and dimensions shown with field conditions prior to installation.

B. Avoid damaging the work or finish of other trades; repair damage, or replace damaged items, as directed, at no additional cost to the Owner.

1.6 WARRANTY

A. Submit in accordance with Section 017700.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Manufacturer: Bobrick Washroom Equipment Company (North Hollywood CA; 818-503-1630), unless approved otherwise.

B. Accessories:
   1. Grab Bars (GB): Bobrick B-6806 Series, size and configuration as indicated; include 2562 concealed anchor devices.
   2. Paper Towel Dispenser and Waste Receptacle (PTD/WR) - Recessed: B-3944.
   3. Toilet Paper Dispenser (TPD): Multi-roll B-2888.

4. Seat Cover Dispenser (SCD): B-3094.
   a. Install in compliance with ANSI A117.1 art. 604.5.
5. Soap Dispenser (SD):
   a. Bobrick automatic foam soap dispenser (battery powered): B-2013.
6. Coat Hook (CH): B-542.
7. Mop/Broom Holder (MH): B-223x36.
8. Framed Mirror (MIR): B-290.
9. Baby Changing Station: Foundations 220-EH-04.
10. Wall-Mounted Shelves:
    a. Type 304 stainless steel, #4 finish;
    b. Full triangular side brackets of matching material.
    c. 12” x 24”, unless indicated otherwise;
    d. 225 pound capacity.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

A. Coordinate with Section 102113 for preparation of reinforcements and openings to receive thru-partition mounted accessories.

B. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Coordinate installation.

C. Furnish templates and rough-in measurements as required.

D. Protect adjacent or adjoining finished surfaces from damage during installation of work of this Section.

E. Verify exact location of accessories.

F. Coordinate installation of blocking and backing as necessary to support wall mounted items.

3.3 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturer's instructions, and as indicated on the Drawings.

B. Install true, plumb, and level, securely and rigidly anchored to substrate.

C. Mount accessories in locations and elevations as indicated on the Drawings. Where elevation is not indicated, mount at the minimum elevation recommended by the manufacturer.
   1. Mount Mop and Broom holders at 6'-0" AFF, over mop sink.

D. Use tamper-resistant fasteners.

END OF SECTION

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Cabinets.

B. Related Sections:
   1. 061000 – Rough Carpentry: Rough framing.
   2. 092200 – Lightgage Metal Support Framing: Rough framing.
   3. 092900 - Gypsum Board: Adjacent finishes.
   4. 099000 - Painting and Coating: Field paint finish.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 REFERENCES

A. National Fire Protection Association (NFPA): NFPA 10 - Portable Fire Extinguishers.

B. Underwriter's Laboratory (UL).

1.3 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers.

B. Extinguishers shall be Factory Mutual approved and UL listed.

C. Provide fire extinguishers, cabinets, and accessories from a single manufacturer.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit product literature for fire extinguisher brackets, fire extinguisher cabinets, and each type of extinguisher proposed for the work.

C. Contract Closeout Submittal: Submit manufacturer's operation and maintenance data under provisions of Section 017700. Include test, refill or recharge schedules, procedures, and re-certification requirements.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Larsen's Manufacturing Company (Minneapolis MN; 612-571-1181).

B. J.L. Industries Inc. (Commerce, CA; 323-726-9070).

C. Potter Roemer (Santa Ana, CA; 714-430-5300, 800-366-3473).

D. Williams Brothers Corporation (Scarborough, Ontario; 540-636-4444; 800-255-5515).

2.2 EXTINGUISHERS

A. Multi-Purpose Dry Chemical Type (FE): Heavy Duty DOT Steel tank; UL rating 2A-10B: C, 5 lb capacity, with pressure gage; red enamel finish; metal valves and siphon tubes.

2.3 TYPICAL INTERIOR CABINETS

A. Semi-recessed and surface-mounted models in locations as indicated on the Drawings.

B. Furnish sizes as necessary to accommodate extinguishers, at locations indicated on the Drawings.

C. Trim: Formed Sheet Steel, minimum 20 gage; 1-1/4 to 1-3/4 inches wide face; square edge configuration.

D. Door: Formed Sheet Steel, minimum 20 gage; reinforced for flatness and rigidity; satin zinc or aluminum pull, roller catch, and continuous hinge; clear glass vision panel.

E. Cabinet Finishes:
   1. Cabinet Trim and Door: Manufacturer's standard primed finish to receive paint coatings as specified in Section 099000.
   2. Cabinet Interior: Manufacturer's standard white epoxy or white baked enamel.

F. Signage: Pressure sensitive letters "FIRE EXTINGUISHER"; red; font as directed by the Architect; vertical ascending.

G. Fire Extinguisher Brackets: Wall mount type, appropriate to the size of the extinguisher, equipped with strap and quick release clip.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect, in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install cabinets plumb and level in wall openings and secured to framing in locations as indicated. Unless otherwise indicated, install 30 inches from finished floor to inside bottom of cabinet.

B. Coordinate with Section 099000 for installation of signage on cabinets.

C. Install fire extinguisher in each fire extinguisher cabinet by brackets mounted at back of cabinet.

D. Where fire extinguishers are indicated for wall mounting, secure bracket to wall through finish to framing or blocking.

E. Fire extinguishers shall be installed, charged, tagged, and dated, not more than 30 days prior to Substantial Completion.

END OF SECTION

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal lockers.

B. Related Sections:
   1. 061000 – Rough Carpentry: Wood blocking and backing.
   2. 092200 – Lightgage Metal support Framing: Metal backing.
   3. 092900 - Gypsum Board: Substrate.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data:
   1. Manufacturer's standard published literature with complete description of components, and features of products proposed for the work.
   2. Color card with samples or reproductions of manufacturer's standard finish colors.

C. Shop Drawings: Indicate locker room layout; locker types and configurations, field dimensions (as appropriate), and attachment details. Identify filler panel locations and accessories.

PART 2 - PRODUCTS

2.1 LOCKERS

A. Manufacturer: One of the following.
   1. Penco Products Inc.
   2. Lyon Metal Products Inc.
   3. Republic Storage Systems Co. Inc.
   4. Medart Inc

B. Type and Size: Standard single tier locker design; size 12”Wx72”Hx18”D per box; louvered door panel; ADA compliant.

C. Finish: Manufacturer's standard baked enamel; color as selected by Architect.

D. Provide all lockers with 6" legs and metal filler panels, 20 gauge.

E. Exposed locker ends shall have minimum 16-gage cover panels; furnish top and vertical filler panels to close gaps between locker row ends and walls.

F. Provide the following accessories at each locker:
   1. Padlock hasp.
   2. Number plate, with sequential number.

G. Provide continuous sloping hood at top row of lockers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect, in

writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install lockers and benches plumb and in strict accordance with the manufacturer's recommendations, unless indicated otherwise.

B. Wall-mounted lockers shall be securely anchored to wall.

END OF SECTION

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Kitchenette and convenience appliances

B. Related Sections:
   1. 064000 – Architectural Woodwork: Adjacent casework construction.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitutions will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit complete product data for each piece of equipment.

1.3 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

PART 2 - PRODUCTS

2.1 APPLIANCES

A. Appliances are scheduled on the Drawings.

B. Disposer: Furnished and installed by Contractor

C. Refrigerator: Furnished and installed by Owner.

D. Ice Maker: Furnished and installed by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Install appliances in accordance with the manufacturer's recommendations in the locations indicated

END OF SECTION

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manual roller shades.
   2. Motorized roller shades

B. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

C. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals under provisions of Section 013300.

B. Product literature: In addition, indicate all components requiring finish selections and provide standard finish options for selection.

C. Shop Drawings:
   1. Indicate roller shade sizes and mounting details. Indicate relationship to adjacent construction. Provide wiring diagrams for motorized shades, including switch configurations.
   2. Provide plan and mounting details based on verified field conditions of each manual and motorized installation. Show location of control loop and width of shade. Provide elevation for non-typical installations.
   3. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

D. Samples: Submit fabric and finish samples for selection.

E. Contract Closeout Submittals: In accordance with Section 017700; cleaning and maintenance instructions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A minimum of 3 years experience in the installation of roller window shade systems of the type specified.

B. Fabrics shall be supplied in continuous rolls with no horizontal seams.

C. Fascia panels shall be able to be installed across two or more shade bands in one piece.

D. Provide mock-up demonstrating relationship between roller shades and systems furniture panel to determine acceptable light gap.

E. Coordinate motorized shades controls design with design/build lighting control vendor.

1.4 WARRANTIES

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Shadecloth: Manufacturer's standard ten year warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.

D. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 - PRODUCTS

2.1 ROLLER WINDOW SHADES

A. Manufacturer:
   1. Basis of Design: MechoShade Systems, Inc. (Long Island City NY; 718-729-2020).
   2. Acceptable Options (subject to compliance with Contract Document requirements and Architect's approval of color and conformance to design intent.):
      a. Draper (Spiceland IN; 765-987-7999).
      b. Levolor Home Fashions Contract Div. (High Point, NC; 910/812-8181).
      c. Hunter Douglas (New York, NY; 845-664-7000)
      d. Skyco Shading Systems, Inc. (Santa Ana, CA; 800-777-5926)]

B. Manually Operated Shades: “Mecho/5” or “Mecho/5 Slimline” as appropriate for the installation; manually operated units;
   1. Manually operated roller shade system with 1-3/8 inch diameter steel tube.
   2. Clutch Mechanism: Wrap-spring design in fiberglass reinforced polyester housing assembly. Clutch shall operate bi-directionally using an endless beaded chain.
   3. Control Loop: Endless #10 nickel-plated steel ball chain.
   4. Brackets: Type as required for installation conditions; color to match fascia panel.
   5. Fascia Panel: Extruded aluminum panel with enamel finish, color as selected by the Architect from the manufacturer's standard line; snap-on mounting to roller-shade mounting brackets.

C. Motorized Shades: Motorized Operating Mechanisms: Provide factory-assembled shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for conditions indicated and recommended by manufacturer for use with shades indicated.
   1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Electric Motors: Manufacturer's standard for operating roller shades.
      a. Electrical Characteristics: Single phase, 110 V, 60 Hz.
   3. Remote Controls: Individual/group wall-switch control stations.
   4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
   5. Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.

D. Fabric: As selected by the Architect from the manufacturer's complete line.

2.2 FABRICATION

A. Fabricate units to fit the openings indicated, from head to sill, and from jamb to jamb.

B. Fabricate elements to integrate with adjacent construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Architect, in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install shades level, square, true, and with uniform and equal perimeter spacing, free of folds. Install

for smooth operation.

C. Provide all support framing and brackets as necessary to support roller shades.

D. Electrical Connections: Connect motor-operated roller shades to building electrical system.

END OF SECTION

SECTION 124813 - ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glue down carpeting/entrance mats.

B. Related Sections:
   1. 030013 - Building Concrete: Substrate.
   2. 084113 - Aluminum-Framed Entrances and Windows: Coordination; thresholds.
   3. 096813 – Tile Carpeting.

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Substitutions: Substitute products will be considered only under the terms and conditions of Section 016000.

1.2 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for all materials and products required for the Work.

C. Samples: Minimum of 9 inch square samples of entrance mat proposed.

1.3 QUALITY ASSURANCE

A. Mat Installer: Minimum of 3 years experience in entrance mat installations of similar type.

1.4 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

1.5 SITE CONDITIONS

A. Space shall be maintained at a minimum of 68 degrees F. a minimum of 72 hours prior to carpet installation.

1.6 GUARANTEE/WARRANTY

A. Submit guarantees and warranties in accordance with Section 017700.

B. Installer's Guarantee: Guarantee installation for 1 year after Substantial Completion. If installation defects have caused irreparable damage to the carpet, provide new materials to match that damaged at no additional cost to the Owner. Perform guarantee work at a time convenient to the Owner.

C. Manufacturer's Warranty: Manufacturer's standard 5 year limited warranty against wear.]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Entrance Mat:
   1. Basis of Design: Cocoa Mat by American Floor Mats.
      a. 3/4" Thick, Recessed, Natural Color,
   2. Or similar approved

2.2 ACCESSORIES

A. Perimeter Frame: Stainless steel angles; 1/8 inch thickness; furnish with embedment anchors; welded corners.

B. Lock Downs: Concealed; manufacturer’s standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

D. Ensure that concrete floors are free from scaling, and exhibit acid neutrality.

E. Moisture Testing of Concrete Slabs:
   1. Perform calcium chloride tests to determine the vapor emission rate from the concrete slab . Notify the Architect if tests results show a vapor emission rate which exceeds 5 lbs per 1000 sf in a 24 hour period.
   2. Test kits are available from VAPRECISION (800-449-6194).

3.2 PREPARATION

A. Clean floors of substances which would be detrimental to the proper performance of adhesive and carpet.

B. Fill low spots and cracks over 1/8 inch in width with latex underlayment.

3.3 INSTALLATION

A. Mat Installation:
   1. Install mat and adhesive in accordance with manufacturer's instructions.
   2. Glue directly to the floor.
   3. Scribe mat material to vertical surfaces.
   4. Align the lines of mat material, as woven, using no fill strips less than [12]24 inches wide, laying all mat in same direction.

B. Seams:
   1. Locate seams parallel to direction of travel, but away from traffic patterns, and in accordance with approved seaming diagram. Align so that pattern continues uninterrupted across seams.
   2. Fabricate seams by compression method, using butt joint; properly bead and seal.

END OF SECTION

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural-steel framing.
2. Engineered design.
3. Component fabrication.
4. Building delivery and handling.

B. Related Sections:
1. 074216 - Sheet Metal Siding
2. 076129 - Sheet Metal Roofing
3. 081113 - Hollow Metal Doors And Frames
4. 083323 - Overhead Coiling Doors
5. 084113 - Aluminum-Framed Entrances, Storefronts and Windows
6. 089100 - Louvers

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

D. Request for approval by alternate manufacturers shall comply with requirements described in the Instructions to Bidders.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. A653 - Steel Sheet, Zinc Coated, (Galvanized), or Zinc-Iron Alloy Coated by the Hot Dip Process.
2. B32 - Solder Metal
3. E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
4. E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
5. E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
6. E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
7. E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

B. American Welding Society (AWS):
1. D1.1 – Structural Welding – Steel.
2. D1.3 - Structural Welding Code - Sheet Steel.

C. Commercial & Industrial Building Systems (CIBS)
1. Installation, Flashings & Details Guide: BR137 July 2020

D. Metal Building Manufacturer's Association (MBMA)

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Sixth Edition 2003.

F. Underwriters Laboratories (UL)
1. 580 - Standard for Tests for Uplift Resistance of Roof Assemblies

1.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance:
1. Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."
2. Design of Metal Building shall be in compliance of International Building Code with State and local amendments.
3. Snow Loads: To be determined by delegated designer in accordance with ASCE/SEI 7.
   a. General: As indicated on the Structural Drawings. Minimum 30 psf.
   b. Unbalanced Snow Load: In accordance with ASCE/SEI 7 and criteria indicated on the Structural Drawings.
4. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
   a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
   b. Girts: Horizontal deflection of 1/240 of the span.
   c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
   d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
   e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
5. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the lesser of following:
   a. Wind Drift: 1/120 of the longest span
   b. Seismic Drift: Maximum of 1/100 of the building height.
6. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
7. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
8. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
9. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
10. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 6.24 lbf/sq. ft.
11. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 6.24 lbf/sq. ft.

12. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 6.24 lbf/sq. ft.
13. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 6.24 lbf/sq. ft.
14. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.
15. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for steep slope roof products.

1.4 SUBMITTALS

A. Product Data: For each type of metal building system component including primary steel, secondary steel, and painting primers.

B. Shop Drawings: For metal building system components. Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

D. Load Reactions: Submit load analysis including column reactions by date indicated in the Bidding Documents.

E. Welding certificates.

F. Manufacturer Accreditation: Statement that metal building system and components were designed and produced by a manufacturer accredited according to the International Accreditation Service's AC472.

G. Metal Building System Certificates: For each type of metal building system, from manufacturer.
   1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
      a. Name and location of Project.
      b. Order number.
      c. Name of manufacturer.
      d. Name of Contractor.
      e. Building dimensions including width, length, height, and roof slope.
      f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
      g. Governing building code and year of edition.
      h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
      i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
      j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

H. Material test reports.

I. Source quality-control reports.

J. Field quality-control reports.

K. Warranties: Sample of special warranties.

L. Maintenance data.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
   1. Accreditation: According to the International Accreditation Service's AC472.
   2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

D. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

E. Detail Design and Installation: Unless otherwise indicated on the Drawings, design and install all sheet metal flashing and trim accessories in compliance with CIBS.

F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY AND HANDLING

A. Pack and load all components to safely transport items to project site without damage to products. Comply with all applicable WSDOT requirements.

B. Coordinate with Contractor of Construction phase for building delivery time and date.

C. Assist construction Contractor with product unloading and staging. This may require physical inspection by fabricator’s representative of the construction site prior to delivery.

D. Assist construction contractor with physical inspection of delivered products, both during unloading procedures and unpacking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Butler Manufacturing Company; a BlueScope Steel company.

2. Ceco Building Systems; Division of NCI Building Systems, L.P.
3. Garco Building Systems; Division of NCI Building Systems, L.P.
4. Nucor Building Systems.
5. Star Building Systems
6. Olympia Steel Building Systems.
7. Sunward Steel Buildings.
8. Approved alternate.

2.2 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Types as indicated on the Structural Drawings.

B. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
2. Exterior Column Type: Tapered.
3. Rafter Type: Tapered.

C. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.

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

E. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.

F. Finish on Exposed Steel Framing: Factory primed as follows:
1. Exterior Primers: At steel framing surfaces exposed to exterior conditions:
a. First Primer: One of the following; provide product from same manufacturer selected for finish systems specified in Section 099000.
1) “Series 394 PerimePrime" by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).
2) "Carbozinc 859" by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645); organic zinc-rich epoxy primer.
3) "68HS" by Ameron Protective Coatings (Brea, CA; 714-529-1951); organic zinc-rich epoxy primer.
4) "Catha-Coat 302H" by ICI Devoe; "reinforced" inorganic zinc-rich epoxy primer.
5) “MIL-PRF-32550” zinc-rich primer by Sherwin Williams
b. Epoxy Tie-Coat Primer: One of the following; provide product from same manufacturer selected for first primer specified above:
1) "Hi-Build Epoxoline II" Series N69 by Tnemec Company Inc. (Kansas City, MO; 816-483-3400).

2) "Carboline 888 " by Carboline Company (St. Louis, MO; 314-644-1000; 800-848-4645); organic zinc-rich epoxy primer.
3) "Amercoat 385." by Ameron Protective Coatings (Brea, CA; 714-529-1951); organic zinc-rich epoxy primer.
4) "Devran 224HS," "Bar-Rust 231," or "Bar-Rust 233H." by ICI Devoe; "reinforced" inorganic zinc-rich epoxy primer.
5) "Duraspar Prime High Speed" epoxy primer by Sherwin Williams.

2. Interior Primer: At steel framing surfaces exposed only to interior conditions: Iron oxide; FS TT-P-31E.
3. Apply specified primer immediately after cleaning and pretreating.

2.3 METAL ROOF AND WALL PANELS

A. Metal roof and wall cladding, including all associated sheet metal flashing and trim, gutters and downspouts, are specified in separate sections.

2.4 THERMAL INSULATION

A. For reference, proprietary thermal insulation system will include thermal insulation, interior liner system fabrics of the type specified, support strapping of the appropriate color, fasteners of the appropriate type and color, sealants, and thermal break materials of the appropriate type to insulate the roof and wall areas to the full designed R-value of the building as specified.

B. Acceptable Manufacturer: Thermal Design, Inc., Simple Saver System. (Madison, NE 800-255-0776) or approved alternate.

C. Materials: Simple Saver System consists of Roof Insulation, Wall Insulation, Vapor Barrier Liner Fabric, Thermal Breaks, Straps, and other devices and components in a proprietary insulation system as follows:
1. Batt Insulation: ASTM C 991 Type 1; preformed formaldehyde-free glass fiber batt conforming to the following:
   a. Thermal Resistance as indicated on the Drawings.
   b. Unfaced.
2. Vapor Barrier Liner Fabric: "Syseal" type woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene coatings, as follows:
   a. Product complies with ASTM C 1136, Types I through Type VI.
   b. Perm rating: 0.02 for fabric and for seams in accordance with ASTM E 96.
   c. Flame/Smoke Properties:
   d. Ultra violet radiation inhibitor to minimum UVMAX rating of 8.
   e. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building area with minimum practicable job site sealing.
   f. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable due to degradation of fabric.
   g. Factory-folded to allow for rapid installation.
   h. Color: As selected by Architect.
3. Vapor Barrier Lap Sealant: Solvent-based, Simple Saver polyethylene fabric adhesive.
4. Vapor Barrier Tape: Double-sided sealant tape 3/4 inch wide by 1/32 inch thick.
5. Vapor Barrier Patch Tape: Single-sided, adhesive backed sealant tape 3 inches wide made from same material as Syseal type liner fabric.
6. Thermal Breaks:

a. 1/8 inch thick by 3 inch wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing.
b. Polystyrene Snap-R snap-on thermal blocks.

7. Straps:
   a. 100 KSI minimum yield tempered, high-tensile-strength steel.
   b. Size: Not less than 0.020 inch (0.50 mm) thick by 1 inch (25 mm) by continuous length.
   c. Galvanized, primed, and painted to match specified finish color on the exposed side.
   d. Color: As selected by Architect.
8. Fasteners:
   a. For light gage steel: #12 by 3/4 inch plated Tek 2 type screws with sealing washer, painted to match specified color.
   b. For heavy gage steel: #12 by 1-1/2 inch plated Tek 4 type screws with sealing washer, painted to match specified color.
   c. For wood, concrete, other materials: As recommended by manufacturer.
9. Wall Insulation Hangers: Fast-R preformed rigid hangers, 32 inch long galvanized steel strips with barbed arrows every 8 inches along its length.

2.5 DOORS AND FRAMES

A. Doors and frames are specified in applicable Division 08 Sections.

B. Hardware is specified in Section 087100.

2.6 WINDOWS

A. Windows are specified in Section 084113.

2.7 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2.8 SOURCE QUALITY CONTROL

A. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
   1. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
      a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

B. Testing: Test and inspect shop connections for metal buildings according to the following:
   1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.9 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.
   1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
   2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

E. Shop prime all steel.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Bolt joists to supporting steel framework using carbon-steel bolts unless high-strength structural bolts are required by the manufacturer.
5. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.2 METAL PANEL INSTALLATION, GENERAL

A. Install metal panels in compliance with separate applicable specifications sections.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
   2. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   3. Install metal panels perpendicular to structural supports unless otherwise indicated.
   4. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
   7. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   2. Install mastic tape at all panel laps.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.
   1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
   1. Install ridge and hip caps as metal roof panel work proceeds.
   2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-drilling or self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
   4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
   5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
   6. Provide metal closures at peaks, rake edges, and each side of ridge and hip caps.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
   4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
   5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   7. Install screw fasteners in predrilled holes.
   8. Install flashing and trim as metal wall panel work proceeds.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
   10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
   11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.5 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.6 THERMAL INSULATION INSTALLATION

A. Install insulation and liner fabric in compliance with insulation manufacturer’s instructions.

B. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
   1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
   2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
   3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

C. Blanket Roof Insulation: Comply with the following installation method:
   1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
      a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
   2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

D. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
   2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

3.7 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying

rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Tie downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.8 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

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

C. Tests and Inspections:
   1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hydraulic passenger elevators including the following:
   1. Elevator cabs and doors.
   2. Hoistway doors, frames, and sills for passenger elevators.
   3. Guide rails and brackets.
   4. Pit buffers.
   5. Pumps, motors and controls.
   6. Hydraulic cylinder and associated piping.
   7. Electrical connections from controller to elevator equipment and cabs.
   8. Testing.
   9. Maintenance.
   10. Early operation.

B. Related Sections:
   1. 033000 - Cast-In-Place Concrete: Concrete portions of hoistway construction.
   2. 042200 - Concrete Unit Masonry: Hoistway construction
   3. 055000 - Metal Fabrications: Pit ladders, pit gratings.
   4. 211300 - Fire-Suppression Sprinkler Systems.
   5. 283100 - Fire Detection and Alarm.

C. Drawings, the Provisions of the Agreement, including bonds and certificates, the General Conditions, and Division 1 specification sections apply to all the work of this Section.

1.2 EARLY OPERATION

A. Allow temporary use of the elevators by the Owner, when operable, before the elevators are placed in permanent service. Provide temporary enclosures, guards, hoistway opening protection, including elevator operators and other items necessary to permit temporary elevator operation.

B. Early operation does not constitute final acceptance of the elevators.

C. Immediately prior to request for final acceptance, make necessary adjustments and repairs as necessary to turn the elevators over to the Owner in new and completed condition.

1.3 SYSTEM DESCRIPTION

A. Each elevator system shall be furnished complete; unspecified details of design and construction shall be the responsibility of the manufacturer. All changes to the design indicated in the Contract Documents to accommodate the elevator sub-contractor shall be accomplished at no additional cost to the Owner.

B. Name plates, logos, or other manufacturer identification will not be permitted on components visible to the public.

C. Performance:
   1. Hydraulic Elevator Speed: Plus 10 percent or minus 20 percent of specified speed, under all loading conditions within the load capacity of the elevator.
   2. Capacity: Safely lower, stop and hold up to 125 percent of rated load.
   3. Leveling: Plus or minus 3/8 inch maximum under any loading condition.
   4. Passenger Elevator Floor to Floor Performance Time: 13.0 seconds from start of door closing until the car is level at the next floor with doors 3/4 open, based on 17'-6" travel.

1.4 SUBMITTALS

A. Make submittals in accordance with Sections 013300 and 017700, as applicable.

B. Submittal with Sub-Bid:
   1. List of previous elevator installations of comparable scope, including names and addresses of each Project, Owner, and Architect.
   2. Exceptions to bid documents.

C. Product Data: Submit catalog cuts for the following:
   1. Hall lantern.
   2. Call station.
   3. Car operating station.
   4. Braille markings.
   5. Telephone.
   6. Oil cooler.

D. Shop Drawings:
   1. Shop drawings shall be drawn to scale.
   2. Indicate machine room plans with equipment sizes, dimensions, locations and loads, service connections, mounting conditions.
   3. Show hoistway sections for each elevator indicating vertical bracket spacing, and guide rails including:
      a. Estimated forces on rails and in pits.
      b. Horizontal forces on guide rail faces during loading and unloading.
      c. Supplementary rail support structure.
      d. Attachment points.
   4. Indicate construction methods, materials, installation details, finishes, and arrangement of equipment, including:
      a. Buffer location, channel supports, if required, end reactions, including impact loads.
      b. Blockouts in floor.
      c. Car location and details.
      d. Entrance locations and details.
      e. Travel.
      f. Clearances.
      g. Critical field dimensions.
      h. Signal equipment.
      i. Control equipment.
      j. Emergency car top access hatches.
      k. Hydraulic plunger, cylinder size, and oil line locations.
   5. Complete dimensioned elevations and details of cabs indicating finishes, attachments, configurations, locations, and substrates, as applicable, including:
      a. Car control stations including precise designation of font and text for each button and Braille markings.
      b. Service cabinet.
   6. Provide motor time/current profiles, horsepower code letter, starting and running currents, service factor, insulation type, and recommended disconnect sizes as separate submittal.

E. Samples:
   1. Minimum(3) samples of sheet metal indicating proposed finish, minimum 4 ½ by 4 ½ inch size.
   2. Color charts for Architects selection of painted components.

F. Wiring Diagrams: Furnish complete single-line electrical wiring diagram (as-installed) for each elevator system with index of location and function of all components.

G. Control and Operation Descriptions: Submit complete detailed specifications for materials, equipment, and associated components.

H. Closeout Submittals:
   1. Certifications:
      a. Required fire endurance rating by acceptable testing organization, or evidence of UL label and listing.
      b. Certification by local elevator inspection authority.

2. Required test certificates and permits.
3. Record Drawings.
4. Operation and Maintenance Manuals:
   a. Within 90 days of final acceptance, submit 2 sets of three-ring binders with information necessary for maintenance and adjustment of equipment. Final retainage will be withheld until data is reviewed and approved by Elevator Consultant before delivery to Owner.
   b. Comply with additional provisions of Section 017700.
   c. Include the following as minimum:
      1) Project Record documents (other than drawings), diagrams, straight-line wiring diagram of as-installed elevator circuits with index of component locations and functions.
      2) Parts list and catalogs for replaceable parts, including ordering forms and instructions.
      3) Instructions on operation, adjustment, servicing, lubrication, including lubricant and recommended equivalent grades of commercially available lubricants to manufacturer's graded lubricants.
5. Wiring Diagrams:
   a. Provide 2 additional corrected as-installed copies of straight-line wiring diagrams for each elevator system.
   b. Mount one copy of each system on a panel which is designed for wall mounting in elevator machine rooms; place on wall at locations directed by Owner.

1.5 QUALITY ASSURANCE

A. Sub-Bidder's Representation: By submitting a bid, the elevator sub-bidder represents that it has reviewed the bid documents for compatibility with products and systems proposed for the Work, and, except as noted in the sub-bid, proposes to comply with document requirements, including structural, mechanical, and electrical systems.

B. Pre Award Meeting:
   1. Conduct in accordance with Section 013119.
   2. Require in attendance the General Contractor, the prospective elevator subcontractors, the National Accounts Representative for each prospective elevator supplier, Architect, and Owner's Representative.
   3. Agenda: Include submittal requirements, delivery and installation schedule, access, temporary and permanent power requirements, coordination with supporting construction, hoistway entrance installation requirements, cab finishes, opening week service and maintenance requirements, terms of warranty, and scheduling of warranty maintenance.

C. Code Requirements: Comply with latest and most stringent applicable provisions of the following:
   1. Safety Code for Elevators and Escalators ASME/ANSI A17.1.
   2. Inspector's Manual ASME/ANSI A17.2.
   3. National Electrical Code NFPA No. 70.
   4. Life Safety Code NFPA No. 101.
   5. Jurisdictional building Code authorities.
   6. International Building Code.
   7. Jurisdictional accessibility Code.
   8. Other applicable governing codes, ordinances, laws, regulations, safety order, and directives.

D. Obtain and pay for required permits and make such tests as are required by regulations of authorities.

E. Comply with Section 014500 and requirements of this Section for accommodation of final and verification testing operations.

1.6 WARRANTY/MAINTENANCE SERVICE

A. In addition to making corrections to defects in the elevator installation, maintain the elevator installation for a period of 3 months after substantial completion of the Work.

B. During the warranty/maintenance period, visit the site on a monthly basis, and perform systematic examination, adjustment, and lubrication of elevator equipment. Repair or replace worn components. Use parts produced by the manufacturer of the original equipment.

C. Perform work on a 24 hour basis without removing car from service during normal working hours.

D. Warranty/maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Otis Elevator Company.

B. Mitsubishi Elevator Company

C. ThyssenKrupp AG

D. Fujitec America

E. Kone Inc.

F. Schindler Elevator Corporation.

2.2 ELEVATORS #26 AND #27

A. Type: Hydraulic. Dual jack holeless hydraulic.

B. Net Capacity: 3,500 pounds.

C. Speed: 150 feet per minute.

D. Hoistway Dimensions: As indicated on the Drawings.

E. Machine Room on Street Level: As indicated on the Drawings.

F. Pit Depth: As indicated on the Drawings.

G. Travel: 60 feet.

H. 5 stops; front/center opening..

I. Entrance Opening Size: 3'-6" wide by 7'-0" high.

J. Doors: Center opening, minimum opening speed 2-1/2 fps, high speed heavy duty type.

K. Operation: Duplex collective.

L. Guide Rails: Planed steel tees, or other approved proprietary steel shape. Provide additional brackets and backing necessary to support rails and meet A17.1 seismic design criteria.

M. Electrical Service: 480 volt, 3 phase.

N. Cylinder:
   1. Provide cylinder with rust preventive treatment and cover outside with fiberglass or double mastic wrap.
   2. Provide steel outer casing and PVC inner casing for corrosion resistance.
   3. Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to prevent the plunger from leaving the cylinder. A sheave shall be located at the top of each plunger and shall be guided through its travel by a set of plunger rails. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

O. Holeless Design:
   1. Provide manufacturer's standard dual jack holeless assembly.
   2. If roped design is furnished, locate governor in machine room or provide associated access panel and metal access ladder equipped with an approved platform.
   3. Ropes: Ropes shall be fastened to the top of the cylinder jackstands, travel over the plunger sheave and attach to the bottom of the elevator carframe.

P. Motor Controls: Hydraulic with automatic leveling; include wye-delta start.

Q. Hoistway Entrances:
   1. Type: Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be UL fire rated steel.
   2. Doors: Entrance doors shall be of hollow metal construction with vertical internal channel reinforcements.
   3. Fire Rating: UL 1-1/2 hour label.
   4. Sills: Extruded Aluminum
   5. Sill Support Angle: Elevator manufacturer's standard. Grouting as needed by others.

R. Car Construction:
   1. Shell: Reinforced 14 gage steel with interior finish of black baked enamel. Apply sound deadening to shaft side.
   2. Canopy/Top: Reinforced 12 gage steel with hinged exit operable from exterior at car top side only. Coordinate location to accommodate ceiling lighting and finishes. Finish with white baked enamel.
   3. Top Height: Minimum 8'-0" above finish floor.

S. Car Finish Components:
   1. Return Panels and Integral Entrance Columns: Satin Stainless Steel
   2. Transom Panels: Satin Stainless Steel
   3. Car Door Panels: Satin Stainless Steel
   4. Side and Rear Panels: Cab walls to have attached vertical non-removable panels, laminated front and back with plastic laminate.
      a. Type: non-removable
      b. Plastic Laminate: To be selected from the manufacturer's standard finish selection chart
      c. Base: Black baked enamel finish with ventilation cutouts.
   5. Floor: Provide 5/8" recess to accommodate stone installation. Stone is specified as work of Section 093000.
   6. Threshold: Extruded Aluminum.
   7. Ceiling: Manufacturer's standard stainless steel panel ceiling, #4 finish; six incandescent downlights
   8. Handrails: Manufacturer's standard satin stainless steel round tubular design, 2 inch diameter.
   9. Pads and Buttons: 3 section removable cab pads to cover side and rear walls.
   10. Blower and Ventilation: Single speed type cab dome style.

T. Car Control Station:
   1. Design: A panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. Raised markings and Braille markings shall be provided for each push-button.
   2. Provide one station on the right side. Auxiliary station not required.
   3. Alarm Button: Siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged. Siren shall have a rated sound pressure level of 80 dba at a distance of 3.0 m from the device. Siren shall respond with a delay of not more than 1 second after the switch or push button has been pressed
   4. Door Open Button: Hold open or stop and reopen closing doors. Buttons shall be operable while car is stopped at landing, regardless of special operational features, except firefighters' service.
   5. Floor Button Design:
      a. Mechanical illuminated, round button target design; manufacturer's standard design.

b. Provide Braille markings to the left of each button; size and shape of each plaque to match buttons; letter style manufacturers standard.

6. Control Position: Operating controls no higher than 48 inches above the car floor; 35 inches for alarm button.
7. Firefighters' Service:
   a. Key switch with metal cylinder.
   b. Call cancel button.
   c. Light jewel.
8. Service Keyswitches
   a. Located above car control button station with hands-free phone within car control station.
   b. Switches:
      1) Elevator stop switch; include markings to indicate "RUN" and "STOP" positions.
      2) Inspection switch, conforming to the Code, for disconnecting automatic operation, and activating hoistway access switch when car is at terminal landing.
      3) Light switch.
      4) Two-position exhaust fan switch; off, and 1 fan speeds.
      5) Identify switches with permanent engraved labels.
9. Emergency Communication System:
   a. ADA compliant communication telephone device. Provide hands-free phone integral with car operating panel.
   b. Provide visual acknowledgment of alarm in accordance with accessibility requirements. Locate on car operating panel.
10. In-Car-Lantern and Chime- A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

U. Call Stations:
   1. Provide single riser with flush-mounted applied faceplate finished in satin stainless steel. Include pushbuttons for each direction of travel which illuminates to indicate call registration. Pushbutton design shall match car operating panel pushbuttons. “IN CASE OF FIRE EMERGENCY, DO NOT USE ELEVATOR. USE STAIRS” shall be provided by others. Include firefighters’ Phase I key switch with proper instructions as required by National and State codes.

V. Hall Position Indicator:
   1. Manufacturer’s standard design with lenses and flat applied face plate. Finished in satin stainless steel, at main landing only.

W. Emergency Lighting:
   1. Car mounted battery unit with solid state charger to operate emergency lighting and alarm bell.
   2. Battery shall be rechargeable with minimum 5 year expectancy.
   3. Provide wiring to include operation of at least 2 downlight fixtures on car emergency power circuit.

X. Additional Features:
   1. Traveling Cables:.
      a. Wiring for cab power and monitoring system.
      b. Shielded wiring for telephone.
      c. Coaxial cable and power for CCTV.
   2. Buffers: Spring type with required blocking.
   3. Seismic protection in accordance with A17.1, including provisions of Section 2400, to meet seismic requirements indicated on the Structural Drawings.
   4. Car top inspection station.
   5. Proximity device at doors for instant reopening; disable manufacturer’s standard nudging feature.
   6. All controls shall be accessible, include braille markings.
   7. Firemen's special emergency service features, Phase I and II. Include [metal] cylinder for installation in lobby (main recall floor) call button cover plate. Coordinate with the Fire Marshal and fire alarm system subcontractor for elevator recall programming.
   8. Sound reducing enclosure for pump/motor unit.

9. Car stall protective circuit.
10. Non-creeping device.
11. Manual lowering feature.
12. Provision for isolation of machine to minimize noise and vibration.
13. Provide approved oil cooler for hydraulic oil:
    a. External radiator and fan with pump.
    b. Design to ensure maximum oil temperature of 115 degrees F. under peak operating condition.
    c. Include measures to shut off fan when cooling is not required.
14. Motor:
    a. Maximum motor horsepower: 40.
    b. Maximum starting current: 145 amps.
    c. Full load running current: 50 amps.

Y. Signage:
1. Engrave directly on return panel above car station; 1/2 inch high letters, black paint filled; font as approved by the Architect.
    a. NO SMOKING
    b. CAPACITY 3500 LBS
    c. IN CASE OF FIRE EMERGENCY, DO NOT USE ELEVATORS. USE EXIT STAIRS.
2. Manufacturer's standard telephone signage.
    a. Telephone symbol.
    b. Braille TELEPHONE.
3. Fire Fighters Service, Phase II Instructions: Text per local requirements; engrave directly on return panel; 1/4 inch high letters unless otherwise required; black paint filled, font as approved.

Z. Floor Designations:
1. Manufacturer's standard ADA compliant plaques with raised 2 inch high numerals, with supplementary braille numerals; numeral and symbols painted black; background.
2. Install on both jambs of each elevator hoistway entrance, 60 inches above finish floor, in compliance with accessible requirements.

2.3 MISCELLANEOUS EQUIPMENT

A. Furnish operating equipment, supports including machine beams, rails, and ancillary equipment, properly sized, and as necessary for complete and functioning elevator installations.

2.4 STAINLESS STEEL FINISHES

A. Apply uniform mechanical finish to match NAAMM "Fine Satin" directional finish; 180 grit, or approved, to all exposed bronze surfaces; direction as follows.
1. Hoistway entrance doors and frames.
2. Hoistway Entry Doors: Vertical satin finish.
3. Cab Doors and Return Panels: Vertical satin finish.
4. Ceiling Panels: Parallel to door panels.
5. Hall Lantern Face Plates: Vertical satin finish.
6. Call Station Cover Plates: Vertical. Satin finish

B. Except at thresholds, coat mechanically finished bronze surfaces with two coats of clear lacquer; protect with temporary adhesive backed protective paper.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Section depends. Report defects to Architect in writing which may affect the work of this trade or equipment operation.

B. Verify that shafts and openings for moving equipment are plumb, level, in line, waterproofed, drained, and with proper pit depth and necessary ladder and guard. Notify Architect of discrepancies.

C. Verify that each machine room is properly configured and equipment foundations and beams correctly located. Notify Architect of discrepancies.

D. Before fabrication, take necessary job site measurements for preparing shop drawings, check measurement of space for equipment, verify means of access for installation and operation.

E. Verify that the following preparatory work, provided by others, has been properly completed to receive the elevator work. Notify the Architect of discrepancies.
   1. Supply of electric feeder wires to the terminals of the elevator control panel, including fused main line switch or circuit breaker. Provision for car light and for light in the pit and outlets in machine room for light. Furnishing of electric power for testing and adjusting elevator equipment.
   2. Provision for machine room connection for telephones and connection for camera in freight elevator.
   3. Supply of power for emergency car enclosure lighting and ventilation from a power panel specified in Division 16 and fed by building emergency circuits.
   4. Machine room secured with lockable door.

F. Furnish inserts, anchors, bearing plates, brackets, supports, and bracing complete with setting templates and diagrams for placement in ample time for installation by other trades.

3.2 INSTALLATION

A. Perform work with competent mechanics skilled in this work and under the supervision of the elevator manufacturer's experienced superintendent.

B. Install items for removal by portable hoists or other means, if necessary, for maintenance and repair, providing readily available safe access. Hoisting beam will not be provided.

C. Set hoistway entrances in alignment with car openings and true with plumb sill lines. Erect hoistway sills, headers and frames prior to erection of rough walls and doors; erect facias and toe guards after rough walls finished.

D. Install machinery, guides, controls, car, equipment, and accessories in accordance with manufacturer's instructions, applicable codes, and standards to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration. Align guide rails vertically within a tolerance of 1/16 inch in 100 feet.

E. Provide terminals for connection of CCTV, telephones, smoke detection, and alarm system at controller.

F. Coordinate grouting of sills and hoistway entrance frames with work of other Sections.

G. Coordinate with Division 16 work for installation and function of smoke detectors.

H. Provide 120v wiring, twisted pairs, and/or coaxial cable wiring in conduit to 4x4 junction box located on rear corner of car enclosure. Locate to avoid interference with emergency escape hatch. Provide hole in car ceiling and protective grommet. Pull wires to junction box, tie back, and secure. Mark box cover "CCTV, 120v". Provide switch for 120v circuit on car top to remove power from this circuit. Feed this circuit from car lighting circuit. In machine room, terminate designated twisted pairs and/or coaxial cable in 4x4 junction box, surface mounted on side of controller. Permanently mark cover "CCTV". Provide adequate wire for required connections. Pull wires into box, tie back and secure.

3.3 ADJUSTING AND BALANCING

A. Make necessary adjustments to ensure elevator operates smoothly, accurately, and in accordance with specified requirements.

B. Adjust controllers, valves, leveling switches, limit switches, stopping switches, door operators, interlocks and safety devices to operate within accepted design tolerances and performance levels. Adjust car leveling devices so car stops within applicable dimension tolerance of finished floor per type of elevator.

C. Balance cars to equalize pressure of car guide shoes on rails.

D. Lubricate equipment in accordance with accepted manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Prior to request for final inspection by the Owner's Elevator Consultant, test elevators to verify performance in accordance with specifications, including floor to floor performance time with full load, stopping accuracy, and temperature rise in motor windings during continuous operation under full load.

B. Notify Owner when elevator systems are complete and ready for final inspection.

3.5 CLEANING

A. Prior to final acceptance, remove protection from finished or ornamental surfaces and clean and polish surfaces with due regard to type of material.

B. At completion of work of this section, remove tools, equipment and surplus materials from site.

3.6 DEMONSTRATION

A. Furnish the services of a trained representative to instruct the Owner's personnel in use of elevators at a time convenient to the Owner.

END OF SECTION

SECTION 21 00 10
GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

A. Conform to General Conditions, Supplementary Conditions, and Division 01.

B. This section of the specification applies to the entire mechanical work, both interior and exterior, as specified herein after and shown on the plans.

C. This Contractor is responsible for coordination with all other trades.

1.02 SCOPE

A. All services to within five (5) feet of the building, shall be provided as shown on plans, and final connections to these services shall be made by the Mechanical Contractor.

1.03 DEFINITIONS

A. The term "approved equal" means final approval by the Owner's representative of a material or piece of equipment substituted for that which is shown in the specifications or plans.

B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

C. The terms "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refers to those subcontractors working under the direction of the "General Contractor (GC)."

1.04 INTENT OF DRAWINGS

A. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in piping. Contractor shall provide additional fittings, offsets and extensions in piping and related mechanical insulation as required to meet the intent of the documents, and shall include these items in his bid. Contractor shall also include in his bid provisions to relocate or shift piping where conflicts exist with Structural, Architectural, or Electrical components.

B. Refer to the complete set of Architectural, Structural, Electrical, and Civil Plans and Specifications for additional details of the work. Review Plans and Specifications of other trades to identify other requirements. Discrepancies shall be reported to the Owner's representative immediately before ordering material or beginning work.

1.05 COORDINATION

A. Examine the complete set of drawings including all disciplines before work is started. Consult with each of the other Contractors regarding locations and spaces required for work and lay out work to avoid interference. Maximum clearance shall be maintained for service access and maintenance of all equipment. Failure to coordinate shall be justification to require Contractor, at his own expense, to move his work to provide the necessary space for the other contractors.

B. Mechanical systems have space priority as follows, listed with highest priority first: Graded Drainage Piping, then Ductwork, Drainage Vents, Hydronic Piping, Domestic Water Piping, Natural Gas Piping, and Fire Protection Piping. MC to make certain that priority access is maintained. This shall be coordinated by the GC and MC without assistance from Owner's representative, Engineer, or Architect.

C. Contractor shall be responsible for his own coordination between all other trades. Development of Shop Drawings shall be a collaborative effort between the General Contractor, Mechanical Contractor, Electrical Contractor and all other subcontractors working on the project. Shifting of piping, ductwork and other mechanical items shall be the responsibility of the Team to maintain the intent of the documents. Submit shop drawings to the Owner's representative.

1.06 WORK IN OTHER SECTIONS

A. Drawings and General Provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.07 CODES AND REFERENCES

A. Codes and Standards listed shall be the most current issue as adopted by the Local Jurisdiction. In the event of a conflict of codes, the most stringent code will apply.
   1. International Building Code (IBC)
   2. Uniform Plumbing Code (UPC)
   3. International Mechanical Code (IMC)
   4. Washington State Energy Code
   5. SMACNA Duct Construction Standards, Metal and Flexible
   6. National Electrical Code (NEC)

1.08 PERMITS AND FEES

A. Obtain and pay for all permits, licenses and construction or utility fees. Furnish final certificate to Owner showing compliance with code requirements.

1.09 SCHEDULING

A. Comply with requirements of General Specifications.

1.10 PRIOR APPROVALS

A. Specifications have been written around equipment and material selected for this project based on quality, size, capacity, and performance required to meet building design criteria. Any equipment and/or material used in this project that is not as specified, must have prior approval from the Owner's representative.

B. Request for Approval must be submitted with substitution request form included in Division 0 to Owner's representative a minimum of 10 calendar days prior to bid date. This letter shall be accompanied with complete information regarding items to be substituted. If supplier requires a reply to the request for approval, he is to send a self-addressed, stamped envelope with request.

C. Those items that receive prior approval will be listed in the Mechanical Addenda.

D. Supplier and/or Mechanical Contractor shall be responsible for ensuring that substituted material or equipment is of the same size, quality, capacity, weight, and electrical characteristics as that specified. Any changes and costs required during construction, due to contractor's/supplier's neglect to properly select substituted equipment, shall be paid by the contractor/supplier.

E. Prior approval to bid does not mean automatic final approval of material or equipment by the Owner's representative. Final approval will be given after final submittal data has been presented to Owner's representative, with complete information regarding weights, capacities, size, electrical requirements and quality.

1.11 MATERIAL AND MATERIAL SUBMITTALS

A. All material used on the project shall be new material and free from defects. This Contractor shall submit catalog data and engineering data on all equipment as specified or having received prior approval.

B. Material and equipment specified is designated by various manufacturer's catalog numbers. Acceptable alternate manufacturers are also listed. Such manufacturers are exempt from the 10-day prior approval clause of these specifications, but must submit standard submittal data for final approval as otherwise noted.

C. Submittal shall be arranged in numerical order, according to specification section number and item number. Submittal shall be in PDF format complete with labeled bookmarks (minimum one per specification section)

D. Submittal shall be as follows: Before ordering or installing any of the materials, this Contractor shall submit copies of complete information on the materials to be used on the project. Submittal shall include, but not be limited to, the following.
   1. Contractor's Cost Breakdown.
   2. Complete List of Subcontractors and Suppliers.
   3. Pipe, Valves and Specialties for fire protection systems.
   4. Fire Sprinkling Systems.

E. The Owner's representative will return one set of this submittal to the contractor showing any corrections, additions, and/or deletions. This Contractor shall resubmit those items that need to be corrected or added.

1.12 CONTRACTOR'S COST BREAKDOWN

A. Mechanical Contractor shall submit, with the bound submittals, a cost breakdown of the major portions of his work, pursuant to the following outline.
   1. Job organization and submittals.
   2. Outside site utilities.
   3. Fire protection systems.

1.13 RECORD DRAWINGS, OPERATING INSTRUCTIONS, OPERATION AND MAINTENANCE RECORD (AS-BUILT) DRAWINGS

A. This Contractor shall maintain a set of Contract Drawings at the site on which the actual installed location of piping, equipment, etc., shall be shown in a legible, neat manner. This set of plans shall show actual dimensions (including depth of bury) of underground piping from construction lines, so they can be readily found after covering. Upon completion of the project, the as-built information shall be transformed into AutoCAD version 2024 or greater. Record drawings shall be the same size as contract drawings. This set of plans shall be submitted for final approval. Drawings shall be one full size set, one half size set and on CD in PDF and .dwg format. The contractor shall be ready for review of the on-site as-builts monthly prior to submitting his billing. Failure to have drawings available for review may delay monthly billings.

1.14 OPERATING INSTRUCTIONS

A. Operate all systems through complete cycles in the presence of designated Owner's representative. Give instructions for operation, care and maintenance. All systems shall be operated through complete operating cycles for a minimum period of 7 days in conjunction with the designated Owner's representative before acceptance.

1.15 TRAINING

A. The Mechanical Contractor shall digitally record all Owner Mechanical training sessions and shall provide copies on DVD/USB flash drives. Training sessions shall be provided for all mechanical systems. Three copies of these DVD/USB flash drives shall be turned over to the Owner at the completion of the project.

1.16 OPERATION AND MAINTENANCE MANUALS (O&Ms)

A. General: Provide one preliminary searchable PDF set of Operation and Maintenance Manuals including maintenance information and parts list furnished by the manufacturer with the equipment, together with supplementary drawings where necessary, to itemize serving and maintenance points. Include the Valve Tag list(s) as posted in the Mechanical spaces. Include filter maintenance, methods of operation, seasonal requirements, manufacturer's data and warranty forms. Warranty forms are to be located in the front of the manuals as well as in each applicable section. Provide address and 24-hour phone number of the firms responsible under warranty. Items requiring service or correction during the warranty period shall be serviced within 24-hours of notification by Owner. Data in manuals shall be neat, clean copies, with operation and maintenance instructions for each item of equipment installed. Drawings shall be accordion folded. An index shall be provided with all contents listed in an orderly presentation with bookmarks according to specification section.

B. Number of Copies: A preliminary set of the O&M Manuals shall be submitted for approval. After this set has been approved, One hard copy and 3 electronic copies on USB flash drives shall be submitted.

C. Hard Copy Binding: Organize operating and maintenance data into suitable sets of manageable size. Copies shall be submitted in 3-ring binders. Covers shall include the name of the Job, Owner, Architect, Engineer, Contractor, and the year of completion. The back edge of the binder shall include a label with the name of the Job, the Owner and the year completed. Each copy shall have a typewritten index and tabbed dividers between equipment categories. Binders are to be no more than 80% full; binders that are over 80% full will be sent back for dividing into additional binders.

1.17 CERTIFICATIONS

A. Provide written certification that work has been fully completed in strict accordance with Plans and Specifications and request final inspection.

B. Provide written certification that Contractor will replace materials and workmanship that prove defective for one (1) year after date of acceptance or extended warranty as listed in individual sections.

C. Provide written certification of inspection from the Authority Having Jurisdiction, stating that all work has been inspected, accepted, and approved as complying with existing governing ordinances and codes.

D. Provide written certification that Owner's representative has been fully instructed in the operation and function of all mechanical systems.

E. Provide copies of certifications in the O & M Manuals.

1.18 DOCUMENTS

A. Present the following documents to the Owner's representative prior to final acceptance of buildings. Final payment of the Contract will be contingent upon receiving these documents:
1. Record (as-built) drawings.
2. Operation and Maintenance Manuals (3 sets).
3. Final material submittal.
4. Warranties and Extended Warranties.
5. State of Washington certification of all pressure vessels installed on the project. Affix a copy to each tank.
6. Final certificates of inspection and code compliance.
7. RPBF device tests.
8. All applicable forms required by these Specifications.
9. Provide copies of the above documents in O & M Manuals.

1.19 WARRANTY

A. All fire sprinkling equipment and systems, including controls and all parts thereof, shall be warranted (parts and labor), for a period of one (1) year after the date of substantial completion as determined by the documentation.

B. Contractor shall repair or replace to the satisfaction of the Owner's representative any defective material, equipment, or poor workmanship, which may show itself during this warranty period.

C. All compressors used in fire sprinkling systems shall have an additional four-year parts warranty.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL

A. Owner's representative's review of submittals is for general conformance with the design concept and Contract Documents. Marking or comments shall not be construed as relieving the Contractor from compliance with the project Plans and Specifications, nor departures therefrom.

The Contractor remains responsible for details and accuracy for confirming and correlating all quantities and assembly and for safe performance of his work.

END OF SECTION

SECTION 21 00 20
BASIC MATERIALS AND METHODS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 WORK INCLUDES

A. General requirements for basic materials and methods.

B. At a minimum, provide system per requirements of NFPA 13. Provide additional items as noted in these specifications. In the event that information in these specifications conflicts with NFPA 13, the more stringent requirements shall apply.

1.02 REFERENCES

A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

B. "Seismic Restraint Manual Guidelines for Mechanical Systems" by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

C. Sprinkler line attachments shall conform to NFPA Pamphlet 13. See Fire Protection Specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. See specific sections for this requirement.

2.02 PRODUCT TESTING

A. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection, such as compressors, pumps, etc., must be provided with an approval label from one of the agencies hereinafter listed.

B. Approval from agency must be for the total package; approval of individual components not acceptable. Labels must be located outside of equipment and shall be visible to inspector. Comply with all requirements of RCW 19.28.010 and NEC Sections 90-7 and 110-3 (1993).

C. It shall be the responsibility of this Contractor or the equipment supplier to meet the requirements of this section. Any agency costs to provide appropriate label for a piece of equipment must be included in this bid. Failure by this Contractor or supplier to obtain approval labels prior to bid shall be sufficient cause for this Contractor/supplier to obtain all such labels at no additional cost to Owner. The following is a list of approval testing laboratories:
   1. Underwriters Laboratories, Inc., www.ul.com
   2. Canadian Standards Association, www.csagroup.org
   3. American Gas Association, www.aga.org.
   4. Factory Mutual Systems, www.fmglobal.com
   5. MET Electrical Testing, www.metlabs.com
   6. Intertek Testing, www.intertek.com

2.03 PRESSURE VESSELS

A. At the completion of the project, the Contractor shall provide State of Washington Certification of all pressure vessels installed on the project. Affix certification on the vessels and provide a copy to the Owner in the O & M Manual.

2.04 DAMAGED OR REJECTED MATERIALS

A. Remove from the site immediately.

2.05 STARTERS AND DISCONNECTS

A. All starters shall be provided and installed by Electrical Contractor unless otherwise noted.

B. All disconnects shall be provided and installed by Electrical Contractor unless otherwise noted.

C. This Contractor shall coordinate with the Electrical Contractor and provide voltage, phase, horsepower, and amperage, based on approved submittals and the actual equipment being provided.

D. Starters, disconnects, and VFDs shall be provided in a timely manner, so as to not delay the Electrical Contractor's work.

2.06 FIRE INTEGRITY - PENETRATION SEALING SYSTEMS

A. Manufacturers
1. 3M Fire Products
2. Holdrite
3. Approved equal

B. The penetration sealing systems shall be provided with F-Rating and/or T-Rating as required by IBC Section 714.3 and 714.4. Penetrations include the following:
1. Through-penetration firestopping in fire-rated construction.
2. Construction-gap firestopping at connections of the same or different materials in fire-rated construction.
3. Construction-gap firestopping occurring within fire-walls, floor or floor-ceiling assemblies.
4. Construction-gap firestopping in smoke partitions.
5. Through-penetration smoke stopping in smoke partitions.
6. Construction-gap smoke stopping in smoke partitions.
7. All piping penetrating mechanical spaces, mechanical mezzanines, mechanical lofts, mechanical boiler rooms, or other mechanical spaces, shall be fire caulked, even if the walls are not rated. Visible piping penetrations shall be covered by split chrome-plated floor and ceiling plates.

C. All products shall be listed in Underwriters Laboratory Fire Resistance Directory. Firestopping for penetrations and voids shall be UL-tested systems
1. Through-penetration firestop devices (XHCR).
2. Fire resistance ratings (BXUV).
3. Through-penetration firestop systems (XHEZ).
4. Fill, void or cavity material (XHHW).

D. All material shall be tested per American Society for Testing and Material Standards, ASTM E814: Standard test method for fire tests of through-penetration firestops.

E. Firestopping for penetrations and voids shall be UL-tested systems.

2.07 HANGERS

A. Manufacturers
1. Grinnell
2. Michigan Hanger
3. Tolco
4. PHD
5. Anvil
6. Holdrite
7. Approved equal

B. Provide all anchors, hangers and all supports for piping and equipment included in contract.

C. It is the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard, commercially-accepted pipe hangers and accessories.

D. All pipe hangers and supports shall conform to the latest requirements of ASME B31.1 Code for Pressure Piping, and Manufacturers Standardization Society Documents MSS SP-58 and MSS SP-69.

2.08 INSERTS AT HANGERS AND SUPPORTS

A. Manufacturers:
   1. Holdrite
   2. Buckaroos
   3. Cooper
   4. Metro Supply Company
   5. Value Engineered Products, Inc.
   6. Hydra-Zorb Klo-Shure 7-series or 8-series strut-mount and Clevis
   7. Approved equal

B. Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. The insert is to consist of either hydrous calcium silicate or polyisocyanurate foam insulation (urethane) encircling the entire circumference of the pipe with a 360-degree PVC (1/16” thick) or galvanized steel jacket (20 gauge minimum). Inserts are to be installed on piping during piping installation, by the Piping Contractor. Provide continuous insulation vapor barrier. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor retarder mastic.

C. For elastomeric insulation, provide Hydra-Zorb Klo-Shure 7-series 8-series strut-mount or Clevis Hanger Insulation Couplings or approved equal.

D. Insulation and covering shall meet the flame spread index and smoke developed index as noted in the International Building Code.

E. Insert thickness shall match Code-required insulation thickness as a minimum.

F. Provide pipe covering protection saddle for piping on rollers; Anvil figure 160 through 166A or approved equal.

G. Inserts for piping in plenums shall have appropriate flame/smoke spread rating.

2.09 SUPPORT FOR ROOF-MOUNTED PIPING

A. Manufacturers
   1. Blox
   2. Dura-blok
   3. Mifab
   4. Approved equal

B. For piping run across roof areas, provide the following support system, detail the type and locations of the different configurations required, and submit for approval prior to starting work:

C. Mount on roof per manufacturer's recommendation; do not penetrate the roofing material. Receive approval from the roofing contractor before gluing down bases. Support bases are to be installed per manufacturer’s installation instructions.

D. Do not exceed support assembly weight limits or that of the roof. Coordinate with the Architect and GC prior to installing the specified system.

E. Secure piping to the support system.

2.10 ELECTRIC MOTORS

A. Minimum efficiencies of electric motors shall comply with the Washington State Energy Code.

2.11 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. Jay R. Smith
   2. Milcor
   3. Mifab
   4. Approved equal.

B. 16 gauge steel door and frame with concealed hinge and cylinder lock. Provide matching latches/locks keyed the same for multiple panels in a project. When "B" dimension is 24" or more,

provide additional latches at the top and bottom of door. Provide finish and material as noted in Part 3 – Execution.

2.12 CONCRETE INSERTS

A. Manufacturers:
   1. Grinnell
   2. Kinsdorf
   3. Elcen
   4. Approved equal.

B. Inserts in concrete for the suspension of piping and equipment shall be provided by this Contractor, unless otherwise noted on the Plans. Inserts in "poured-in-place" concrete shall be Grinnell 282 galvanized, or approved equal.

2.13 VIBRATION AND SEISMIC CONTROLS

A. Manufacturers:
   1. Kinetics Noise Control, Inc.
   2. Mason Industries
   3. Amber-Booth
   4. I.S.A.T.
   5. Flexicraft
   6. Twin City Hose
   7. Approved equal.

B. General
   1. If equipment is internally isolated by the manufacturer, internal isolation (base and isolator) shall be equivalent to the scheduled base and isolator and the isolator shall meet the scheduled spring static deflection.
   2. Size anchoring bolts to withstand lateral seismic shear and isolate bolts from direct contact with structure using bolt isolation washer and bushing.
   3. Bases specified in the schedule can be supplied by the manufacturer of the equipment if they meet the specification given herein.
   4. Electrical connections shall be made with floppy length of flexible cable.
   5. Piping in connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.
   6. Provide seismic restraint for piping, equipment, and ductwork.
   7. Submit all seismic restraint and vibration isolation components, calculations, and designs for approval. Do not install equipment or isolation until approval is received.
   8. The Contractor shall coordinate with the Project Structural Engineer to ensure mounting attachment points for seismic restrained springs and seismic snubbers will withstand forces generated from the maximum acceleration rating of the restrained springs and snubbers.
   9. Install in accordance with all codes, regulations and the requirements of the Authority Having Jurisdiction. Provide the Authority with copies of the components, calculations and design for their approval, if requested.
   10. Seismic requirements for non-structural components, calculations shall utilize an "Importance Factor" of 1.5 for life safety systems and a factor of 1.0 for other systems.

C. Shop Drawings:
   1. Provide schedule of vibration isolator type with location and load on each.
   2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
   3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
   4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.

5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
7. Include the seal of the Professional Engineer registered in the State in which the Project is located, on the drawings and calculations which at a minimum include the following:
    a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
    b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
        1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
        2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
    c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
    d. Detailed description of the equipment anchorage devices on which the certifications are based.

D. Pipe Isolation - General
1. Hung Type Isolators: Double-Deflection Neoprene Hanger to 4", Deflection - 30 degree Swing Spring and Double Deflection Neoprene Hanger - 6" and larger.
2. Isolator Deflection: 1/4” to 4", 1" - 6" and larger IPS.
3. Motion Restraint Snubber: seismic restraint cable, rod clamp for standard 1-5/8" x 1-5/8" unistrut, and clevis cross brace.

E. Piping not requiring sway bracing is as follows:
1. Piping in mechanical spaces less than 1".
2. All other piping less than 2-1/2".
3. Piping suspended by hangers 12" or less in length measured from the top of the pipe to bottom of hanger support where the hanger is attached.

PART 3 EXECUTION

3.01 LAYING OUT WORK

A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work executed under the Contract. Exercise proper precautions to verify figures shown on drawings, before laying out work and be responsible for any errors resulting from failure to exercise such precaution. The coordination of the utility installation with the final site grading and elevation by the General Contractor shall be the responsibility of this contractor. Locate existing utility lines which will be affected by the building location before any footing work begins. Report conflicts with the Plans to the Owner's representative for adjustment before proceeding with the work. Failure to follow this instruction will result in the contractor being required to alter his work at his own expense.

3.02 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specification shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to all applicable codes.

3.03 WORKMANSHIP

A. Furnish and install all equipment for a neat and finished appearance. If it is the opinion of the Owner's representative that any portion of the work has not been installed in a workmanlike manner, or has been left in a rough unfinished manner, Contractor will be required to remove and

reinstall the equipment, and patch and paint surrounding surfaces in a manner satisfactory to the Owner's representative. This shall be completed without any increase in cost to the Owner.

3.04 EXCAVATION - GENERAL

A. Perform all necessary excavation, shoring and backfilling required for the proper installation of work inside the buildings and premises, or outside as may be necessary. Slope sides of excavation to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

B. Excess excavation shall be backfilled with gravel or sand and mechanically compacted to give full support to the piping. No underground lines shall be covered until the installation has been approved by the Owner's representative, and the local Authority Having Jurisdiction. Maintain sides and slopes of excavations in safe condition until completion of backfilling. All backfill shall be thoroughly compacted.

C. No cinders shall be used for backfilling where steel, iron or copper piping is used. All trenches near or under footings shall be cut only after approval of the Owner's representative, and all backfilling of such trenches shall be according to his direction.

D. All items of grading which will in any manner affect the bearing capacity of the soil foundations upon which will be placed floor slabs, walls, column footings or pipe beds shall be performed to the satisfaction of the Owner's representative. All soil foundation areas which will in any manner support any of the above-stated construction will be compacted by the use of mechanical tampers to at least 95% of the maximum density of the soil foundations as determined by the compaction control test, in accordance with the "Method of test for Moisture Density Relations of Soils, ASTM Designation D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described "Compaction Control Test." Place fill in 8" loose layers, each layer compacted.

E. Division 31 (31 23 16 - Excavation, 31 23 23 Fill, 31 26 16.13 Trenching) shall provide Excavation, Fill and Trenching for this contractor, as needed to complete his work.

3.05 EXCAVATION DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations, and from a flooding project site and/or surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions, outside excavation limits to convey rain water and water removed from excavations to collection points or run off areas. Do not use trench excavation as temporary drainage ditches.

3.06 EXCESS EXCAVATION MATERIAL

A. Dirt and debris from trench excavation shall be disposed of by this Contractor, as directed by the Owner's representative.

3.07 PIPING INSTALLATION

A. Lay piping in straight lines with uniform slope, leave no pockets. Care shall be taken to keep all foreign materials out of the piping during installation. Where ground water is present, provide suction pumps to keep trenches free of water, and cap ends of piping exposed to ground water when work is interrupted.

B. All underground piping used for the distribution of fire protection services located outside the building perimeter shall be buried a minimum of 36" from finish grade to top of piping.

C. All piping run above the floor SHALL NOT BE LOCATED OVER ELECTRICAL PANELS OR SWITCHBOARDS, except where located above a structural ceiling, or with drain pans approved by the AHJ. Piping includes, but is not limited to, fire sprinkler lines.

D. All piping SHALL BE ROUTED AROUND Elevator Equipment Rooms. Piping may serve the room, but shall not pass through it. Follow all codes applicable to these areas.

E. Provide access panels to valves located above hard ceilings.

3.08 OPENINGS IN PIPING

A. Keep all openings covered tightly with plastic during the work.

3.09 PIPE SLEEVES

A. General: Provide pipe sleeves for piping passing through foundations, walls, floors, partitions, and roof to allow piping to pass freely through.

B. Foundation Walls: Where piping passes through walls below finished grade, but does not enter the building spaces, the sleeves shall be Schedule 40 galvanized steel pipe. Provide a modular seal between the sleeve and the piping.

C. Building Walls (Below Grade) and Floor Slabs: Where piping passes through building walls below grade, and floor slabs on grade or below grade, the sleeves shall extend a minimum of 1" inside the building wall or above the finished floor level, and shall be made watertight and gas tight by the appropriate modular seal. Sleeves shall be Schedule 40 galvanized steel pipe. If the sleeve and modular seal are subject to trapping water on the top side, pack with water-resistant foam and caulk with flexible caulking or grout.

D. Building Walls and Floor Slabs (Above Grade): Where piping passes through concrete walls or floors within the building, the sleeves shall be of sufficient strength to withstand the pressure and concrete pouring operation without deforming or rupturing. Sheet metal ductwork with ends slit and formed into flanges is not acceptable. Sleeves shall extend 1" above the finished floor. Sleeves in walls shall be flush on both sides.

E. Piping Subject to Expansion: where piping is subject to motion due to expansion, the sleeve shall be made large enough to allow free motion. When piping passing through is insulated, the sleeve shall be large enough to permit the covering to pass through.

3.10 WALL/FLOOR PLATES AND ESCUTCHEONS

A. Where piping passes through any wall, floor or ceiling, it shall be fitted with chromium-plated steel escutcheons, with suitable set screws or other approved holding device. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.11 PIPE HANGERS AND SUPPORTS

A. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger location, in order to prevent excessive stress in either pipe or equipment connections.

B. Concrete Inserts: Where piping is supported from the concrete structure, inserts shall be provided for rod sizes up to 3/4". Where support rod sizes exceeds 3/4" diameter or where pipe load exceeds the recommended load for the inserts, use two inserts with a trapeze-type connecting member below the concrete.

C. Where piping is to be supported from building steel, beam clamps shall be used. Beam clamp selection shall be for the required load and the configuration of the steel at the point of attachment. Drilling holes in the steel for hanger rod will not be permitted unless approved by the Structural Engineer. Use only adjustable side beam clamps (Type 25); standard beam clamps are not acceptable.

D. Riser Clamps (Vertical Piping): Piping shall be supported at each floor with a riser clamp or at sufficient intervals to carry the weight of the piping and that of its contents. Stacks shall be supported at their base by a concrete pier or by a suitable hanger located on the horizontal run,

close to the riser. Riser clamp extensions shall rest on the building structure where possible; auxiliary steel supports shall be provided where it is impractical to rest directly on the building structure.

E. Angle Clips: Where piping is to be supported from building wood structure, angle clips shall be used with lag bolts sized to support the load in shear. Any attachment to wooden structural members shall be subject to the approval of the Structural Engineer.

F. Hanger Rods: Hanger rod size shall be selected on the basis of loading from the following table:

3/8"	610 pounds
1/2"	1130 pounds
5/8"	1810 pounds
3/4"	2710 pounds
7/8"	3770 pounds
1"	4960 pounds

G. Hangers shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing. DO NOT BEND RODS.

H. All rods shall be electro-plated to prevent corrosion.

I. All rods shall be double-nutted with lock washer and cut washer, on both ends if applicable, and excess rod on the bottom shall be cut flush and ground for safety.

J. Hanger Spacing: The maximum allowable spacing for pipe hangers shall be in accordance with the following. Where concentrated loads of valves, fittings, etc., occur, closer spacing will be necessary and shall be based on the weight supported and recommended loads for the hanger components.

1. Spacing:
    a. Steel Piping - Threaded or Welded:
        1) Horizontally: 3/4" and smaller, 10'; 1" and larger, 12'.
        2) Vertically: Every other floor, not to exceed 25'. See note 1.
    b. Notes Referenced Above:
        1) Vertical water lines may be supported in accordance with recognized engineering principles with regard to expansion and contraction when first approved by the Authority Having Jurisdiction.
        2) See the appropriate IAPMO Installation Standard for expansion and other special requirements.

K. Hangers - Horizontal Piping:

1. General: All hangers shall be provided with means of vertical adjustment. The following schedule shall be followed to select acceptable hangers for the type of service.
    a. Non-Insulated Steel Piping:
        1) Adjustable Split Ring Swivel Hanger
        2) Adjustable steel Band Hanger
        3) Clevis Hanger
2. Trapeze Hangers: Where piping is grouped in parallel, provide manufactured strut or trapeze hangers consisting of two steel angles bolted back-to-back, with space between for a hanger rod at each end. Where the length of angles is greater than 24", there shall be three (3) rod

supports. Piping shall be able to move independently, and hanger spacing shall be dictated by the smallest pipe.

3. Brackets and Racks: Where piping is run adjacent walls or steel columns, welded steel brackets shall be used as base supports. Multiple pipe racks or trapeze hangers shall be designed and fabricated to suit conditions.
4. Anchors, Guides and Sliding Supports: Shall be as shown on the drawings or as necessary to prevent excessive stress in either piping or equipment.
5. Auxiliary Steel: All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook, furnished by the Contractor, and shall receive one shop coat of primer paint.
6. Submittals: The Contractor shall submit the following information and data for approval prior to installation.
    a. Data Sheets on all cataloged items to be used.
    b. Sketches covering all specially designed hanger assemblies and fabrications.

3.12 CUTTING AND PATCHING

A. Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. Cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements, shall be done by the General Contractor. at the expense of this contractor.

3.13 ACCESSIBILITY

A. Locate valves, etc., so as to be easily accessible in mechanical spaces or through access panels, specified hereinafter. Otherwise, obtain Owner's representative's approval of location.

B. Any equipment requiring maintenance clearances for servicing of filters, motors, compressors, etc., shall be carefully coordinated to avoid servicing problems. Failure of contractor to comply with this requirement shall be sufficient cause for contractor to make all necessary changes at no cost to the Owner. To avoid problems with interpretation of the NEC, allow 42" for all electrical clearances.

C. Maintain 6'-8" minimum head room in all Mechanical spaces, and 8’ in all other spaces. If minimum spacing is not possible, obtain the Owner's representative's permission, in writing, to install piping at lower heights.

3.14 ACCESS DOORS AND PANELS

A. Locations of panels shall be carefully selected during construction, so as not to be located behind cabinets, etc. Coordinate closely with the Architectural and Electrical Plans before installing panels.

B. In areas such as janitor's room or on painted walls, etc., access panels shall be prime-coated and painted by the General Contractor; install before surrounding surfaces have been painted. In areas such as toilet rooms, the access panels shall be stainless steel or chrome-plated. In other finished areas such as on ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.

C. Verify with the Owner's representative location and finish prior to ordering; failure to get the Owner's representative's approval may result in replacement of access panels at the Contractor's expense. Minimum size of access doors is 12" x 12"; actual size depends on the specific circumstance, and panel shall be large enough to accomplish replacement or repair of the item requiring access. The Owner's representative shall have the final say on whether or not the access is of sufficient size.

D. Provide access panels for all concealed valves for all piping.

E. Doors shall have cylinder lock latches, all keyed alike.

F. Provide fire-rated access doors for one-hour or two-hour rated walls and ceilings; units shall be UL labeled.

3.15 ACCESSES

A. Provide suitable access to all equipment requiring servicing, maintenance, replacement, or repair. In concealed spaces where access has not been provided by the Architect by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the Owner's representative, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades, to avoid conflict therewith, and such locations shall be approved by the Owner's representative prior to installation of access panels.

3.16 PAINTING, TAGS, ETC.

A. Field painting of all fire sprinkler equipment, piping etc., located in and exposed in occupied spaces, shall be by the General Contractor. See Architectural painting specification.

B. Identification Tags: Provide identification tags for each main shutoff and control valve throughout the building indicating the system served. Tags shall be black phenolic plastic with white engraved inscription attached with chrome chain.

C. Provide valve tag lists under glass. Locate as directed by Owner's representative.

D. Each major item of fire equipment shall be provided with the name of the item, i.e., Pump No. 1, etc., in labels of black phenolic plastic with white engraved inscription. Minimum size of lettering is 1" with a maximum of 2". Select appropriate sizes for the size of the equipment being labeled. Align labels with edges of equipment and locate labels so as to be visible.

E. Pipe Markers:
   1. Piping throughout the building shall equal to Brady Corporation No. B-946, M.S.I. No. MS-900, meeting or exceeding ANSI A13.10-1981. Pipe markers shall consist of two wraps of arrows in the direction of flow, color, and wording as indicated in the schedule following. Stencils shall be visibly located and spaced on maximum 20'-0" centers for long straight piping runs. Stencils shall be located on both sides of a wall, within the first 3'.
   2. Color Code Schedule:

Service	Color	Stencil
Fire Protection	Red	FIRE

   3. Ceiling Tile Access Labels: Where it is necessary to remove ceiling tile(s) to access valves, etc., provide and install round 1/2" diameter, red, self-adhesive labels on the metal ceiling grid, visible near all four corners of each tile requiring removal.

3.17 TEST PLUGS AND GAUGES

A. Pressure or temperature test plugs shall be installed on inlet and discharge of all pumps, even if not shown on Plans.

B. A minimum of six (6) compatible pressure gauges (including pressure gauge adapters) and six (6) compatible temperature gauges shall be provided.

C. P&T test plugs included on other devices that serve the same purpose and that provide the same information are acceptable; duplicates are not required.

3.18 FIRE INTEGRITY

A. All penetrations of fire-rated walls, ceilings, roofs or floors via piping must be protected by appropriately-rated assemblies and caulking to maintain integrity of structure.

3.19 CLEANING UP

A. Comply with requirements of the General Specifications.

3.20 CAULKING

A. Caulk all openings and flash around all piping and equipment passing through roof, floor, and walls. All caulking shall be water resistant. See also paragraph "Fire Integrity" for piping penetrations of rated walls, ceilings, roofs, or floor penetrations.

B. All piping penetrations of walls, ceilings, and floors shall be caulked. A chrome-plated steel escutcheon plate shall be installed at each visible piping penetration of walls, ceilings, or floors.

3.21 OPERATION OF EQUIPMENT AND SYSTEMS

A. Contractor is responsible during all periods of testing. Provide temporary utilities as required.

3.22 TESTS, ADJUSTMENTS AND INSPECTION

A. Test all work thoroughly and systematically, both during construction and after completion. Notify Owner's representative 48 hours in advance of all tests. Tests shall be maintained until approved. Tests shall be as hereinafter specified.

B. The Contractor shall test the completed installation as in regular service. Any defects or imperfections that may show up are to be promptly corrected. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from date of final acceptance. The Contractor shall repair or replace any part which may show signs of failure during that time, if such failure, in the opinion of the Owner's representative, is due to imperfections in material or to improper workmanship.

C. No system, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing, without first notifying the Owner's representative. Failure to notify the Owner's representative for inspection of concealed systems shall be cause to require this contractor to uncover and re-cover such systems at no additional cost to Owner.

D. A log of all tests shall be kept. The log shall note, dates, time of day test started, system or portion of system tested, length of test, test results, and who witnessed the test (AHJ, Owner's representative, or GC). Contractor shall insert legible name of witnesses. Contractor to submit a copy of the contractor's test log monthly to the Owner's representative.

E. Review the project to determine when final inspection is appropriate and advise Owner's representative. Contractor is required to complete his work before requesting final inspection.

F. See specification section of piping used for test methods or procedures to be followed.

3.23 FINAL INSPECTION

A. This contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall so advise the Owner's representative. It shall be understood that the work is to be essentially complete. If such is not the case and more than one final inspection and one backcheck are necessary, this Contractor may be billed for the additional backchecks at the then governing rate for the personnel involved. The final inspection punchlist shall be legibly signed on a copy of the punch list by a person responsible for the trade involved, and transmitted to the Owner’s representative, before a backcheck will be scheduled.

3.24 PROTECTION AND CLEANING

A. All equipment and material installed by this contractor shall be properly protected from damage during the course of construction. All equipment shall be thoroughly cleaned before final inspection.

B. In attic or other spaces where piping has been installed at floor level and interferes with foot traffic, this contractor shall provide covers to protect this piping. Wood or other such material will be acceptable.

C. Provide and protect walking paths in mechanical spaces. Maintain 6'-8" minimum headroom for all piping. If the required clearance is not possible, obtain permission from the Owner's representative to violate the above requirement, and comply with protective measures required.

3.25 SPECIAL PROTECTION

A. Exercise maximum precaution to protect the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

3.26 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's representatives.

B. General Description of Instruction Periods: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings, followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures, and available adjustments.

C. Scheduling of Instruction Periods: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given to the Owner's representative at least two weeks prior to the instruction periods, and agreement reached as to the date at which the instruction periods are to be performed. Advise Owner's representative two weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.27 ON-SITE OBSERVATIONS AND SAFETY MEASURES

A. During its progress, all work shall be subject to observation by the Owner's representative, and by the National Board of Fire Underwriters, State and Local Inspectors. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor will be totally responsible for conditions of the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Owner's representative to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. It shall be the Contractor's responsibility to comply with "Safety and Health Regulations for Construction" in the Federal Register by the U.S. Department of Labor. Contractor shall be responsible for providing all such safety measures and shall consult with the State and/or Federal Safety Inspector for interpretation whenever in doubt as to whether he is or is not in compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damage or injury to any persons or property wherever located resulting from any action or operation under this contract or in connection with the work.

3.28 CONTINUITY OF BUILDING UTILITIES AND SHUTDOWNS

A. General: Continuity of utilities services in the building shall be maintained at all times, as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services shall be accomplished in accordance with the following requirements.

B. Shutdowns: While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings. The actual time and date is to be coordinated with and approved by the Owner's representative at least 72 hours in advance.

C. Costs: The Contractor shall include in his bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes, or failure to complete utilities connections within authorized shutdown periods.

3.29 DRAFT STOPS

A. It shall be the responsibility of each contractor performing his trade to verify with Architectural Plans and to maintain the integrity of draft stops, whenever his work requires penetration of these areas. Patch as required to maintain integrity of draft stops.

3.30 COMMISSIONING

A. This Contractor will be required to participate in the commissioning process. See Section 23 08 00 and the Commissioning Section in the Architectural Section of the specification. The Contractor shall complete the start-up forms and be available to assist in the commissioning process. The Contractor shall include in his bid all cost associated with his portion of the commissioning process.

B. The following systems shall be commissioned:

1. Fire Sprinkling System.

END OF SECTION

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler and/or standpipe systems.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Piping identification.

B. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

C. Section 21 12 00 - Fire-Suppression Standpipes: Standpipe design.

D. Division 31 - Excavation, Fill, Trenching.

1.03 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; (ANSI/ASME B16.5).

F. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers.

G. ASTM A 47 - Standard Specification for Ferritic Malleable Iron Castings

H. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

I. ASTM A 135 - Standard Specification for Electric-Resistance Welded Steel Pipe.

J. ASTM A 795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

K. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids; American Water Works Association.

L. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).

M. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).

N. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association.

O. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association.

P. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; National Fire Protection Association.

Q. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.

R. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.

S. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.

T. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

B. Grooved joint couplings and fittings shall be referred to on drawings and product submittals and shall be identified by the manufacturer’s style or series designation. Trade names and abbreviations are not acceptable.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and valve tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. All grooved joint couplings, fittings, valves, and specialties shall be of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

C. All castings used for fittings, couplings, valve bodies, etc., shall include a cast date stamp for quality assurance and traceability.

D. Conform to UL and FM requirements.

E. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. The installer shall possess a valid state of Washington "Fire Sprinkler Contractor's License". Provide a copy with the submittals.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.

C. Welding Materials and Procedures: Conform to ASME Code.

D. Below Ground systems : Conform to NFPA 24.

2.02 BELOW-GROUND PIPING

A. Pipe: Provide piping in accordance with NFPA 24. Piping shall be UL-listed for fire protection service and comply with AWWA Standards. Design working pressure shall not be less than 150 PSI. Ferrous metal pipe shall be lined and coated in accordance with NFPA 24. Ductile Iron Pipe: AWWA C151/A21.51.

B. Below-Ground Systems

1. Fittings: Fittings shall be compatible with pipe system and be provided to the same criteria. AWWA C110, standard thickness.
2. Joints: AWWA C111, rubber gasket.
3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.
4. Thrust Blocks: Provide thrust blocking at all below-grade elbows.
5. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3" minimum width, color-coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "Caution: Buried Water Piping Below" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.03 ABOVE-GROUND PIPING

A. Piping: Provide steel pipe per NFPA 13 and NFPA 14, except as modified herein.
   1. Steel Pipe: ASTM A 53 Schedule 40, black, unless otherwise specified. Steel piping shall be Schedule 40 minimum for sizes less than 8", and Schedule 10 for sizes 8" and larger.
   2. Iron Fittings: ASME B16.1, flanges and flanged fittings, ASME B16.4 and threaded fittings.
   3. Mechanical Grooved Couplings: Two ductile-iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 electroplated steel bolts, nuts, and washers; galvanized for galvanized pipe.

B. Above-Ground Systems
   1. Shop welding allowed per NFPA 13, NO field welding allowed. Perform welding in the shop; field-welding will not be permitted.
   2. Steel piping with wall thickness less than Schedule 30 shall not be threaded.
   3. Conceal piping in finished area, unless otherwise indicated.

C. Fittings: Provide fittings for changes in direction of piping and for connections.
   1. Fittings shall be UL-listed or FM-approved for use in wet pipe sprinkler systems.
   2. Fittings, mechanical couplings, and rubber gaskets shall all be supplied by the same manufacturer.
   3. Short-pattern fittings shall have flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock.
   4. Rubber-gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1-1/2" and larger.
   5. Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type.
   6. Plain end fittings with mechanical couplings, and fittings which use steel gripping devices to bite into the pipe when pressure is applied, will not be permitted.
   7. U-bolt connected threaded mechanical tees will not be permitted.
   8. Piping shall be hot-dipped galvanized inside and out (dry systems only).

2.04 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2" to 1-1/2": Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2" and Over: Carbon steel, adjustable, clevis.

C. Wall Support for Pipe Sizes to 3": Cast iron hook.

D. Wall Support for Pipe Sizes 4" and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.05 GATE VALVES

A. Up to and including 2":

1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2":
1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, grooved or flanged ends. Basis of Design: Victaulic Series 771.

2.06 GLOBE OR ANGLE VALVES

A. Up to and including 2":
1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2":
1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.07 BALL VALVES

A. Up to and including 2":
1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle or with weatherproof actuator housing and handwheel, and balancing stops, threaded ends with union. Basis of Design: Victaulic Series 728.

B. Over 2":
1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10" and over, flanged.

2.08 BUTTERFLY VALVES

A. Cast or Ductile Iron Body
1. Cast or ductile iron, chrome or electroless nickel-plated ductile iron or aluminum bronze disc, resilient replaceable EPDM pressure responsive seat, wafer, lug, or grooved ends, extended neck. Weatherproof actuator housing with handwheel, and gear drive, integral indicating device, and external tamper switch rated 15 amps at 115 volt AC. Coordinate voltage with EC. Basis of Design: Victaulic Style 705.

2.09 CHECK VALVES

A. Up to and including 2":
1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2":
1. Iron body, stainless steel or bronze trim, spring-assisted swing check with stainless steel or rubber-coated disc, renewable disc and seat, flanged or grooved ends. Suitable for vertical or horizontal installation. Basis of Design: Victaulic Series 717.

2.10 DRAIN VALVES

A. Compression Stop:
1. Bronze with hose thread nipple and cap.

B. Ball Valve:
1. Brass with cap and chain, 3/4" hose thread.

2.11 BACKFLOW PREVENTER - DOUBLE DETECTOR CHECK VALVE ASSEMBLY

A. Provide backflow preventer listed by the State of Washington and local jurisdiction as an approved cross-connection control device for fire protection.

B. Backflow preventer shall have the following ratings; UL, FM, ASSE1048.

C. The backflow preventer shall have OS&Y gate valves as manufactured by Watts, Febco, or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise indicated or specified, all materials and equipment shall be installed and tested in accordance with the manufacturer's recommendations and in accordance with NFPA 13, NFPA 14, and NFPA 24. Cutting structural members for passage of piping or for pipe-hanger fastenings will not be permitted.

B. Until approval has been obtained from the Authority Having Jurisdiction, shop fabrication or installation may proceed at the Contractor's risk. The Contractor shall make all changes to fabricated or installed components in order to conform to the Plans approved by the Authority Having Jurisdiction.

C. The location of ductwork, other piping, and other equipment takes precedence over sprinkler piping. Provide all offsets, fittings, and transitions required to install the sprinkler system in the available space as part of the scope of work.

D. Coordinate with Fire Alarm Contractor. Provide all information concerning the connection and operation of tamper switches, alarm valves, flow switches, and all other indicating devices.

E. Coordinate with Electrical Contractor. Provide all information concerning the connection and operation of devices requiring electrical power.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Unions and flanges for servicing or disconnect are not required on installations using grooved joint couplings. The couplings shall serve as disconnect points.

3.03 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer’s written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer’s representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

D. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

E. Install piping to conserve building space, to not interfere with use of space and other work.

F. Attend coordination meetings with other subcontractors to layout work. Failure to participate gives last priority to this subcontractor for space or work flow.

G. Group piping whenever practical at common elevations.

H. Sleeve pipes passing through partitions, walls, and floors.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
2. Place hangers within 12" of each horizontal elbow.
3. Use hangers with 1-1/2" minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

K. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

L. Do not penetrate building structural members unless indicated or written permission is received from the structural engineer.

M. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. On floor and subgrade sleeves use modular seals to prevent leakage. Fill sleeve void with water resistant foam and caulk or grout, flush with top of sleeve.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

O. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

P. Provide gate valves for shut-off or isolating service.

Q. Provide drain valves at main shut-off valves, low points of piping, and apparatus.

END OF SECTION

SECTION 21 12 00
FIRE-SUPPRESSION STANDPIPES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standpipe system.

B. Fire department connection.

1.02 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression: Fire protection piping.

B. Section 21 13 00 - Fire-Suppression Sprinkler Systems.

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

D. Division 31 - Excavation, Fill, Trenching.

1.03 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation.

B. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.

D. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

B. Shop Drawings:
   1. Indicate supports, components, accessories, and sizes.
      a. Submit shop drawings to authority having jurisdiction for approval.
      b. Submit proof of approval to Architect and Engineer.
   2. Project Record Documents: Record actual locations of components.
   3. Operation Data: Include manufacturer's data.
   4. Maintenance Data: Include servicing requirements and test schedule.
   5. Certificates: Provide certificate of compliance from Authority Having Jurisdiction indicating approval of field acceptance tests.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Perform work in accordance with NFPA 14.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience. Include written certificate with submittals.

1.06 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in shipping packaging until installation.

PART 2 PRODUCTS

2.01 FIRE HOSE CABINETS

A. Hose Cabinets:

1. Style: Recessed mounted.
2. Tub: 16 gage thick steel, prepared for pipe and accessory rough-in.
3. Door: 12 gage thick steel, flush, glazed with 1/4" thick wired glass full panel; hinged, positive latch device.
4. Finish: Prime Coated.

B. Hose Rack: Steel with polished chrome finish; swivel type with pins and water stop.

C. Hose: 1" diameter, 50' long linen hose, mildew- and rot-resistant.

D. Nozzle: Chrome plated brass; combination fog, straight stream, and adjustable shut-off.

2.02 VALVES

A. Hose Station Valve: Angle type, chrome plated finish, 1-1/2" nominal size with automatic ball drip; refer to Section 21 05 00.

B. Hose Connection Valve: Angle type; chrome plated finish; 2-1/2" size, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish; refer to Section 21 05 00.

C. Pressure Reducing Valve: Angle type; brass finish with inner hydraulic controls; 1-1/2" size, thread to match fire department hardware, 400 psi inlet pressure, with threaded cap and chain of same material and finish; refer to Section 21 05 00.

2.03 FIRE DEPARTMENT CONNECTION

A. Type: Flush mounted wall type with brass finish.

B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4" automatic drip, exterior.

D. Label: "Standpipe - Fire Department Connection".

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 14.

C. Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal) surface 66" above finished floor.

D. Locate hose station valve in cabinet at 60" above finished floor.

E. Connect standpipe system to water source ahead of domestic water connection.

F. Where static pressure exceeds 100 psi at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi.

G. Provide two-way fire department outlet connection on roof when required.

H. Flush entire system of foreign matter; have Owner's representative witness flushing.

I. Hydrostatically test entire system.

3.02 FIELD QUALITY CONTROL

A. Test entire system in accordance with NFPA 14.

B. Test shall be witnessed by Authority Having Jurisdiction and Owner’s representative.

C. Provide 2 hours of instruction to the Owner's personnel, at a time acceptable to the Owner. These hours may be added to the other Fire Protection Sections for total hours of training available to the Owner.

END OF SECTION

SECTION 21 13 00
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

B. Section 21 12 00 - Fire-Suppression Standpipes

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

D. Division 31 - Excavation, Fill, Trenching

1.03 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association.

C. NFPA 101 - Safety to Life from Fire in Buildings and Structures (Life Safety Code).

D. NFPA 170 - Fire Safety Symbols.

E. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.

F. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Predesign Meeting: Convene one week before starting design work for this section.

1.05 SCOPE OF WORK

A. Design, fabricate, and install a complete wet pipe and/or dry pipe fire sprinkler system in accordance with the Standards set forth in this Section and as conceptually described on the Plans.

B. Obtain and pay for all permits and fees required by the Authority Having Jurisdiction.

C. Arrange for, perform and pay all fees associated with all tests required by the Authority Having Jurisdiction.

D. Unless otherwise determined by the Authority Having Jurisdiction, occupancy shall be as defined in NFPA 13, Annex A.

E. Obtain and pay for all power requirements needed for any part of the Fire sprinkler design build system.

1.06 DESIGN CRITERIA

A. Systems shall be hydraulically designed in accordance with NFPA 13 and NFPA 14.

B. Water Supply Information: Obtain water flow test information from the local water purveyor.

C. Provide complete sprinkler coverage for building and overhangs.

D. Provide a control assembly consisting of a supervised control valve, pressure gauge, test/drain connection, and drain piping.

E. All system piping shall be seismically braced and restrained in accordance with NFPA 13. This includes restraint of branch lines.

F. Provide listed flexible sprinkler hose connections to supply sprinkler heads in suspended ceiling applications.

1.07 INTENT OF DRAWINGS

A. The Plans may depict the design location of sprinkler heads or piping. These locations may be changed if required to conform to applicable codes. There is no intent by the Owner or his representatives to provide design for any portion of the fire protection systems except for the location of the service entry.

1.08 SUBMITTALS

A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturer's catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Obtain and pay for all permits required for this system. Submit copies for approval.

C. Shop Drawings:
1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Make changes requested by the Owner's representative as needed to maintain building esthetics; request prior approval from the Owner's representative should a situation exist that could cause a future problem.
3. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls. Show seismic protection in accordance with NFPA 13.
4. Submit shop drawings and hydraulic calculations to Authority Having Jurisdiction for approval. Submit proof of approval to Owner's representative. Provide approved drawings to the Owner's representative for final review. The Engineer will retain one copy of approved drawings.
5. Sprinklers shall be referred to on drawings, submittals, and other documentation, 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.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.09 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Conform to UL and FM requirements.

C. Designer Qualifications: System designer shall hold minimum of NICET Level III certification, and be experienced in the design of this type of work.

D. The installer shall possess a valid State of Washington Fire Sprinkler Contractor's License. Provide a copy with the submittals.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience. Provide written certificate with the submittals.

F. Equipment and Components: Provide products that bear UL, FM, Manufacturer's Logo or Manufacturer's Name, and Country of Origin labels or markings.

G. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated.

1.10 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.12 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet located adjacent alarm valve.

1.13 USE OF THE SYSTEM PRIOR TO COMPLETION

A. Owner reserves the right to order the entire automatic fire sprinkler system or any portion thereof turned on and made operational at any time after installation has been completed sufficiently to permit beneficial use without causing unreasonable delays in contract work. If so ordered, comply within 24 hours after receipt of order. Such use of system by Owner shall not be construed as acceptance of any part of the work, and claims which Owner may have against Contractor shall not be deemed to be waived by such use. The following items shall occur if the system is used prior to completion.
   1. Arrangements for monitoring the system shall be made.
   2. Portions of the system planned for use shall be hydrostatically tested.
   3. All parties involved with construction or operation agree to assume responsibility for damage as a result of system leakage which they cause.

1.14 SERVICE AGREEMENTS

A. After completion of fire protection installation and at start of guarantee year, execute National Automatic Sprinkler and Fire Control Association, Inc. Standard Form of Inspection Agreement, or equal, without charge to Owner for four (4) inspections of sprinkler system during guarantee year.

B. During guarantee year, inspections shall be made as per Inspection Agreement, plus the following maintenance is to be performed during the course of fourth inspection:
   1. Operation of all control valves.
   2. Lubrication of operating stems of all interior control valves.
   3. Operation of water motor gong and/or electric alarms.
   4. Cleaning of alarm valves.
   5. Lubrication of fire department hose connection inlets.

1.15 MISCELLANEOUS REQUIREMENTS

A. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products.

B. Verification of Dimensions: The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner's representative of any discrepancies before performing work.

C. Welding: Welding shall be in accordance with NFPA 13. Only shop-welded appropriate welding fittings shall be used.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:

1. Tyco Fire Suppression & Building Products: tyco-fire.com.
2. Viking Corporation: vikinggroupinc.com.
3. Reliable: reliablesprinkler.com
4. Potter: pottersignal.com
5. Approved equal.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for the entire building, wet system and/or dry system as indicated on the Plans.

B. Install sprinklers in the top of elevator shafts, at elevator pits, and in elevator machine room. Installation shall be controlled by an isolation valve with tamper switch and water flow switch tied to the Fire Alarm System; install valves in a easily accessible location. Use intermediate temperature heads in these areas.

C. Sprinkler body shall be integrally cast with a hex- or square-shaped wrench boss to reduce the risk of damage during installation. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss.

D. Sprinklers shall not contain rubber O-rings.

E. Occupancy: Comply with NFPA 13. Verify with Plans.

F. Water Supply: Determine volume and pressure from water flow test data provided on the Civil Drawings.

G. Provide fire department connections where indicated.

H. Provide steel storage cabinet for spare sprinklers and tools; locate adjacent alarm valve.

2.03 WET SPRINKLERS

A. Ceiling - Recessed
1. Recessed pendant with matching push-on escutcheon plate.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Escutcheon Plate Finish: Chrome-plated.
6. Fusible Link: Glass bulb type, temperature-rated for specific area hazard.
7. Guard:
    a. Provide where piping is below 7’-0”
    b. Provide in areas where heads are subject to damage
    c. Finish is to match sprinkler finish
8. Basis of Design: Victaulic Model V27.

B. Exposed - Upright
1. Upright with guard.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Fusible Link: Glass bulb type, temperature-rated for specific area hazard.
6. Guard:
    a. Provide where piping is below 7’-0”
    b. Provide in areas where heads are subject to damage
    c. Finish is to match sprinkler finish
7. Basis of Design: Victaulic Model V27.

C. Sidewall

1. Recessed horizontal sidewall type with matching push-on escutcheon plate and guard.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Escutcheon Plate Finish: Chrome-plated.
6. Fusible Link: Glass bulb type, temperature rated for specific area hazard.
7. Basis of Design: Victaulic Model V27.

2.04 DRY SPRINKLERS

A. Ceiling - Recessed
1. Recessed pendant with matching push-on escutcheon plate.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Escutcheon Plate Finish: Chrome-plated.
6. Fusible Link: Glass bulb type, temperature-rated for specific area hazard.
7. Provide length as required to suit installation
8. Guard:
    a. Provide where piping is below 7’-0”
    b. Provide in areas where heads are subject to damage
    c. Finish is to match sprinkler finish
9. Basis of Design: Victaulic Model V36.

B. Exposed - Upright
1. Upright with guard.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Fusible Link: Glass bulb type, temperature-rated for specific area hazard.
6. Guard:
    a. Provide where piping is below 7’-0”
    b. Provide in areas where heads are subject to damage
    c. Finish is to match sprinkler finish
7. Provide length as required to suit installation
8. Basis of Design: Victaulic Model V36.

C. Sidewall
1. Recessed horizontal sidewall type with matching push-on escutcheon plate and guard.
2. Response Type: Quick
3. Coverage Type: As required
4. Finish: Chrome-plated.
5. Escutcheon Plate Finish: Chrome-plated.
6. Fusible Link: Glass bulb type, temperature rated for specific area hazard.
7. Provide length as required to suit installation
8. Guard:
    a. Provide where piping is below 7’-0”
    b. Provide in areas where heads are subject to damage
    c. Finish is to match sprinkler finish
9. Basis of Design: Victaulic Model V36.

2.05 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check-type valve with divided seat ring, rubber-faced or aluminum-bronze clapper with elastomer seal, pressure retard chamber, and variable pressure trim to automatically actuate water motor alarm and electric alarm. Include test and drain valve.

B. Dry Pipe Sprinkler Alarm Valve: Check-type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator. Required air pressure shall be 13-psi (90-kPa). Include test and drain valve. Valve shall be externally resettable, and all internal components shall be replaceable without removing the valve from the installed position. Basis of Design: Victaulic Series 768-NXT.

C. Water Motor Alarm: Hydraulically-operated impeller type alarm with aluminum alloy red-enameled gong and motor housing, nylon bearings, and inlet strainer. Locate as approved by the Authority Having Jurisdiction. Basis of Design: Victaulic Series 760.

D. Electric Alarm: Electrically-operated red-enameled gong with pressure alarm switch. Coordinate electrical connection with EC. Basis of Design: System Sensor.

E. Water Flow Switch: Vane type switch for mounting horizontally or vertically, with two contacts; rated 15 amps at 125 volt AC and 2.5 amps at 24 volt DC. Basis of Design: System Sensor.

F. Main Alarm Check Valve: For horizontal, vertical, or horizontal and vertical installation, with non-slamming spring-loaded elastomer-faced clapper. Basis of Design: Victaulic Series 751.

G. Automatic Drip Valve: Designed to Underwriter's Laboratory and Factory Mutual requirements. Brass casting body, stainless steel ball, phosphor-bronze spring, stainless steel retaining ring.

H. Test and Drain Valve: Single-handle ball valve for test function and express drain function, with tamper-resistant test orifice and integral tamper-resistant sight glasses.

I. Main Drain Valve: Nibco or approved equal.

J. Tamper Switch: Supervisory switch, integral to butterfly valves, field-mountable on OS&Y valves.

K. Pressure Switch: Provides a low pressure supervisory signal. Provide explosion-proof switch if required.

L. Flexible Sprinkler Hose Connections for Suspended Ceilings
   1. Provide multiple-use flexible piping connections to sprinkler heads in suspended ceilings. All flexible piping systems shall be UL 2443 listed as Flexible Sprinkler Hose with Fittings for Fire Protection Service. Flexible piping systems shall be installed according to their listing.
   2. All flexible piping connections to include a fully-welded (non-mechanical fittings), braided, leak-tested, stainless steel sprinkler drop with a minimum internal corrugated hose diameter of 1", or with zinc plated steel 1" NPT Male threaded nipple for connection to branch-line piping, and a one-piece multi-port open-gate ceiling bracket with removable attachment hub and self-securing integrated snap-on clip ends, for attachment to ceiling grid without the need for a screw fastener. The bracket shall allow installation before the ceiling tile is in place.
   3. The drop shall include a UL approved Series AH2 braided hose with a bend radius to 2" to allow for proper installation in confined spaces. The hose shall be listed for [(4) bends at 31" length] [(5) bends at 36" length] [(8) bends at 48" length] [(10) bends at 60" length] [(12) bends at 72" length].
   4. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 bracket.
   5. Victaulic Vic-Flex, Flexhead Industries, or approved equal.

M. Fire Department Connections:

1. Type: Free-standing type with ductile iron pipe pedestal and brass hose outlets.
2. Check Valve: For horizontal and vertical installation, with non-slamming spring-loaded elastomer-faced clapper
3. Outlets: Two-way with thread size to suit fire department hardware (by this subcontractor); threaded dust cap, and chain of matching material and finish.
4. Drain: 3/4” automatic drip, outside.
5. Label: "Sprinkler - Fire Department Connection".
6. At the low-point near each fire department connection, install a 90-degree elbow with drain connection to allow for drainage to prevent freezing. Basis of design: Victaulic #10-DR

2.06 AIR COMPRESSOR

A. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch, and unloader valve. Minimum size tank is 5 gallons. Mount on wall or floor.

B. Compressor shall have a minimum capacity capable of charging the complete sprinkler system to normal system air pressure within 30 minutes.

C. Electrical Characteristics: Provide characteristics to EC for final coordination of power requirements. Sprinkler contractor is responsible for air compressor power. At sprinkler contractor’s option they may hire the electrical contractor or their own electrical contractor to provide any power needed

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Ductwork location shall take precedence over sprinkler piping. General Contractor shall coordinate all subcontractors’ work. Notify the Owner's representative of any irresolvable field issues.

D. Maintain 6'-8" minimum head room in all Mechanical spaces, and 8’ in all other spaces. If minimum spacing is not possible, obtain the Owner's representative's permission, in writing, to install piping at lower heights.

E. Conform to requirements for phased construction, if phasing is required by Owner.

F. Install buried shut-off valves in valve box. Provide post indicator where required.

G. Provide approved double check valve assembly at sprinkler system water source connection.

H. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

I. Locate outside alarm gong on building wall as indicated.

J. Place piping runs so as to minimize obstruction to other work.

K. Place piping in concealed spaces above finished ceilings.

L. Center sprinklers in two directions in ceiling tile and provide piping offsets as required. Do not install sprinkler heads through or with escutcheon plate covering suspended ceiling grids.

M. Do not install sprinklers that have been dropped or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

N. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.

O. Provide chrome-plated steel escutcheon plates for exposed piping passing through walls, floors, or ceilings. Provide identification of piping throughout building.

P. Flush entire piping system of foreign matter; have Owner's representative witness flushing.

Q. Hydrostatically test entire system. Test shall be witnessed by the Authority Having Jurisdiction and Owner's representative.

R. Inspector's Test Connection and Test Valves:
   1. Provide test connections approximately 6' above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without property damage. Provide discharge orifice of same size as corresponding sprinkler orifice.
   2. Locate test valves such that they are conveniently accessible from the floor. Coordinate locations with the AHJ and Owner. Drips and drains shall be installed for all test valves. All drains shall be piped to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily carry the full flow from each sprinkler drain under maximum pressure. In no case shall a direct connection be made to any sewer system.

S. Installation of Piping
   1. Install accurately cut steel piping to measurements established at the jobsite, free of fins and burrs. Install using full pipe lengths; random pipe lengths jointed by couplings will not be accepted. Clean all piping before placing in position and maintain in a clean condition. Work into place without springing or forcing. Support pipe from structural member only.
   2. For pipe joints, provide full cut threads. Apply pipe compound to male thread only. Connect joints so that not more than three threads on the pipe remain exposed.
   3. Install grooved couplings in accordance with manufacturer's recommendations.

T. Fire Stopping: Provide approved fire stop materials for all penetrations through fire-rated walls. Maintain wall fire rating.

U. Dirt Legs and Drain Valves: Install approved dirt legs and drain valves at low points of all piping to permit complete drainage of system without disconnection of any piping; drain valves at base of riser to have 1-1/2" hose adapters matching threads of hose systems in the building.

V. Modifications: Install in accordance with approved Shop Drawings. Modifications made to system design or arrangement after approval of drawings by the Authority Having Jurisdiction may only be made after receiving written approval of authority and the Owner's representative; such modifications do not include minor relocations in piping or head placement. Make all revisions in accordance with NFPA 13.

W. Damage During Testing: The Contractor shall be responsible during the installation and testing periods of the sprinkler system for any damage to the work of others, to the building, its contents, etc., caused by leaks in any equipment, by unplugged or disconnected pipes, fittings, etc., or by overflow, and shall pay for necessary replacements or repairs to work of others damaged by such leakage.

X. Supports: Provide pipe/equipment supports and seismic bracing per NFPA 13. The earthquake zone shall be as defined by the IBC.

Y. Test: Test sprinkler piping under hydrostatic pressure of 200 PSI for two-hour period. Prove system watertight to satisfaction of the Owner's representative. Prior to performing tests, notify the Authority Having Jurisdiction and the Owner's representative of the pressure test schedule. All dry fire sprinkling lines shall be drained following initial flow testing.

Z. Provide four hours of instruction to the Owner's personnel at a time acceptable to the Owner. The four hours may be in one session or multiple sessions, and may be added to other Fire Protection Sections for total hours of training available to the Owner.

AA. Posted Instructions: Provide, next to the sprinkler riser main, a printed sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data as required by NFPA 13. For hydraulically designed sprinkler system, permanently attach a placard to the riser indicating the location and basis of design (discharge density and system demand).

BB. Approval and Acceptance: After the sprinkler system has been completely installed, pressure tested, drained, and all punch list items corrected, obtain the approval and acceptance of the system by the Authority Having Jurisdiction, in accordance with NFPA 13. Submit the certification of approval and acceptance by the Authority Having Jurisdiction to the Owner's representative.

CC. Do not install pumps or air compressors on the riser pipe; locate them on the wall or floor with appropriate isolation and flexible connections.

DD. Identification Signs: Provide per NFPA 13. Attach properly lettered and approved metal signs to each valve and alarm device. Permanently affix hydraulic design data name plates to the riser of each system.

EE. Dry Pipe Sprinkler Systems: Water shall reach the most remote sprinkler head 60 seconds after sprinkler head activation. Provide all necessary devices, including accelerators and exhausters, if required to achieve required performance.

END OF SECTION

SECTION 22 00 10
GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

A. Conform to General Conditions, Supplementary Conditions, and Division 01.

B. This section of the specification applies to the entire mechanical work, both interior and exterior, as specified herein after and shown on the plans.

C. This Contractor is responsible for coordination with all other trades.

1.02 SCOPE

A. All services to within five (5) feet of the building shall be provided as shown on plans, and final connections to these services shall be made by the Mechanical Contractor.

1.03 DEFINITIONS

A. The term "approved equal" means final approval by the Owner's representative of a material or piece of equipment substituted for that which is shown in the specifications or plans.

B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

C. The terms "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the "General Contractor (GC)."

1.04 INTENT OF DRAWINGS

A. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in piping. Contractor shall provide additional fittings, offsets and extensions in piping and related mechanical insulation as required to meet the intent of the documents and shall include these items in his bid. Contractor shall also include in his bid provisions to relocate or shift piping where conflicts exist with Structural, Architectural or Electrical.

B. Refer to the complete set of Architectural, Structural, Electrical, and Civil Plans and Specifications for additional details of the work. Review Plans and Specifications of other trades to identify other requirements. Discrepancies shall be reported to the Owner's representative immediately before ordering material or beginning work.

1.05 COORDINATION

A. Examine the Architectural, Civil, Structural and Electrical drawings before work is started. Consult with each of the other Contractors regarding locations and spaces required for work and lay out work to avoid interference. Maximum clearance shall be maintained for service access and maintenance of all equipment. Failure to coordinate shall be justification to require Contractor, at his own expense, to move his work to provide the necessary space for the other contractors.

B. Mechanical systems have space priority as follows, listed with highest priority first: Graded Drainage Piping, then Ductwork, Drainage Vents, Hydronic Piping, Domestic Water Piping, Natural Gas Piping, and Fire Protection Piping. MC to make certain that priority access is maintained. This shall be coordinated by the GC and MC without assistance from Owner's representative, Engineer, or Architect.

C. Contractor shall be responsible for his own coordination between all other trades. Development of Shop Drawings shall be a collaborative effort between the General Contractor, Mechanical Contractor, Electrical Contractor and all other subcontractors working on the project. Shifting of piping, ductwork and other mechanical items shall be the responsibility of the Team to maintain the intent of the documents. Submit drawings to the Owner's representative.

1.06 WORK IN OTHER SECTIONS

A. Drawings and General Provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.07 CODES AND REFERENCES

A. Codes and Standards listed shall be the most current issue as adopted by the Local Jurisdiction. In the event of a conflict of codes, the most stringent code will apply.
   1. International Building Code (IBC)
   2. Uniform Plumbing Code (UPC)
   3. International Mechanical Code (IMC)
   4. Washington State Energy Code
   5. SMACNA Duct Construction Standards, Metal and Flexible
   6. National Electrical Code (NEC)

1.08 PERMITS AND FEES

A. Obtain and pay for all permits, licenses and construction or utility fees. Furnish final certificate to Owner showing compliance with code requirements.

1.09 SCHEDULING

A. Comply with requirements of General Specifications.

1.10 PRIOR APPROVALS

A. Specifications have been written around equipment and material selected for this project based on quality, size, capacity, and performance required to meet building design criteria. Any equipment and/or material used in this project, that is not as specified, must have prior approval from the Owner's representative.

B. Request for Approval must be submitted with substitution request form included in Division 0 to Owner's representative a minimum of 10 calendar days prior to bid date. This letter shall be accompanied with complete information regarding items to be substituted.

C. Those items that receive prior approval will be listed in the Mechanical Addenda.

D. Supplier, and/or Mechanical Contractor, shall be responsible for ensuring that substituted material or equipment is of the same size, quality, capacity, weight, and electrical characteristics as that specified. Any changes and costs required during construction, due to contractor's/supplier's neglect to properly select substituted equipment, shall be paid by the contractor/supplier.

E. Prior approval to bid does not mean automatic final approval of material or equipment by the Owner's representative. Final approval will be given after final submittal data has been presented to Owner's representative, with complete information regarding weights, capacities, size, electrical requirements and quality.

1.11 MATERIAL AND MATERIAL SUBMITTALS

A. All material used on the project shall be new material and free from defects. This Contractor shall submit catalog data and engineering data, on all equipment as specified or having received prior approval.

B. All Plumbing Fixtures, Trim, Piping and Valves in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards, or be NSF-61-G certified to all requirements of NSF/ANSI 61 (health effects) and all requirements of Annex G and NSF/ANSI 372 (lead content) via third-party testing and certification.

C. Material and equipment specified is designated by various manufacturer's catalog numbers. Acceptable alternate manufacturers are also listed. Such manufacturers are exempt from the 10-day prior approval clause of these specifications, but must submit standard submittal data for final approval as otherwise noted.

D. Submittal shall be arranged in numerical order, according to specification section number and item number. Submittal shall be in PDF format complete with labeled bookmarks (minimum one per specification section)

E. Submittal shall be as follows: Before ordering or installing any of the materials, this Contractor shall submit copies of complete information on the materials to be used on the project. Submittal shall include, but not be limited to, the following.
   1. Contractor's Cost Breakdown.
   2. Complete List of Subcontractors and Suppliers.
   3. Pipe, Valves and Specialties for each system including storm and sanitary drainage systems, domestic water systems, plumbing systems, and all outside systems including fire protection systems.
   4. All Plumbing Fixtures.
   5. All pumps for Plumbing.
   6. Water Heaters.
   7. Insulation.

F. The Owner's representative will return one set of this submittal to the contractor showing any corrections, additions, and/or deletions. This Contractor shall resubmit those items that need to be corrected or added.

1.12 CONTRACTOR'S COST BREAKDOWN

A. Mechanical Contractor shall submit, a cost breakdown of the major portions of his work, pursuant to the following outline.
   1. Job organization and submittals.
   2. Outside site utilities.
   3. Plumbing rough-in.
   4. Plumbing fixtures.
   5. Plumbing piping and insulation.
   6. Plumbing specialties - compressed air.

1.13 RECORD (AS-BUILT) DRAWINGS

A. This Contractor shall maintain a set of Contract Drawings at the site on which the actual installed location of piping, equipment, etc., shall be shown in a legible, neat manner. This set of plans shall show actual dimensions (including depth of bury) of underground piping from construction lines, so they can be readily found after covering. Upon completion of the project, the as-built information shall be transformed into AutoCAD version 2024 or greater. Record drawings shall be the same size as contract drawings. This set of plans shall be submitted for final approval. Drawings shall be one full size set, one half size set and on a USB flash drive in PDF and .dwg format. The contractor shall be ready for review of the on-site as-builts monthly prior to submitting his billing. Failure to have drawings available for review may delay monthly billings.

1.14 OPERATING INSTRUCTIONS

A. Operate all systems through complete cycles in the presence of designated Owner's representative. Give instructions for operation, care and maintenance. All systems shall be operated through complete operating cycles for a minimum period of 7 days in conjunction with the designated Owner's representative before acceptance.

1.15 TRAINING

A. The Mechanical Contractor shall digitally record all Owner Mechanical training sessions and shall provide copies on a USB flash drive. Training sessions shall be provided for all mechanical systems. Three copies shall be turned over to the Owner at the completion of the project.

1.16 OPERATION AND MAINTENANCE MANUALS (O&MS)

A. General: Provide one preliminary searchable PDF set of Operation and Maintenance Manuals including maintenance information and parts list furnished by the manufacturer with the equipment, together with supplementary drawings where necessary, to itemize serving and

maintenance points. Include the Valve Tag list(s) as posted in the Mechanical spaces. Include filter maintenance, methods of operation, seasonal requirements, manufacturer's data and warranty forms. Warranty forms are to be located in the front of the manuals as well as in each applicable section. Provide address and 24-hour phone number of the firms responsible under warranty. Items requiring service or correction during the warranty period shall be serviced within 24-hours of notification by Owner. Data in manuals shall be neat, clean copies, with operation and maintenance instructions for each item of equipment installed. Drawings shall be accordion folded. An index shall be provided with all contents listed in an orderly presentation with bookmarks according to specification section.

B. Number of Copies: A preliminary set of the O&M Manuals shall be submitted for approval. After this set has been approved, One hard copy and 3 electronic copies on USB flash drives shall be submitted.

C. Hard Copy Binding: Organize operating and maintenance data into suitable sets of manageable size. Copies shall be submitted in 3-ring binders. Covers shall include the name of the Job, Owner, Architect, Engineer, Contractor, and the year of completion. The back edge of the binder shall include a label with the name of the Job, the Owner and the year completed. Each copy shall have a typewritten index and tabbed dividers between equipment categories. Binders are to be no more than 80% full; binders that are over 80% full will be sent back for dividing into additional binders.

1.17 CERTIFICATIONS

A. Provide written certification that work has been fully completed in strict accordance with Plans and Specifications and request final inspection.

B. Provide written certification that Contractor will replace materials and workmanship that prove defective for one (1) year after date of acceptance or extended warranty as listed in individual sections.

C. Provide written certification of inspection from the Authority Having Jurisdiction, stating that all work has been inspected, accepted, and approved as complying with existing governing ordinances and codes.

D. Provide written certification that Owner's representative has been fully instructed in the operation and function of all mechanical systems.

E. Provide copies of certifications in the O & M Manuals.

1.18 DOCUMENTS

A. Present the following documents to the Owner's representative prior to final acceptance of buildings. Final payment of the Contract will be contingent upon receiving these documents:
1. Record (as-built) drawings.
2. Operation and Maintenance Manuals (3 sets).
3. Final material submittal.
4. Warranties and Extended Warranties.
5. Approved Final Balancing logs.
6. State of Washington certification of all pressure vessels installed on the project. Affix a copy to each tank.
7. Final certificates of inspection and code compliance.
8. Domestic water test results.
9. RPBF device tests.
10. All applicable forms required by these specifications.
11. Provide copies of the above documents in O & M Manuals.

1.19 WARRANTY

A. All Plumbing systems, and all parts thereof, shall be warranted (parts and labor), for a period of one (1) year after the date of substantial completion as determined by the documentation.

B. Contractor shall repair or replace, to the satisfaction of the Owner's representative, any defective material, equipment, or poor workmanship which may show itself during this warranty period.

C. Test and Balance shall be warranted for two (2) years total, from date of final acceptance.

1.20 MECHANICAL ACOUSTICAL REQUIREMENTS

A. The noise criteria (NC) end resultant for each space shall be per Code, as accepted by Local Jurisdiction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL

A. Owner's representative's review of submittals is for general conformance with the design concept and Contract Documents. Marking or comments shall not be construed as relieving the Contractor from compliance with the project Plans and Specifications, nor departures therefrom. The Contractor remains responsible for details and accuracy for confirming and correlating all quantities and assembly and for safe performance of his work.

END OF SECTION

SECTION 22 00 20
BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 GENERAL

1.01 WORK INCLUDES

A. General requirements for basic materials and methods.

1.02 REFERENCES

A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

B. "Seismic Restraint Manual Guidelines for Mechanical Systems" by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

PART 2 PRODUCTS

2.01 GENERAL

A. See specific sections for this requirement.

2.02 PRODUCT TESTING

A. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection, such as pumps, water heaters, booster heaters, etc., must be provided with an approval label from one of the agencies hereinafter listed.

B. Approval of agency must be for the total package (approval of individual components not acceptable). All labels must be located outside of equipment and shall be visible to inspector. Comply with all requirements of RCW 19.28.010 and NEC Sections 90-7 and 110-3 (1993).

C. It is the responsibility of the Mechanical Contractor or the equipment supplier to meet the requirements of this section. Any agency costs to provide appropriate label for a piece of equipment must be included in this bid. Failure by Mechanical Contractor or supplier to obtain approval labels prior to bid shall be sufficient cause for the Mechanical Contractor/supplier to obtain all such labels at no additional cost to Owner. The following is a list of approval testing laboratories:
   1. Underwriters Laboratories, Inc., www.ul.com
   2. Canadian Standards Association, www.csagroup.org
   3. American Gas Association, www.aga.org
   4. Factory Mutual Systems, www.fmglobal.com
   5. MET Electrical Testing, www.metlabs.com
   6. Intertek Testing, www.intertek.com

2.03 PRESSURE VESSELS

A. At the completion of the project, the Contractor shall provide State of Washington Certification of all pressure vessels installed on the project. Affix certification on the vessels and provide a copy in the O&M Manual.

2.04 DAMAGED OR REJECTED MATERIALS

A. Remove from the site immediately.

2.05 STARTERS AND DISCONNECTS

A. All starters shall be provided and installed by Electrical Contractor unless otherwise noted.

B. All disconnects shall be provided and installed by Electrical Contractor unless otherwise noted.

C. VFDs shall be provided by the Control Contractor, installed by the Electrical Contractor, and controlled by the Control Contractor, unless otherwise noted.

D. Mechanical Contractor shall coordinate VFDs based on direction provided in the contract specification. All VFDs are to be of a single manufacture and/or provided by a specific contractor.

The MC shall be responsible for compliance with the specification, or shall correct problems at his expense.

E. The Mechanical Contractor shall coordinate with the Electrical Contractor and provide voltage, phase, horsepower, and amperage for all of the mechanical equipment being provided, based on approved submittals and the actual equipment being provided.

F. Starters, disconnects, and VFDs shall be provided in a timely manner, so as to not delay the Electrical Contractor's work.

2.06 FIRE INTEGRITY - PENETRATION SEALING SYSTEMS

A. Manufacturers
1. 3M Fire Products
2. Holdrite
3. Approved equal

B. The penetration sealing systems shall be provided with F-Rating and/or T-Rating as required by IBC Section 714.3 and 714.4. Penetrations include the following:
1. Through-penetration firestopping in fire-rated construction.
2. Construction-gap firestopping at connections of the same or different materials in fire-rated construction.
3. Construction-gap firestopping occurring within fire-walls, floor or floor-ceiling assemblies.
4. Construction-gap firestopping in smoke partitions.
5. Through-penetration smoke stopping in smoke partitions.
6. Construction-gap smoke stopping in smoke partitions.
7. All and piping penetrating mechanical spaces, mechanical mezzanines, mechanical lofts, mechanical boiler rooms, or other mechanical spaces, shall be fire caulked, even if the walls are not rated. Visible piping penetrations shall be covered by split chrome-plated floor and ceiling plates.

C. All products shall be listed in Underwriters Laboratory Fire Resistance Directory.
1. Through-penetration firestop devices (XHCR).
2. Fire resistance ratings (BXUV).
3. Through-penetration firestop systems (XHEZ).
4. Fill, void or cavity material (XHHW).

D. All material shall be tested per American Society for Testing and Material Standards, ASTM E814: Standard test method for fire tests of through-penetration firestops.

E. Firestopping for penetrations and voids shall be UL-tested systems.

2.07 HANGERS

A. Manufacturers:
1. Grinnell
2. Michigan Hanger
3. Tolco
4. PHD
5. Anvil
6. Holdrite
7. Approved equal

B. Provide all anchors, hangers and all supports for piping and equipment included in contract.

C. It is the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard, commercially-accepted pipe hangers and accessories.

D. All pipe hangers and supports shall conform to the latest requirements of ASME B31.1 Code for Pressure Piping , and Manufacturers Standardization Society Documents MSS SP-58 and MSS SP-69.

2.08 INSERTS AT HANGERS AND SUPPORTS

A. Manufacturers:
   1. Holdrite
   2. Buckaroos
   3. Cooper
   4. Metro Supply Company
   5. Value Engineered Products, Inc.
   6. Hydra-Zorb Klo-Shure 7-series or 8-series strut-mount and Clevis
   7. Approved equal

B. Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. The insert is to consist of either hydrous calcium silicate or polyisocyanurate foam insulation (urethane) encircling the entire circumference of the pipe with a 360-degree PVC (1/16” thick) or galvanized steel jacket (20 gauge minimum). Inserts are to be installed on piping during piping installation, by the Piping Contractor. Provide continuous insulation vapor barrier. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor retarder mastic.

C. For elastomeric insulation, provide Hydra-Zorb Klo-Shure 7-series 8-series strut-mount or Clevis Hanger Insulation Couplings or approved equal.

D. Insulation and covering shall meet the flame spread index and smoke developed index as noted in the International Building Code.

E. Insert thickness shall match Code-required insulation thickness as a minimum.

F. Provide pipe covering protection saddle for piping on rollers; Anvil figure 160 through 166A or approved equal.

G. Inserts for piping in plenums shall have appropriate flame/smoke spread rating.

2.09 ELECTRIC MOTORS

A. Minimum efficiencies of electric motors shall comply with the Washington State Energy Code.

B. For VFD applications, provide motors rated for VFD (inverter ready) service only.

2.10 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. Jay R. Smith
   2. Milcor
   3. Mifab
   4. Approved equal.

B. 16 gauge steel door and frame with concealed hinge and cylinder lock. Provide matching latches/locks keyed the same for multiple panels in a project. When "B" dimension is 24" or more, provide additional latches at the top and bottom of door. Provide finish and material as noted in Part 3 – Execution.

2.11 CONCRETE INSERTS

A. Manufacturers:
   1. Grinnell
   2. Kinsdorf
   3. Elcen
   4. Approved equal.

B. Inserts in concrete for the suspension of piping and equipment shall be provided by this Contractor, unless otherwise noted on the Plans. Inserts in "poured-in-place" concrete shall be Grinnell 282 galvanized, or approved equal.

2.12 VIBRATION AND SEISMIC CONTROLS

A. Manufacturers:

1. Kinetics Noise Control, Inc.
2. Mason Industries
3. Amber-Booth
4. I.S.A.T.
5. Flexicraft
6. Twin City Hose
7. Approved equal.

B. General
1. If equipment is internally isolated by the manufacturer, internal isolation (base and isolator) shall be equivalent to the scheduled base and isolator and the isolator shall meet the scheduled spring static deflection.
2. Size anchoring bolts to withstand lateral seismic shear and isolate bolts from direct contact with structure using bolt isolation washer and bushing.
3. Bases specified in the schedule can be supplied by the manufacturer of the equipment if they meet the specification given herein.
4. Electrical connections shall be made with floppy length of flexible cable.
5. Piping in connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.
6. Provide seismic restraint for piping, equipment, and ductwork.
7. Submit all seismic restraint and vibration isolation components, calculations, and designs for approval. Do not install equipment or isolation until approval is received.
8. The Contractor shall coordinate with the Project Structural Engineer to ensure mounting attachment points for seismic restrained springs and seismic snubbers will withstand forces generated from the maximum acceleration rating of the restrained springs and snubbers.
9. Install in accordance with all codes, regulations and the requirements of the Authority Having Jurisdiction. Provide the Authority with copies of the components, calculations and design for their approval, if requested.
10. Seismic requirements for non-structural components, calculations shall utilize an "Importance Factor" of 1.5 for life safety systems and a factor of 1.0 for other systems.

C. Shop Drawings:
1. Provide schedule of vibration isolator type with location and load on each.
2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
7. Include the seal of the Professional Engineer registered in the State in which the Project is located, on the drawings and calculations which at a minimum include the following:
    a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
    b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
        1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.

2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.

c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
d. Detailed description of the equipment anchorage devices on which the certifications are based.

D. Pipe Isolation - General
1. Hung Type Isolators: Double-Deflection Neoprene Hanger to 4", Deflection - 30 degree Swing Spring and Double Deflection Neoprene Hanger - 6" and larger.
2. Isolator Deflection: 1/4” to 4", 1" - 6" and larger.
3. Motion Restraint Snubber: seismic restraint cable, rod clamp for standard 1-5/8" x 1-5/8" unistrut, and clevis cross brace.

E. Piping not requiring sway bracing is as follows:
1. Piping in mechanical spaces less than 1".
2. All other piping less than 2-1/2".
3. Piping suspended by hangers 12" or less in length measured from the top of the pipe to bottom of hanger support where the hanger is attached.

F. Pumps
1. Provide seismic restraint cable for inline pumps.

2.13 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Where non-metallic piping is buried, provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3" minimum width, color-coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "Caution: Buried Water Piping Below" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

PART 3 EXECUTION

3.01 LAYING OUT WORK

A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work executed under the Contract. Exercise proper precautions to verify figures shown on drawings before laying out work, and be responsible for any errors resulting from failure to exercise such precaution. The coordination of the utility installation with the final site grading and elevation by the General Contractor shall be the responsibility of this Contractor. Locate existing utility lines which will be affected by the building location before any footing work begins. Report conflicts with the Plans to the Owner's representative for adjustment before proceeding with the work. Failure to follow this instruction will result in the Contractor being required to alter his work at his own expense.

3.02 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specification shall conform to all applicable portions of the Electrical section of the Specifications, and shall conform to all applicable Codes.

3.03 WORKMANSHIP

A. Furnish and install all equipment for a neat and finished appearance. If, in the judgment of the Owner's representative, any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, Contractor will be required to remove and reinstall the equipment, and patch and paint surrounding surfaces in a manner satisfactory to the Owner's representative, without any increase in cost to the Owner.

3.04 EXCAVATION - GENERAL

A. Perform all necessary excavation, shoring and backfilling required for the proper installation of work inside the buildings and premises, or outside as may be necessary. Slope sides of excavation to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Sewer trenches shall be excavated to the grade with the bottom rounded to the outside of the sewer piping. Bell holes shall be hand excavated to ensure that piping rests for its entire length upon the bottom of the trench.

B. Excess excavation shall be backfilled with gravel or sand and mechanically compacted to give full support to the piping. In case of sewer lines in rock excavation, the excavation shall be made at least 6" deeper than required and backfilled with sand to outside invert grades to provide cushion. No underground lines shall be covered until the installation has been approved by the Owner's representative and the Authority Having Jurisdiction. Maintain sides and slopes of excavations in safe condition until completion of backfilling. All backfill shall be thoroughly compacted.

C. No cinders shall be used for backfilling where steel, iron or copper piping is used. All trenches near or under footings shall be cut only after approval of the Owner's representative, and all backfilling of such trenches shall be according to his direction.

D. All items of grading which will in any manner affect the bearing capacity of the soil foundations upon which will be placed floor slabs, walls, column footings or pipe beds shall be performed to the satisfaction of the Owner's representative. All soil foundation areas which will in any manner support any of the above-stated construction will be compacted by the use of mechanical tampers to at least 95% of the maximum density of the soil foundations as determined by the compaction control test, in accordance with the "Method of test for Moisture Density Relations of Soils, ASTM Designation D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described " Compaction Control Test." Place fill in 8" loose layers, each layer compacted.

E. Division 31, (31 23 16 - Excavation, 31 23 23 Fill, 31 26 16.13 Trenching), shall provide Excavation, Fill and Trenching for the Mechanical Contractor, as needed to complete his work.

3.05 EXCAVATION DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations, and from a flooding project site and/or surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions, outside excavation limits to convey rain water and water removed from excavations to collection points or run off areas. Do not use trench excavation as temporary drainage ditches.

3.06 EXCESS EXCAVATION MATERIAL

A. Dirt and debris from trench excavation shall be disposed of by this Contractor, as directed by the Owner's representative.

3.07 PIPING INSTALLATION

A. Lay piping in straight lines with uniform slope, leave no pockets. Care shall be taken to keep all foreign materials out of the piping during installation. Where ground water is present, provide suction pumps to keep trenches free of water, and cap ends of piping exposed to ground water when work is interrupted.

B. All underground piping used for the distribution of domestic water systems and waste drainage systems located outside the building perimeter shall be buried a minimum of 36" from finish grade to top of piping.

C. Piping run above the floor SHALL NOT BE LOCATED OVER ELECTRICAL PANELS OR SWITCHBOARDS, except where located above a structural ceiling, or with drain pans approved by the AHJ. This piping includes, but is not limited to, waste and vent and domestic water lines.

D. All piping SHALL BE ROUTED AROUND Elevator Equipment Rooms unless placed above a structural ceiling. Piping may serve the room, but may not pass through it. Follow all codes applicable to these areas.

E. Isolation Valves:
1. Provide isolation valves on inlets and outlets of all major pieces of equipment, to facilitate serving and removal of such equipment without the necessity of draining the associated system. Provide whether or not shown on Plans.
2. Provide isolation ball or butterfly valves with positive shutoff for all hot water, cold water and hot water recirculation piping serving restrooms.
3. Provide isolation ball or butterfly valves at all branches off the mains.
4. Isolation valves shall be located above T-Bar ceiling where possible.
5. Provide access panels to isolation valves located above hard ceilings.

F. Circuit balance valves: Hot water recirculation lines are to have a circuit balance valve at each branch and restroom in addition to the isolation valve. Provide whether or not shown on Plans.

G. Do not solder within 12” of valves, flanges, etc., manufactured from any bismuth alloy.

H. Maintain 6'-8" minimum head room in all Mechanical spaces, and 8’ in all other spaces. If minimum spacing is not possible, obtain the Owner's representative's permission, in writing, to install piping at lower heights.

3.08 OPENINGS IN PIPING

A. Keep all openings covered tightly with plastic during the work.

3.09 PIPE SLEEVES

A. General: Provide pipe sleeves for piping passing through foundations, walls, floors, partitions, and roof to allow piping to pass freely through.

B. Foundation Walls: Where piping passes through walls below finished grade, but does not enter the building spaces, the sleeves shall be Schedule 40 galvanized steel pipe. Provide a modular seal between the sleeve and the piping.

C. Building Walls (Below Grade) and Floor Slabs: Where piping passes through building walls below grade, and floor slabs on grade or below grade, the sleeves shall extend a minimum of 1" inside the building wall or above the finished floor level, and shall be made watertight and gas tight by the appropriate modular seal. Sleeves shall be Schedule 40 galvanized steel pipe. If the sleeve and modular seal are subject to trapping water on the top side, pack with water resistant foam and caulk with flexible caulking or grout.

D. Building Walls and Floor Slabs (Above Grade): Where domestic hot and cold water and hot water circulation piping passes through concrete walls or floors within the building, the sleeves shall be of sufficient strength to withstand the pressure and concrete pouring operation without deforming or rupturing. Sheet metal ductwork with end slit and formed into flanges is not acceptable. Sleeves shall extend 1" above the finished floor. Sleeves in walls shall be flush on both sides.

E. Piping Subject to Expansion: Where piping is subject to motion due to expansion, such as domestic hot water piping, the sleeve shall be made large enough to allow free motion. When piping passing through is insulated, the sleeve shall be large enough to permit the covering to pass through.

3.10 WALL/FLOOR PLATES AND ESCUTCHEONS

A. Where piping passes through any wall, floor or ceiling, it shall be fitted with chromium-plated steel escutcheons, with suitable set screws or other approved holding device. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.11 PIPE HANGERS AND SUPPORTS

A. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger location, in order to prevent excessive stress in either pipe or equipment connections.

B. Where piping is to be supported from building steel, beam clamps shall be used. Beam clamp selection shall be for the required load and the configuration of the steel at the point of attachment. Drilling holes in the steel for hanger rod will not be permitted unless approved by the Structural Engineer. Use only adjustable side beam clamps (Type 25); standard beam clamps are not acceptable.

C. Riser Clamps (Vertical Piping): Piping shall be supported at each floor with a riser clamp or at sufficient intervals to carry the weight of the piping and its contents. Stacks shall be supported at their base by a concrete pier or by a suitable hanger located on the horizontal run, close to the riser. Riser clamp extensions shall rest on the building structure where possible; auxiliary steel supports shall be provided where it is impractical to rest directly on the building structure.

D. Angle Clips: Where piping is to be supported from building wood structure, angle clips shall be used with lag bolts sized to support the load in shear. Any attachment to wooden structural members shall be subject to the approval of the Structural Engineer.

E. Hanger Rods: Hanger rod size shall be selected on the basis of loading from the following table:

3/8"	610#
1/2"	1,130#
5/8"	1,810#
3/4"	2,710#
7/8"	3,770#
1"	4,960#

F. Hangers shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing. DO NOT BEND RODS.

G. All rods shall be electro-plated to prevent corrosion.

H. All rods shall be double-nutted, on both ends if applicable, and excess rod on the bottom shall be cut flush and ground for safety.

I. Hanger Spacing: The maximum allowable spacing for pipe hangers shall be in accordance with the following. Where concentrated loads of valves, fittings, etc., occur, closer spacing will be necessary and shall be based on the weight supported and recommended loads for the hanger components.

1. Spacing:
    a. Cast Iron Hubless - Shielded Coupling:
        1) Horizontally: Every other joint, unless over 4', then support each joint. See notes 1, 2, 3, and 4.
        2) Vertically: Base and each floor not to exceed 15'.
    b. Copper Tube and Piping - Soldered, Brazed or Welded.
        1) Horizontally: 1-1/2" and smaller, 6'; 2" and larger, 10'.
        2) Vertically: Each floor, not to exceed 10'. See note 5.
    c. Schedule 40 PVC DWV - Solvent Cemented.
        1) Horizontally: All sizes, 4'. Allow for expansion every 30'. See notes 3 and 6.
        2) Vertically: Base and each floor. Provide mid-story guides. Provide for expansion every 30'. See note 6.
    d. Notes For Above:
        1) Support adjacent to joint not to exceed 18".
        2) Brace at not more than 40' intervals to prevent horizontal movement.

3) Support at each horizontal branch connection.
4) Hangers shall not be placed on the coupling.
5) Vertical water lines may be supported in accordance with recognized engineering principles with regard to expansion and contraction when first approved by the Authority Having Jurisdiction.
6) See the appropriate IAPMO Installation Standard for expansion and other special requirements.

J. Hangers - Horizontal Piping:
1. General: All hangers shall be provided with means of vertical adjustment. The following schedule shall be followed to select acceptable hangers for the type of service.
   a. Non-Insulated Copper Piping:
      1) Copper Tubing Hanger
      2) Copper Tubing Band Hanger
      3) Copper Tubing Clevis Hanger
   b. Insulated Copper Piping:
      1) Adjustable steel Band Hanger with Shield.
      2) Clevis hanger with Shield.
   c. Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. See paragraph “Inserts at Hangers and Supports” in this Section.
   d. Plastic Piping:
      1) Plastic Coated Steel Band Hanger
      2) Plastic Coated Clevis Hanger
2. Trapeze Hangers: Where piping is grouped in parallel, provide manufactured strut or trapeze hangers consisting of two steel angles bolted back to back, with space between for a hanger rod at each end. Where the length of angles is greater than 24", there shall be three rod supports. Piping shall be able to move independently, and hanger spacing shall be dictated by the smallest pipe.
3. Brackets and Racks: Where piping is run adjacent walls or steel columns, welded steel brackets shall be used as base supports. Multiple pipe racks or trapeze hangers shall be designed and fabricated to suit conditions.
4. Anchors, Guides and Sliding Supports: Shall be as shown on the drawings or as necessary to prevent excessive stress in either piping or equipment.
5. Auxiliary Steel: All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook, furnished by the Mechanical Contractor, and shall receive one shop coat of primer paint.
6. Submittals: The Contractor shall submit, prior to installation, the following information and data for approval.
   a. Data Sheets on all cataloged items to be used.
   b. Sketches covering all specially designed hanger assemblies and fabrications.

3.12 CUTTING AND PATCHING

A. Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. Cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements, shall be done by the General Contractor. at the expense of the Mechanical Contractor.

3.13 ACCESSIBILITY

A. Locate valves, traps, damper operators, etc., so as to be easily accessible in mechanical spaces or through access panels, specified hereinafter. Otherwise, obtain Owner's representative's approval of location.

B. Any equipment requiring maintenance clearances for servicing of filters, motors, compressors, etc., shall be carefully coordinated to avoid servicing problems. Failure of Contractor to comply with this requirement shall be sufficient cause for Contractor to make all necessary changes at no cost to the Owner. To avoid problems with interpretation of the NEC, allow 42" for all electrical clearances.

3.14 ACCESS DOORS AND PANELS

A. Locations of panels shall be carefully selected during construction, so as not to be located behind cabinets, etc. Coordinate closely with the Architectural and Electrical Plans before installing panels.

B. In areas such as janitor's room or on painted walls, etc., access panels shall be prime-coated and painted by the General Contractor; install before surrounding surfaces have been painted. In areas such as toilet rooms, the access panels shall be stainless steel or chrome-plated. In other finished areas such as on ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.

C. Verify with the Owner's representative location and finish prior to ordering; failure to get the Owner's representative's approval may result in replacement of access panels at the Mechanical Contractor's expense. Minimum size of access doors is 12" x 12"; actual size depends on the specific circumstance, and panel shall be large enough to accomplish replacement or repair of the item requiring access. The Owner's representative shall have the final say on whether or not the access is of sufficient size.

D. Provide access panels for all wall cleanouts on drainage piping and concealed valves for all piping.

E. Doors shall have cylinder lock latches, all keyed alike.

F. Provide fire-rated access doors for one-hour or two-hour rated walls and ceilings; units shall be UL labeled.

3.15 MECHANICAL ACCESSES

A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair. In concealed spaces where access has not been provided by the Architect by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the Owner's representative, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades, to avoid conflict therewith, and such locations shall be approved by the Owner's representative prior to installation of access panels.

3.16 PAINTING, TAGS, ETC.

A. Field painting of all equipment, piping etc., located in and exposed in occupied spaces, shall be by the General Contractor. See Architectural painting specification.

B. Identification Tags: Provide identification tags for each main shut-off and control valve throughout the building indicating the system served. Tags shall be black phenolic plastic with white engraved inscription attached with chrome chain.

C. Provide valve tag lists laminated in mechanical room. Provide matching floor plan diagram showing locations for each valve on an overall floor plan. Locate as directed by the Owner's representative.

D. Each major item of Equipment shall be provided with the name of the item, i.e., Water Heater No. 1, etc., in labels of black phenolic plastic with white engraved inscription. Minimum size of lettering is 1" with a maximum of 2". Select appropriate sizes for the size of the equipment being labeled. Align labels with edges of equipment and locate labels so as to be visible.

E. Pipe Markers:
   1. Piping throughout the building shall be equal to Brady Corporation No. B-946, M.S.I. No. MS-900, meeting or exceeding ANSI A13.10-1981. Pipe markers shall consist of two wraps of arrows in the direction of flow, color, and wording as indicated in the following schedule.

Stencils shall be visibly located and spaced on maximum 20'-0" centers for long straight pipe runs. Stencils shall be located on both sides of a wall, within the first 3'.

2. Color Code Schedule: (Service, Color, Stencil)

Domestic Cold Water	Green	C.W.
Domestic Hot Water	Yellow	H.W.
Domestic Hot Water Recirc.	Yellow	H.W.C.
Waste and Vent Lines	Yellow	D.W.V.
Air Piping	Green	AIR

3. Ceiling Tile Access Labels: Where it is necessary to remove ceiling tile(s) to access valves, etc., provide and install round 1/2" diameter, yellow, self-adhesive labels on the metal ceiling grid, visible near all four corners of each tile requiring removal.

3.17 TEST PLUGS AND GAUGES

A. Pressure or temperature test plugs shall be installed on inlet and discharge of all pumps, even if they are not shown on Plans.

B. Pressure or temperature test plugs shall be installed adjacent all temperature and/or pressure sensors, even if they are not shown on Plans.

C. A minimum of two compatible pressure gauges (including pressure gauge adapters) and two compatible temperature gauges shall be provided.

D. P&T test plugs included on other devices that serve the same purpose and that provide the same information are acceptable; duplicates are not required.

3.18 FIRE INTEGRITY

A. All penetrations of fire-rated walls, ceilings, roofs or floors by piping must be protected by appropriately-rated assemblies and caulking to maintain integrity of structure.

3.19 CLEANING UP

A. Comply with requirements of the General Specifications.

B. Remove tags, labels, etc., from all plumbing fixtures. Clean all fixtures and trim.

3.20 CAULKING

A. Caulk all openings and flash around all piping and equipment passing through roof, floor, and walls. All caulking shall be water resistant. See also Paragraph "Fire Integrity" for rated wall, ceiling, roof, or floor penetrations.

B. All piping penetrations of walls, ceilings, and floors shall be caulked. A chrome-plated steel escutcheon plate shall be installed at each visible pipe penetration of walls, ceilings, or floors.

3.21 OPERATION OF EQUIPMENT AND SYSTEMS

A. Contractor is responsible during all periods of balancing and testing. Provide temporary utilities as required.

3.22 TESTS, ADJUSTMENTS AND INSPECTION

A. Test all work thoroughly and systematically, both during construction and after completion. Notify Owner's representative 48 hours in advance of all tests. Tests shall be maintained until approved. Tests shall be as hereinafter specified.

B. The Contractor shall test the completed installation as in regular service. Any defects or imperfections that may show up are to be promptly corrected. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from date of final acceptance. The Contractor shall repair or replace any part which may show signs of failure during that time, if such failure, in the opinion of the Owner's representative, is due to imperfections in material or to improper workmanship.

C. No system, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing, without first notifying the Owner's representative. Failure to notify the Owner's representative for inspection of concealed systems

shall be cause to require this Contractor to uncover and recover such systems at no additional cost.

D. A log of all tests shall be kept. The log shall note dates, time of day test started, system or portion of system tested, length of test, test results, and who witnessed the test (AHJ, Owner's representative, or GC). Contractor shall include legible names of witnesses. Contractor to submit a copy of the contractor's test log monthly to the Owner's representative.

E. Review the project to determine when final inspection is appropriate and advise Owner's representative. Mechanical Contractor is required to complete his work before requesting final inspection.

F. See specification section of piping used for test methods or procedures used.

3.23 FINAL INSPECTION

A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall so advise the Owner's representative. It shall be understood that the work is to be essentially complete. If such is not the case and more than one final inspection and one backcheck are necessary, this Contractor may be billed for the additional back checks at the then governing rate for the personnel involved. The final inspection punchlist shall be legibly signed on a copy of the punch list by a person responsible for the trade involved, and transmitted to the Owner’s representative, before the backcheck will be scheduled.

3.24 PROTECTION AND CLEANING

A. All equipment and material installed by this Contractor shall be properly protected from damage during the course of construction. Enamelware or china fixtures which are plastered around and/or over shall be protected with heavy, thoroughly-secured, wrapping paper. All fixtures and equipment shall be thoroughly cleaned before final inspection. Remove all pasted paper labels from plumbing fixtures.

B. In attic or other spaces where piping such as domestic water lines, etc. have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect these pipes. Wood or other such material will be acceptable.

C. Provide and protect walking paths in mechanical spaces. Maintain 6'-8" headroom for all piping. If required clearance is not possible, obtain permission from the Owner's representative to violate the above requirement, and comply with protective measures required.

3.25 SPECIAL PROTECTION

A. Exercise maximum precaution to protect the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

3.26 BALANCING WORK

A. Provide Testing, Adjusting and Balancing as required in this section of the specification.

3.27 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's representatives.

B. General Description of Instruction Periods: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings, followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures, settings, and available adjustments.

C. Scheduling of Instruction Periods: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given to the Owner's representative at least two weeks prior to the instruction periods, and agreement reached as to the date at which the instruction periods are to be performed. Advise Owner's representative two weeks prior to date when ready to conduct

instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.28 ON-SITE OBSERVATIONS AND SAFETY MEASURES

A. During its progress, all work shall be subject to observation by the Owner's representative, and of the National Board of Fire Underwriters, State and Local Inspectors. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor will be totally responsible for conditions of the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Owner's representative to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. It shall be the Contractor's responsibility to comply with "Safety and Health Regulations for Construction" in the Federal Register by the U.S. Department of Labor. Contractor shall be responsible for providing all such safety measures and shall consult with the State and/or Federal Safety Inspector for interpretation whenever in doubt as to whether he is or is not in compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damage or injury to any persons or property wherever located resulting from any action or operation under this contract or in connection with the work.

3.29 DRAFT STOPS

A. It shall be the responsibility of each Contractor performing his trade to verify with Architectural Plans and to maintain the integrity of draft stops, whenever his work requires penetration of these areas. Patch as required to maintain integrity of draft stops.

3.30 COMMISSIONING

A. This Contractor will be required to participate in the commissioning process. See Section 23 08 00 and the Commissioning Section in the Architectural Section of the specification. The Mechanical Contractor shall complete the start-up forms and be available to assist in the commissioning process. The Mechanical Contractor shall include in his bid all cost associated with his portion of the commissioning process.

B. The following Mechanical Items shall be commissioned.
   1. Water heaters
   2. Hot water recirculation systems
   3. Compressed air systems

END OF SECTION

SECTION 22 05 16
PIPING EXPANSION COMPENSATION – PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible Pipe Connectors - Copper Piping

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

1.03 SUBMITTALS

A. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

B. Design Data: Indicate selection calculations.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. REGULATORY REQUIREMENTS

E. Conform to UL requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:
   1. Flex Hose, Inc.
   2. Metraflex Company
   3. Approved equal.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4" on each side of installed center line.

H. Application: Copper piping.

PART 3 EXECUTION

A. INSTALLATION

B. Install in accordance with manufacturer's instructions.

C. Provide support and equipment required to control expansion and contraction of piping. Provide flexible connectors, pipe offsets as required. Contractor is responsible for a complete piping system.

END OF SECTION

SECTION 22 05 19
GAUGES AND METERS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure Gauges

B. Pressure Gauge Accessories

C. Stem Type Thermometers

D. Test Plugs

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Domestic Water Piping

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi; The American Society of Mechanical Engineers.

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

D. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.06 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. H.O. Trerice Co.
   2. Weiss Instrument, Inc.
   3. Weksler Instrument Co.
   4. Approved equal

B. Gauge: ASME B40.1, stainless steel case, phosphor bronze tube, rotary brass movement, brass socket, black scale on white background.
   1. Case: Drawn stainless steel, with stainless steel ring.
   2. Window: Lexan or acrylic.
   3. Size: 4-1/2" diameter.
   4. Mid-Scale Accuracy: 1% middle half of range, 2% of full range.
   5. Scale: Psi.
   6. Range: Contractor to select operating pressure near middle of range. Provide combination scale for pump suction applications.

2.02 PRESSURE GAUGE ACCESSORIES

A. Needle Valve: Brass, 1/4" NPT for minimum 150 psi. Usage: all projects.

B. Pulsation Damper: Pressure snubber, brass with 1/4" connections. Usage: all projects.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
1. H.O. Trerice Co.
2. Weiss Instrument, Inc.
3. Weksler Instrument Co.
4. Approved equal

B. Thermometers - Fixed Mounting: Blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish.
1. Size: 9" scale.
2. Case: Cast Aluminum, no plastic case.
3. Window: Clear Lexan or acrylic.
4. Fill Type: Blue colored, spirit, organic.
5. Mercury fill is not acceptable.
6. Stem: 3/4" NPT with 3-1/2" standard brass socket.
7. Accuracy: 1%.
8. Calibration: Degrees F.

2.04 TEST PLUGS

A. Test Plug: 1/4" or 1/2" brass fitting and cap for receiving 1/8" outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2" diameter pressure gauge, one gauge adapter, with 1/8" probes, two 1" dial thermometers. Provide one Test Kit for Owner.

PART 3 PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gauges with pulsation dampers. Provide needle valve to isolate each gauge. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2" for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale. Scale selected shall operate near center of range.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs where indicated on Plans. Also provide adjacent pressure gauges, thermometers and temperature or pressure sensors even if not shown. Install test plugs on the inlet and discharge of all heating equipment, pumps, hot water tanks, etc., even if not shown on Plans.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING, PIPING, AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Valve Tags.

C. Pipe Markers and Arrows.

D. Equipment Identification Nameplates.

E. Ceiling Tile Access Markers.

F. Valve Chart Frame.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

B. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification, include matching size and colored arrows.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturer’s catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves, on As-Built's.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation

B. Seton Identification Products

C. Marking Services, Inc.

D. Approved equal.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height, Equipment: 1-1/2"
   3. Background Color: Black.

2.03 VALVE TAGS

A. Metal Tags: Brass with stamped blackened letters; tag size minimum 1-1/2" diameter with smooth edges, 40 mils thick.

B. Tag Lettering: First Line = System Abbreviation; Second Line = Consecutive Valve Numbers, staring at 01.

C. Beaded Chain: #6 x 4-1/2" - Nickel Plated.

2.04 PIPE MARKERS AND ARROWS

A. Comply with ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Tape Pipe Arrows: Nominal sizes and colors to match pipe markers. 1", 2" and 4".

D. Size of pipe markers:
   1. 3/4" to 1-1/4" OSD of covering = 1/2" letters.
   2. 1-1/2" to 2" OSD of covering = 3/4" letters.
   3. 2-1/2" to 6" OSD of covering = 1-1/4" letters.
   4. 8" to 10" OSD of covering = 2-1/2" letters.
   5. Over 10" OSD of covering = 3-1/2" letters.

2.05 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Description:
   1. Plastic Laminate 1-1/4" letters and arrow.
   2. Vinyl Markers 1-1/4" letter and arrow.
   3. Color per ASME standards.

2.06 CEILING TILE ACCESS MARKERS

A. Description: Vinyl or Plastic markers, 1/2" diameter minimum with color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Plumbing Valves: Green.

2.07 VALVE CHART FRAME

A. Description: Anodized aluminum frame, letter size, to hold typewritten chart under clear plastic window.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates and markers with corrosion-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.

B. Install tags with nickel-plated chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions. Install a circular wrap of arrows at each end of the pipe marker.

D. Install plastic tape pipe arrows completely around pipe in accordance with manufacturer's instructions.

E. Identify all mechanical equipment, air handling units, water heaters, pumps, heat transfer equipment, etc., with plastic nameplates.

F. Identify control panels and major control components on outside of panels with plastic nameplates.

G. Identify ALL valves with tags.

H. Tag automatic controls, instruments, valves and relays. Key to control schematic, show on control As-Builts. Provide tags identical to valve tags. First line = abbreviation Number consecutively starting at 01. Provide Valve Chart Frames and Control Device List on walls in an accessible location, and well lighted space, in each Mechanical Space. (Does not include Janitor Rooms).

I. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20' on center

for straight runs including risers and drops, adjacent each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Identify all ductwork with plastic or vinyl nameplates. Identify with air handling unit identification number, system (Outside Air, Return Air, Exhaust Air, Supply Air, etc.) and area served. Locate identification as ducts leave or return to Air Handling Unit, on duct runs not to exceed 20' on center, adjacent each branch, at each side of penetration of structure or enclosure, and at each obstruction. Do not install labels on exposed ductwork.

K. Provide ceiling tile access markers to locate Mechanical Equipment, Filters, Valves, Dampers, etc., above T-bar type panel ceilings. Locate on the metal ceiling grid near all four corners of the tile requiring removal.

L. Install Valve Chart Frames and Valve Lists on walls in an accessible, well-lighted location in each Mechanical Space. (Does not include Janitor Rooms). Provide matching floor plan diagram showing locations for each valve on an overall floor plan. Locate as directed by the Owner's representative.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass Fiber Pipe Insulation, Rigid and Semi-Rigid

B. Glass Fiber Board Insulation, Rigid

C. Cellular Glass

D. Jackets

E. Flexible Insulation Blanket/Pad

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

D. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

H. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

I. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

J. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

M. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

O. All insulation material and installations shall meet or exceed Washington State Energy Code.

P. All codes and standards shall be latest version as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials, thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50 maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Provide thickness of insulation to meet or exceed Washington State Energy Code and/or local codes, whichever is more stringent.

2.02 MANUFACTURERS

A. Knauf Fiberglass

B. Johns Manville Corporation

C. Owens Corning Corporation

D. CertainTeed Corporation

E. Pittsburgh Corning Corporation

F. Armacell International

G. Approved equal

2.03 GLASS FIBER

A. Pipe Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible, with factory applied vapor barrier jacket.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F.
   3. Maximum moisture absorption: 0.2% by volume.

B. Usage: Domestic Water, Condensate Piping - Interior - Medium to Low Temperature, bare tanks and uninsulated plumbing equipment.

C. Vapor Barrier Jacket: White kraft paper, All Service Jacket (ASJ), with 2" overlapped joints, and glass-fiber yarn, bonded to aluminized film finished in white craft paper; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

D. Tie Wire: 0.048” stainless steel with twisted ends on maximum 12” centers.

E. Vapor Barrier Coating:
   1. Manufacturers:
      a. Childers Model CP-35
      b. Approved equal.
   2. Compatible with insulation.

F. Insulating Mastic/Coating:
   1. Manufacturers:
      a. Childers Model CP-10/11
      b. Approved equal.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 ounces per square yard.
   2. Blanket: 1.0 pounds per cubic foot density.
   3. Weave: 5x5.

H. Combination Coating and Lagging Adhesive:

1. Manufacturers:
    a. Childers Model CP-50A HV2
    b. Approved equal.

I. Fibrous Adhesive:
1. Manufacturers:
    a. Childers Model CP-97
    b. Approved equal.

2.04 JACKETS

A. PVC Plastic.
1. Jacket: One-piece molded-type fitting covers and sheet material; off-white color.
    a. Minimum Service Temperature: 0 degrees F.
    b. Maximum Service Temperature: 150 degrees F.
    c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    d. Thickness: 10 mil.
    e. Connections: Brush-on welding adhesive.
2. Covering Adhesive Mastic:
    a. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.040” sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2” laps.
4. Fittings: 0.016” thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8" wide; 0.010" thick stainless steel.

C. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
1. Thickness: 0.016".
2. Finish: Smooth.
3. Fittings: 0.010" thick die shaped fitting covers with factory attached protective liner.
4. Metal Jacket Bands: 3/8" wide; 0.010” thick stainless steel.

D. Flexible insulation blanket/pad: Filled with fiberglass insulation, encased in textile fabric and components. Blankets to be wired on, using copper wire and attached hooks. Blankets to be removable and reusable on maintenance items, such as pumps, valves, y-strainers, balance valves, etc. Lap over adjacent insulation a minimum of 3".

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards, have a copy on site for reference. Employ only skilled tradesmen specializing in this kind of work.

C. Exposed Piping: Locate seams of insulation and cover in least visible locations.

D. Insulated piping conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated piping conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding stainless steel staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent piping. Finish with PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment. Bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets with vapor barrier, factory-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding stainless steel staples. Maintain a continuous vapor barrier.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.

H. Inserts and Shields: Provided and installed by piping contractor at each hanger. Reference Section 22 00 20.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

J. Insulate all domestic cold water, copper condensate piping, rain leaders and roof drain bowls with a minimum of 1/2" insulation or as required by the Washington State Energy Code and or local codes, whichever is more stringent.

K. Piping Exposed in Finished Spaces less than 10’ above finished floor: Finish with stainless steel jacket and stainless steel fitting covers.

3.03 SCHEDULES OF THICKNESSES

A. Provide thicknesses of insulation to meet or exceed Washington State Energy Code and or local codes, whichever is more stringent.

END OF SECTION

SECTION 22 10 05
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Piping, Buried to 5' outside of Building
B. Water Piping, Above Grade
C. Flanges, Unions, and Couplings
D. Pipe Hangers and Supports
E. Ball Valves
F. Butterfly Valves
G. Thermostatic Balancing Valve
H. Swing Check Valves
I. Water Pressure Reducing Valves
J. Relief Valves
K. Solenoid Valves
L. Strainers
M. Drain Valves

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
B. Section 22 07 19 - Plumbing Piping Insulation.
C. Division 31 - Excavation, Fill, and Trenching.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; (ANSI B16.18).
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.
C. ASME B16.51 Copper and Copper Press-Connect Pressure Fittings
D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; (ANSI/ASME B31.9).
E. ASTM B32 - Standard Specification for Solder Metal.
F. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
G. ASTM B75 - Standard Specification for Seamless Copper Tube.
H. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
I. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
J. ICC LC1002 PMG Listing Criteria for Press Connection Fittings for Potable Water Tube and Radiant Heating Systems
K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
L. MSS SP-67 - Butterfly Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

M. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

N. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

O. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

Q. NSF Standard 14: Plastic Piping Components & Related Materials

R. NSF 61 & NSF 372 Drinking water system components and drinking water systems components – lead content.

S. NSF 61-G Annex G Lead Free Designation

T. All codes and standards shall be latest version as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide data on all materials, tubing, tube fittings, valves, and accessories. Provide manufacturer’s catalog information. Indicate valve data and ratings.

B. Shop Drawings: Provide drawings covering all specially-designed hanger assemblies and fabrications. Also provide drawings showing assemblies of standard manufactured hangers based upon this particular project’s requirements.

C. Project Record Documents: Record actual locations of valves, buried piping, and any other changes made to contract drawings.

D. Mechanical Contractor to submit sketches covering all hangers proposed for use on this project. Manufacturer’s data shall also be submitted.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. All domestic water piping and valves in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards, or be NSF-61-G certified to all requirements of NSF/ANSI 61 (health effects) and all requirements of Annex G and NSF/ANSI 372 (lead content) via third-party testing and certification.

D. Do not solder within 12” of valves manufactured from any bismuth alloy.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping systems from entry of foreign materials by providing temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 WATER PIPING, BURIED TO 5' OUTSIDE OF BUILDING

A. Copper Tube: ASTM B42, soft drawn, type K.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: AWS A5.8, BCuP silver braze.

2.02 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Hard Drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints:

a. ASTM B 32, lead-free solder.
b. Extracted collars approved for pipe sizes 1/2" to 2". For joints made with a T-Drill mechanical extractor, follow manufacturer's operating instructions.
c. Press-Seal Fitting, approved for pipe sizes 1/2" to 4".
    1) Manufacturers
        a) Viega,
        b) Nibco Press System
        c) Approved equal
    2) Fittings shall be manufactured with an inboard bead design having compression crimp applied on both upstream and downstream sides of EPDM elastomeric seal bead and un-pressed fitting leak identification feature. 2-1/2" thru 4" shall have a 420 stainless steel grip ring, PBT separator ring, and EPDM sealing element.
d. Mechanical Couplings: See paragraph "Flanges, Unions and Couplings"

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2" and Under:
    1. Copper tube: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size 2-1/2" and larger.
    1. Copper tube: Class 150 slip-on bronze flanges; preformed EPDM gaskets.
C. Mechanical Couplings for Grooved and Shouldered Joints
    1. Manufacturers:
        a. Victaulic
        b. Gruvlok
        c. Approved equal
    2. Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
    3. Grooved mechanical couplings. 200 psi minimum joint working pressure, cast ductile iron housing conforming with ASTM A-536. Gaskets for domestic water service, EPDM per ASTM D-2000.
    4. Grooved mechanical flange adapters shall be ductile iron (ASTM A-536), engaging directly into roll grooved copper tube and fittings and bolting directly into ANSI Class 150 steel flanged components. Gasket material similar to coupling gasket material noted above.
    5. Dimensions and Testing: In accordance with AWWA C606.
    6. Housing Material: Ductile iron conforming to ASTM A-536, grade 65-45-12.
    7. Housing Coating: Copper-colored alkyd enamel.
    8. Gasket Material: Grade EHP or EP, UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service.
    9. Bolts and Nuts: Hot dipped galvanized.
    10. When pipe is field grooved, provide coupling manufacturer's grooving tools if required by manufacturer's warranty.
D. Dielectric Connections
    1. Manufacturers:
        a. Victaulic
        b. Gruvlok
        c. Approved equal
    2. Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation. Fittings shall comply with ASTM F 492, and be listed by IAPMO. For pipe sizes 2" and less used dielectric nipples and for pipe sizes 2-1/2" and larger use dielectric flange kits. Do not use dielectric unions.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with ASME B31.9, MSS SP-58 & SP-69.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 & SP-69 recommendations, see Section 22 00 20.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Supports for roof mounted pipe, for flat roof applications, see Section 22 00 20

B. Plumbing Piping - Water:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2" to 2": Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Water Piping Sizes 2" and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Water Piping Sizes 2" and over: Carbon steel, adjustable, clevis.
5. Adjustable side beam clamps MSS-SP69-Type 25 or approved equal.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Piping Sizes 6" and over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Piping: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and or steel support.
10. Floor Support for Hot Piping: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and steel support.
11. Floor Support for Hot Piping Sizes 6” and Over: Adjustable cast iron pipe roll and stand, steel screws, and steel support.
12. Copper Tube Support: Carbon steel ring, adjustable, copper plated.
13. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded, zinc plated.
14. All hanger materials to be zinc or cadmium plated.
15. Isolate all pipe work within the first 50' of vibration isolated equipment or within the mechanical spaces, whichever is greater.
16. Provide roller hangers for all applications where thermal movement causes hanger rods to deviate more than 4 degrees from vertical or longitudinal movement exceeds 1/2". Provide protection saddles for use with roller hanger.
17. All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook and furnished by the Mechanical Contractor and shall have one coat of primer paint prior to or after installation.
18. It shall be the responsibility of the Mechanical Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard, commercially-accepted pipe hangers and accessories.

2.05 VALVES

A. Manufacturers:
1. Armstrong
2. Apollo
3. Asco
4. Acorn
5. Griswold Controls
6. Gruvlok
7. Kitz
8. Milwaukee Valve Company
9. Nexus
10. Nibco, Inc.
11. Red-White Valve Corporation
12. Stockham Valve Company
13. ThermOmegaTech
14. Tour Anderson

15. Victaulic
16. Viega, LLC
17. Watts Regulator Company
18. Zurn-Wilkins Industries
19. Approved equal

B. Ball Valves
1. 2" and Smaller:
    a. MSS SP-110, 150 psig SWP, 600 psig CWP, bronze, two-piece body, chrome-plated brass ball, full port, teflon seats and stuffing box ring, blow-out-proof stem, lever handle, with solder, threaded, or grooved ends; provide stem extension to allow operation without interfering with pipe insulation.

C. Butterfly Valves
1. 2-1/2" and Larger:
    a. MSS SP-67, 200 psi CWP, ductile iron body, aluminum bronze disc, resilient replaceable EPDM seat, lug ends, extended neck, infinite position lever handle with memory stop.
    b. Provide gear operators for valves 6" and larger.
    c. Provide chain-wheel operators for valves 6" and larger mounted over 8' above floor.
    d. Provide butterfly valve with gear operator for main building shut off.

D. Thermostatic Balancing Valve for Domestic Hot Water Systems
1. Self-acting thermostatic recirculation valve
2. Type 303 stainless steel, or lead free brass construction
3. Valve shall bypass small amount of water
4. Valve shall have integrated check valve
5. ThermOmegaTech CircuitSolver union, Acorn TZV or approved equal.

E. Swing Check Valves
1. Up to 2":
    a. MSS SP-80, Class 150, bronze body and cap, bronze swing disc with bronze seat, solder or threaded ends.

F. Water Pressure Reducing Valves
1. Single Valves
    a. Up to 2":
        1) Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends. Equal to Watts 223, lead free.
    b. 2-1/2" and larger:
        1) Bronze body, stainless steel and elastomeric diaphragm and seat disc, flanged ends. Equal to Watts N223B, lead free.
2. Combination High/Low Valves
    a. Water pressure reducing valve with integral by-pass check valve and 3/4” low flow by-pass kit.
    b. Wilkins 500XLFCBP or approved equal.
3. Range 30 to 150 psi for dead end service. Spring to act directly on valve stem. Delivery pressure shall not vary more than one psi for each 10 psi variation in inlet pressure.

G. Relief Valves
1. Pressure Relief:
    a. CSA certified to ANSI Z21.22, bronze body, teflon seat, steel stem and springs, automatic, direct-pressure actuated. Capacity ASME(BPV IV) certified and labeled.
2. Temperature and Pressure Relief:

a. CSA certified to ANSI Z21.22, bronze body, teflon seat, stainless steel stem and springs, automatic, direct-pressure actuated. Temperature relief maximum 210 degrees F. Capacity ASME (BPV IV) certified and labeled.

H. Strainers
1. Size 2" and Under:
a. Threaded bronze body for 175 psi working pressure, Y-pattern with 1/32” stainless steel perforated screen. Equal to Watts 777. Provide lead-free models where in contact with potable water.
2. Size 2-1/2" and Larger:
a. Class 125, flanged bronze or grooved ductile iron body, Y- pattern with 3/16” stainless steel perforated screen. Equal to Watts 77F-B. Provide lead-free models equal to Watts 77F-DI-FDA-125 where in contact with potable water.

I. Drain Valves
1. Provide a full-port lead free, bubble tight shutoff, ball valve with 3/4" hose connection, provide at all low points and at equipment drains. Nibco T-585-66-LF-HC or approved equal. Provide with cap.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt; protect open ends with temporary plugs or caps.

E. After completion, fill, clean and disinfect system.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Lead type solders are not allowed on the jobsite.

C. Use only water soluble paste flux designed to work with lead free solders.

D. Do not solder within 12” of valves, flanges, etc., manufactured from any bismuth alloy.

E. Provide non-conducting dielectric waterway connections wherever jointing dissimilar metals. Dielectric unions are not allowed.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain 6'-8" headroom minimum in mechanical spaces, 8’ in all other areas, conserve space, and do not interfere with use of the space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

K. Provide access where valves and fittings are not exposed, minimum size 12" x 12".

L. Install valves with stems upright or horizontal, not inverted.

M. Provide circuit balance and check valves between domestic hot water and hot water circulating branch lines on the return leg, even if not shown on the Plans. All branches are to be balanced.

N. Install water piping to ASME B31.9.

O. Copper Tube Extracted Joints may be used on copper tubing. Dimple branch connection to control insertion. Brazed joints only.

P. Tube Press Fit Joints shall be installed in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked after pressing against the mark on the tubing to assure the tubing is fully inserted into the fitting. The joints shall be pressed using only the tool approved by the manufacturer.

Q. Copper Tube Rolled Groove joints shall be installed in accordance with manufacturer's instructions.

R. Provide sleeves for pipes passing through partitions, walls and floors. Use commercially manufactured modular seals for sleeves passing through floors, below-grade walls and floor slabs below grade. Make these penetrations water-tight against ground water pressure.

S. Pipe Hangers and Supports:
1. It shall be the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard commercially-accepted pipe hangers and accessories.
2. Install in accordance with ASME B31.9 and MSS SP-89.
3. Use only adjustable side beam clamps (Type 25); standard beam clamps are not acceptable.
4. Inserts and shields are to be placed at each hanger by the piping contractor. Reference Section 22 00 20.
5. Install hangers to provide a minimum of 1/2" space between finished covering and adjacent work.
6. Place hangers within 12" of each horizontal elbow.
7. Use hangers with 1-1/2" minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
8. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
9. Where more than one piping run can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
10. Provide copper-plated hangers and supports for un-insulated copper tubing. Pipe-tight hangers are acceptable only for piping conveying fluids at ambient temperatures. All Hot Water, Hot Water Circulating, Cold Water, Heating Water, Condensing Water, and Chilled Water piping, etc., is to be insulated.
11. Provide hangers adjacent motor-driven equipment with vibration isolation.
12. Auxiliary Steel: All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook, and shall be furnished and installed by this Contractor.
13. All steel rods, hangers and brackets, shall be electro-plated. Custom fabricated steel brackets or hangers shall receive one shop coat primer paint by this Contractor.

3.03 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Provide unions downstream of valves and at equipment or apparatus connections.

C. Provide ball valves for shut-off and to isolate equipment, parts of systems, or vertical risers.

D. Provide flow controls in water recirculating systems where required or indicated.

E. Provide isolation valves with positive shutoff for domestic hot water, cold water and hot water recirculation at restrooms. Isolation valves shall be located above T-bar ceiling in area adjacent restrooms where possible. If located above a hard ceiling, provide access panel.

F. Connect hot water circulating piping to hot water piping within 24” of plumbing fixtures. Bring circulating piping down into wall as needed to meet this distance requirement.

3.04 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Inject disinfectant (free chlorine in liquid, powder, tablet or gas form) throughout system to obtain 50 to 80 mg/L residual.

C. Bleed water from outlets to ensure distribution, and test for disinfectant residual at minimum of 15% of outlets.

D. Leave disinfectant in system for 24 hours.

E. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

F. Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.

G. Take samples no sooner than 24 hours after flushing, from 10% of outlets and from water point of entry; analyze in accordance with AWWA C651.

H. Provide copies of certified test reports from the Health Department to the Owner's Commissioning Agent, Owner's representative, and General Contractor prior to occupancy.

3.05 SERVICE CONNECTIONS

A. Provide new water service complete with the following components in a Water Header as detailed on the contract drawings.
   1. Approved reduced pressure backflow preventer (RPBP); do not install bypass or add drains or vents upstream of the RPBP.
   2. Pressure reducing valve (PRV) with bypass and globe valve.
   3. Y-Strainer, to share bypass with PRV. Pipe strainer blow-off to nearest drain; provide full-port ball valve on drain.
   4. System-rated water hammer arrestors: Provide PPP SCS Series 150-pound flanged, 3" minimum size.
   5. Drain valves: Provide at low point on header.
   6. Pressure Gauges. Provide two minimum, located on each side of PRV.
   7. Provide sleeves in walls or floors for service mains. Make watertight with commercially-manufactured modular seals and pliable material. Anchor service main inside of building to concrete walls or floors.
   8. Provide Schedule 40 galvanized pipe sleeve around service main to 1" above finished floor.
   9. Zone building from header; as a minimum provide one zone for each floor and a separate zone each for science rooms and kitchen. If irrigation system is to be fed from the building system, provide a separate connection point at the header and space for a RPBP.
   10. See detail on Plans.

3.06 TESTING

A. Test Domestic Water a minimum of 100 PSI or 1-1/2 times incoming pressure whichever is greater and hold pressure for two hours, without loss of pressure. Have the test witnessed by the Commissioning Agent and the Owner's representative. If the building is phased, provide multiple tests as needed.

END OF SECTION

SECTION 22 10 06
DOMESTIC WATER PIPING SPECIALITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior Hose Bibbs

B. Non-Freeze Wall Box Hydrants

C. Refrigerator Recessed Box

D. Reduced Pressure Backflow Preventer

E. Water Hammer Arrestors

F. Trap Primers

G. Thermostatic Mixing Valves

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Domestic Water Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering.

C. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; (ANSI/ASSE 1019).

D. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute.

E. All codes and standards shall be latest version as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Instructions: Indicate manufacturer's installation instructions: Indicate assembly and support requirements.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. All Domestic Water Piping Specialties in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards, or be NSF-61-G certified to all requirements of NSF/ANSI 61 (health effects) and all requirements of Annex G and NSF/ANSI 372 (lead content) via third-party testing and certification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on-site in original factory packaging. Inspect for damage.

1.07 EXTRA MATERIALS

A. Supply for Owner's use in maintenance of project:
   1. One extra loose key for each inside and outside hose bibb and/or hydrants.

1.08 REGULATORY REQUIREMENTS

A. Conform to applicable codes for installation of backflow preventing devices.

B. Provide certificate from Authority Having Jurisdiction indicating approval of installation of backflow preventing devices.

PART 2 PRODUCTS

2.01 INTERIOR HOSE BIBBS

A. Manufacturers:
1. Chicago Faucet Company
2. Woodford Manufacturing Company
3. Acorn Engineering Company
4. Zurn
5. Approved equal

B. Interior Hose Bibbs:, ASSE 1011.
1. Recessed box-type with single service faucet.
    a. Box construction: Stainless steel, 18-gage box, 16-gage flange and door. Include cylinder lock with two (2) keys.
    b. Valve: Chrome-plated cast bronze, cartridge-operated with removable loose key wheel handle, screwdriver-operated stop, and vacuum breaker.
    c. Acorn model 8151 or approved equal for installation at non-chase wall.

C. Interior Mixing Type Hose Bibbs:
1. Recessed box-type with dual-service faucets (hot and cold).
    a. Box construction: Stainless steel, 18-gage box, 16-gage flange and door. Include cylinder lock with two (2) keys.
    b. Valve: Chrome-plated cast bronze, cartridge-operated with removable loose key wheel handle, screwdriver-operated stop, and vacuum breaker.
    c. Acorn model 8156 or approved equal for installation at non-chase wall.

2.02 NON-FREEZE HYDRANTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company
2. Woodford Industries
3. Zurn
4. Approved equal

B. Wall Hydrant, Single Temperature, ASSE 1052
1. Box-type, integral vacuum breaker, nickel-plated bronze, quarter-turn, with wall clamp and T-handle key.
    a. Jay R. Smith 5509QT OR 5509QT-R (for cored wall) or approved equal.

2.03 REFRIGERATOR ICE-MAKER OUTLET BOX

A. Box Manufacturers:
1. IPS Corporation/Guy Gray
2. Oatey
3. Sioux Chief
4. Approved equal

B. Epoxy-coated steel rough-in box, lead-free valve, hammer arrester; Guy Gray MIB, or approved equal.

C. Fire-rated box: Epoxy-coated steel rough-in box, brass valves, water hammer arresters, and intumescent pads; Guy Gray FR-12 or approved equal

2.04 REDUCED PRESSURE BACKFLOW PREVENTERS

A. Manufacturers:

1. Watts Regulator Company
2. Zurn/Wilkins Industries, Inc.
3. Approved equal

B. All reduced pressure backflow preventers shall be listed by the State of Washington Department of Health as an approved cross-connection control device.

C. Provide air-gap fitting and route drainage piping to nearest floor drain.

D. Reduced-Pressure Backflow Preventers
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating spring-loaded check valves, diaphragm-type differential pressure relief valve located between check valves, third check valve that opens under backpressure in case of diaphragm failure, non-threaded vent outlet, assembled with two ball valves (gear-operated butterfly valves on 2-1/2" and larger), and four test cocks.
   a. Watts 957QT - Silver Eagle or approved equal.
2. Gate valves to be bronze, or substituted with butterfly valves.

E. Reduced Pressure Zone Assembly
1. A Reduced Pressure Zone Assembly shall be installed at each potential health hazard location to prevent backflow due to back-siphonage and/ or back-pressure.
2. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts. Body and shutoffs shall be constructed using Lead Free* cast copper silicon alloy materials. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks, and an air gap drain fitting.
3. Lead Free* reduced pressure zone assembly shall comply with state codes and standards requiring reduced lead content. The assembly shall meet the requirements of: USC; ASSE Standard 1013 and AWWA Standard C511; CSA B64.4.
   a. Watts Series LF009 or approved equal.

2.05 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company
2. Precision Plumbing Products
3. Zurn Industries, Inc.
4. Approved equal

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows-type, sized in accordance with PDI-WH 201.
2. Precharged, suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.06 TRAP PRIMERS

A. Manufacturers:
1. Precision Plumbing Products, Inc.
2. Jay R Smith
3. Approved equal

B. General
1. Provide ball valve shut-off at each trap primer.
2. Provide an access panel large enough to remove and replace trap primer assembly; panel minimum size is 12" x 12".

C. Provide non-electronic trap primers for all traps where electronic trap primers have not been provided on plans.

D. Trap Primer for Individual Drains: Provide Prime-Rite PR-500 automatic trap primer for each floor drain and funnel floor drain. Primers shall be concealed, located in pipe space or wall cavities. Installation shall be per manufacturer's installation instructions. Provide where electronic trap primers have not been provided.

E. Trap Primer for Multiple Drains: In addition to the trap primer specified above, add Prime-Rite primer valve DU-2, DU-3, or DU-4 distribution unit. A maximum of 4 floor drains may be fed off of one trap primer valve. Install additional trap primer valves as needed.

F. Electronic Trap Primer for one to four drains: Provide a PPP MPB-500 Mini-Primer with distribution unit, 120v, with electronic controller, 1/2" inlet, integral vacuum breaker and flush mount cabinet with prime coat or stainless steel access door as needed.

G. Electronic Trap Primer for four to thirty drains: Provide a PPP PT-*, Prime Time, 120v, with 24 hour clock, 3/4" inlet. integral vacuum breaker and flush mount cabinet with prime coated, stainless steel, or fire rated prime coated access door, as needed. * in model number indicates number of manifold openings.

2.07 THERMOSTATIC MIXING VALVES

A. Manufacturers:
1. Powers
2. Leonard Valve Company
3. Bradley
4. Lawler
5. Acorn
6. Approved equal

B. Thermostatic Mixing Valves:
1. Valve: Cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Valve to have cold water bypass in case of valve failure or loss of hot water. Valve to be Certified lead free. ASSE 1017.
2. Capacity: See schedule.
3. Accessories:
   a. Stem thermometer on outlet.
   b. Strainer stop checks on inlets.
4. Cabinet: 16 gage stainless steel, for recessed mounting with keyed lock.

C. Individual Lavatory Mixing Valve
1. ASSE 1016, bronze body with corrosion-resistant internal parts, 1/2" NPT. Includes integral checks with screens and thermal actuator to compensate for inlet temperature fluctuations. Valve to be factory set at 105 degrees F. Install under individual lavatories to mix and adjust hot water temperature. Each tempering valve shall serve an individual lavatory or sink. Valve to be Certified Lead Free.
2. Piping connections are to be made so as to permit proper operation of integral check valves.
3. Equal to Powers LFe480.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur, as required or as shown on the Plans.

C. Pipe drain from reduced pressure backflow preventer to nearest drain, utilizing an air gap fitting.

D. Provide individual mixing valves under the counter for all lavatories.

E. The Mechanical Contractor shall be responsible for providing trap primers, water to trap primers and running primer lines to the drains. Trap primer layout shall be by contractor. Verify location of trap primers with Owner's representative before installing. ALL floor drains, trench drains, and

floor sinks, including showers, are to have primers. Show trap primer locations on Record Drawings.

F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, washing machine outlets, etc. for fixtures equipped with quick-closing valves. Install on cold water supply for any fixtures with flush valves. Install behind access panel for future maintenance; minimum panel size 12" x 12".

G. Provide access panels for all concealed valves in walls or above hard ceiling.

END OF SECTION

SECTION 22 13 16
SANITARY WASTE, VENT, AND STORM PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, and connections for piping systems

B. Sanitary Sewer Piping, Buried to 5' Outside of Building

C. Sanitary Sewer/Vent piping, Above Grade

D. Storm Water Piping, Buried to 5' Outside of Building

E. Storm Water Piping, Above Ground

F. Flanges, Unions, and Couplings

G. Pipe Hangers and Supports

1.02 RELATED SECTIONS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 22 07 19 - Plumbing Piping Insulation.

C. Division 31 - Excavation, Fill, Trenching.

1.03 REFERENCES

A. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; (ANSI/ASME B31.9).

B. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

C. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

D. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute.

E. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute.

F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

G. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

H. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

I. ASTM F 1668 Procedures for Buried Plastic Pipe

J. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information. Indicate valve data and ratings.

B. Provide sketches covering all specially designed hanger assemblies and fabrications. Also provide sketches showing assemblies of standard manufactured hangers based on this particular project’s requirements.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept products on-site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AB&I

B. Charlotte

C. Tyler

D. Approved equal

2.02 SANITARY SEWER/STORM PIPING, BURIED TO 5' OUTSIDE OF BUILDING

A. Cast Iron Pipe: CISPI 301 and ASTM A888, hubless.
   1. Fittings: Iron.
   2. Joints: Heavy-duty shielded, stainless steel couplings, with stainless steel shield, stainless steel bands and tightening devices and ASTM C56A rubber sleeve.
      a. Manufacturers
         1) Clamp-All Hi -Torq 125
         2) Husky SD 4000
         3) Approved equal; must be listed for underground application.
   3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute

B. PVC Schedule 40 solid wall DMV
   1. Pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665.
   2. Fabricated PVC DWV fittings shall conform to ASTM F 1866.
   3. All pipe and fittings are to be produced by a single manufacturer and to be installed in accordance with manufacturer’s recommendations and local code requirements.
   4. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564.
   5. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products or other aggressive chemical agents not compatible with PVC compounds.
   6. The system shall be hydrostatically tested after installation.
   7. Pipe and fittings shall conform to NSF International Standard 14.

2.03 SANITARY SEWER/STORM PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301 and ASTM A888, hubless.
   1. Fittings: Iron.
   2. Joints: CISPI 310, neoprene gasket or stainless steel clamp and shield assemblies conforming to ASTM C1277.
      a. Manufacturers
         1) Clamp-All Hi-Torq 125
         2) Husky SD 4000
         3) Or Approved Equal.
   3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute, and be listed by NSF International.

2.04 VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301 and ASTM A888, hubless.
   1. Fittings: Iron.
   2. Joints: CISPI 310, neoprene gasket or stainless steel clamp and shield assemblies conforming to ASTM C1277.
      a. Manufacturers
         1) Clamp-All Hi-Torq 125
         2) Husky SD 4000
         3) Or Approved Equal.
   3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute, and be listed by NSF International.

B. PVC Schedule 40 solid wall DMV
   1. Pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665.
   2. Fabricated PVC DWV fittings shall conform to ASTM F 1866.
   3. All pipe and fittings are to be produced by a single manufacturer and to be installed in accordance with manufacturer’s recommendations and local code requirements.
   4. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564.
   5. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products or other aggressive chemical agents not compatible with PVC compounds.
   6. The system shall be hydrostatically tested after installation.
   7. Pipe and fittings shall conform to NSF International Standard 14.

2.05 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2” to 1-1/2”: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2” and Over: Carbon steel, adjustable, clevis.
   4. Adjustable side beam clamps MSS-SP69-Type 25 or approved equal.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Vertical Support: Steel riser clamp.
   7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Keep open ends of pipe free from scale and dirt, protect open ends with temporary plugs or caps.

D. After completion, fill, clean and flush system.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain 6'-8" minimum headroom in mechanical spaces, 8’ in all other spaces, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, or joints.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; All pipe shall be flashed, flashing shall extend to at least 10" in all directions from pipe and run at least 12" above roof around pipe. Each pipe shall be counter-flashed or turned down inside of pipe. Vent flashing shall be made watertight. Two-piece flashings are not acceptable.

H. Pipe Hangers and Supports:
   1. It shall be the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard commercially-accepted pipe hangers and accessories.
   2. Use only adjustable side beam clamps (Type 25), standard beam clamps are not acceptable.
   3. Inserts: Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. The insert is to consist of either hydrous calcium silicate or polyisocyanurate foam insulation (urethane) encircling the entire circumference of the pipe, with a 360-degree PVC (1/16” thick) or galvanized steel jacket (20 gauge minimum). Inserts are to be installed on piping during piping installation, by the piping contractor. Provide continuous insulation vapor barrier. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
   4. Install hangers to provide a minimum of 1/2” space between finished covering and adjacent work.
   5. Place hangers within 12” of each horizontal elbow.
   6. Use hangers with 1-1/2” minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   7. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   9. Provide hangers adjacent to motor driven equipment with vibration isolation.
   10. Support cast iron drainage piping at every joint.
   11. Auxiliary Steel: All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook, and furnished and installed by this Contractor.
   12. All steel rods, hangers and brackets, shall be electro-plated. Custom-fabricated steel brackets or hangers shall receive one shop coat of primer paint by this Contractor.

I. Indirect drain piping shall terminate two (2) pipe diameters above the flood rim of the receptor and shall be cut at a 45 degree angle.

J. Installation of Plastic Piping:
   1. Install per Uniform Plumbing Code, including Installation Standards IAPMO IS 1-2006 and IS-5-2006. Provide trench width of the pipe O.D. plus 16”or pipe O.D. times 1.25 plus 12”. Compact backfill in 6” maximum layers, by hand, as required by ASTM D2321.Support horizontally at every 4’, and provide mid-story guides to maintain alignment of vertical piping. Provide supports at base.
   2. Allow for expansion every 30’ horizontally and vertically.

3.03 ERECTION TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2” vertically of location indicated and slope to drain at minimum of 1/4” per foot slope.

3.04 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide sleeves in walls or floors for service mains. Caulk enlarged sleeve and make watertight with modular seals and pliable material. Anchor service main inside to concrete walls or floors.

C. Sleeves around service mains to be Schedule 40 galvanized pipe to 1" above finished floor.

3.05 TESTING

1. Test the Drainage Systems as required by local Authority Having Jurisdiction.

END OF SECTION

SECTION 22 13 19
SANITARY AND STORM PIPING SPECIALITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor Drains

B. Cleanouts

C. Vandal-Proof Hooded Vent Caps

1.02 RELATED SECTIONS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

D. Division 31 - Excavation, Fill, and Trenching.

1.03 REFERENCES

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.

B. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

C. Operation Data: Indicate frequency of treatment required for interceptors.

D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Light commercial drains and cleanouts are not acceptable. If found on this project they will be removed and replaced by the Mechanical Contractor, at no cost to the Owner.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturers:
   1. Jay R. Smith
   2. Wade, Inc.
   3. Zurn Industries, Inc.
   4. Josam
   5. Mifab
   6. Sioux Chief
   7. Approved equal.

B. Floor Drain (FD):
   1. ASME A112.6.3; galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, trap primer connection, vandal-proof screws, and round, adjustable nickel-bronze strainer.

C. Floor Sink (FS):

1. All stainless steel body 16 gauge 304 SS, seepage flange, flashing clamp, and vandal-proof screws, dome strainer, and trap primer connection. Size 12" x 12" x 8"deep. Equal to Jay R Smith 3003/Zurn Z1751.
2. Grate:
    a. 1/2 Grate

2.02 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith
2. Zurn Industries, Inc.
3. Wade, Inc.
4. Mifab
5. Josam
6. Sioux Chief
7. Approved equal.

B. Cleanouts at Exterior Surfaced Areas (SCO):
1. Round cast nickel bronze access frame and non-skid cover, marked “CO”.

C. Cleanouts at Exterior Unsurfaced Areas (SCO):
1. Same as above except with 18" x 18" x 4" concrete pad around cleanout.

D. Cleanouts at Interior Finished Floor Areas (FCO):
1. Lacquered cast iron body with anchor flange, threaded top assembly, and round scoriated secured nickel bronze cover in a round depressed frame, with ABS tapered threaded plug.
2. Cleanouts at Interior Finished Floor Areas for Carpeted Floors:
    a. Where cleanout is installed in carpeted areas, provide nickel bronze carpet clamp frame.
    b. MC to coordinate carpet clamp rings or correct after carpet installation.
3. Cleanouts at Interior Finished Floor Areas for Tile Floors:
    a. Where cleanout is installed in tiled areas, provide nickel bronze top with 1/8" tile recess cover; obtain tile piece to insert into cover.

E. Cleanouts at Interior Finished Wall Areas (WCO):
1. Line type with lacquered cast iron body and ABS tapered thread plug, and round smooth stainless steel access cover secured with stainless steel machine screws.

F. Cleanouts at Interior Unfinished Accessible Areas (CO): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

G. Provide cleanouts at each pair of 45-degree elbows. At each 90-degree turn, and at each 50’ of straight run.

H. Cleanouts shall be line size up to and including 3” piping, and 4” for piping 4” and larger.

2.03 VANDAL-PROOF HOODED VENT CAPS

A. Manufacturers:
1. Jay R. Smith
2. Zurn Industries, Inc.
3. Wade, Inc.
4. Josam
5. Mifab
6. Approved equal.

B. Provide vandal proof vent caps on all vents passing through the roof. Vent caps to be lacquered cast iron body and dome. All units to be secured with fasteners internal to the units. Vent caps do not need flashing sleeves unless roofing membrane extends up vent.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. MC to coordinate the height of floor drains with the GC.

C. Provide cleanouts under all sinks. Note that these are not shown on the drawings for clarity.

D. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.

E. Ensure adequate clearance at Floor Cleanouts and Floor Drains for rodding of drainage system; 18” minimum required. Do not install Floor Cleanouts or Floor Drains directly under toilet partitions.

F. Encase exterior cleanouts in concrete flush with grade.

G. Install floor cleanouts at elevation to accommodate finished floor. Mechanical Contractor to coordinate with floor finisher for a smooth finished floor.

H. Provide traps and trap primers for all drains (floor drains, floor sinks, etc.)

I. Provide two-way cleanout at junction of building drain and building exterior sewer. Provide concrete pad around cleanout; see contract drawing details.

J. All downspouts shall be furnished and installed by the General Contractor.

END OF SECTION

SECTION 22 15 00
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and Pipe Fittings
B. Valves
C. Unions and Couplings
D. Compressor
E. Aftercooler
F. Air Dryer
G. Air Receiver
H. Accessories

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment:
B. Division 31 - Excavation, Trenching, Fill

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.
B. ASME (BPV) - Boiler and Pressure Vessel Code; The American Society of Mechanical Engineers.
C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers;.
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; (ANSI B16.18).
E. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.
F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers.
G. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).
H. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; (ANSI/ASME B31.9).
I. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
J. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
K. ASTM B32 - Standard Specification for Solder Metal.
L. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
M. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
O. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

P. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Pressure Vessels: Conform to applicable code for installation of pressure vessels.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors, refrigerated air dryer on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Copper Tube: ASTM B 88, Type L (B), drawn.(above floor)
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B 32, solder, Lead Free Solder.

2.02 VALVES

A. Ball Valves:(up to and including 2")
1. Manufacturers:
   a. Nibco, Inc.
   b. Milwaukee Valve Company
   c. Stockham Valve Company
   d. Approved equal
2. MSS SP-110, Class 150, 600 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends.

B. Swing Check Valves:(up to and including 2")
1. Manufacturers:
   a. Nibco, Inc.
   b. Milwaukee Valve Company
   c. Stockham Valve Company
   d. Approved equal
2. MSS SP-80, Class 150, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.

C. Air Outlets:
1. Manufacturers:
   a. Snap-Tite, Inc.
   b. Approved equal
2. Quick Connector: 3/8" brass, snap on connectors with self-closing valve. Contractor to conform to Owner's quick connection standard and equal.

2.03 UNIONS AND COUPLINGS

A. Unions:

1. Ferrous Pipe: 150 psi galvanized malleable iron, ground joint, threaded unions.
2. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

B. Dielectric Connections:
1. Manufacturers
   a. Victaulic
   b. Gruvlock
   c. Approved equal
2. Dielectric waterway nipple.

C. Flexible Pipe Connector: See Section 22 05 16.

2.04 COMPRESSOR

A. Manufacturers:
1. Gardner Denver, Inc. (Champion)
2. Ingersoll-Rand Air Solutions
3. Approved equal.

B. Type: Simplex compressor unit consisting of air cooled compressor, air receiver, after cooler, and refrigerated air dryer, see schedule.

C. Reciprocating Two Stage Compressors:
1. Unit: Compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves, on cast iron or welded steel base for motor and compressor with provision for V-belt adjustment, see schedule.
2. Automatic Capacity Reduction Equipment: Suction valve unloader with lifting mechanism operated by oil pressure. Provide for unloaded compressor start.
3. Motor: Constant speed 1800 rpm with electronic overheating protection in each phase, full voltage starting.
4. Controls:
   a. Control Panel: Factory wired, steel, containing power and control wiring, molded case disconnect switch, factory wired for single point power connection.
   b. Starter: Full with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
   c. Safety Controls: Manually reset low oil pressure cutout.
   d. Panel Face: Compressor run light, start-stop switch, elapsed time meter.
   e. Pressure Gages: Furnish on air receiver, discharge air, compressor air temperature.

D. Capacity: See schedule.

E. Electrical Characteristics: See schedule.

F. Motor: Refer to Section 22 05 13.

G. Controls:
1. Pressure Switch: Line voltage contactor to break at 100 psi with minimum differential of 20 psi.

H. Disconnect Switch: Factory mount disconnect switch in control panel.

2.05 AFTERCOOLER

A. Manufacturers:
1. Gardner Denver, Inc. (Champion)
2. Ingersoll-Rand Air Solutions
3. Approved equal

B. Construction: Removable tube nests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gage, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

C. Working Pressure: 135 psi.

D. Discharge: Cool air to within 12 degrees F of ambient air temperature at specified flow capacity.

E. Capacity: See schedule.

F. Controls: Unit to include automatic start and stop operation with NEMA-1 pressure switch. Low oil level shut down with NEMA-1 switch.

2.06 AIR DRYER

A. Manufacturers:
1. Gardner Denver, Inc. (Champion)
2. Ingersoll-Rand Air Solutions
3. Approved equal

B. Type: Self-contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Air to air and refrigerant to air coils. Provide heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage, air outlet temperature gage, air outlet pressure gage.

H. Capacity: See schedule.

I. Electrical Characteristics: See schedule.

J. Disconnect Switch: Factory mount disconnect switch in control panel.

2.07 ACCESSORIES

A. Pressure Reducing Valve
1. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage. Provide oil separator where indicated. Brass body, adjustable spring.
2. Valve Capacity: Reduce pressure from 300 psi to 30 psi, adjustable upwards from reduced pressure.
3. Usage: At compressor location

B. Filters
1. Full flow inlet.
2. Differential pressure indicator and internal float
3. Self-cleaning screened drain.
4. Install where shown on drawings.
5. Ingersoll-Rand, 1” model FA190l (110 CFM) or approved equal.
6. Usage: At compressor location

C. Lubricators
1. Arrow or approved equal, general purpose lubricator
2. 1/2" port size, aluminum body, zinc bowl with sight glass, model L376W.
3. 1" port size, aluminum body, steel bowl, with sight glass, model 4108.
4. Install where shown on drawings.

D. Auto Condensate Trap
1. Timer controlled automatic condensate drain controllable from the front panel of the dryer.

E. Auto Tank Drain

1. Armstrong Model 1-LDC, or approved equal, with 1/2" inlet and outlet connections, stainless steel ball float mechanism, and polysulfone body.

F. Filter/Silencer
1. Maximum 10 micron filter
2. Provide with pressure indicator, to indicate when element is clogging.
3. Furnish with auto drain
4. Usage: At compressor location

G. General Purpose combination pressure regulator, filter, oiler
1. Speedaire or equal
2. 5-150psi adjustability, with indicating gauge
3. Polycarbonate bowl with guard
4. 5 micron filter
5. ¼”, ½”, or ¾” per drawings models #7D687, #7D732, #7D734
6. Usage: End use at compressed air outlets

H. General Purpose combination pressure regulator/filter
1. Parker or equal
2. 5-125psi adjustability, with indicating gauge
3. Zinc bowl
4. 5 micron filter
5. ¼”, ½”, or ¾” per drawings models #06E14B18AC, #06E34B18AC, #07E44B18AC
6. Usage: End use at compressed air outlets

PART 3 EXECUTION

3.01 INSTALLATION

A. Contractor to furnish and install a complete compressed air piping system as shown on the Plans and as hereinafter specified.

B. Install equipment in accordance with manufacturer's instructions.

C. Install compressor unit on concrete housekeeping pad.

D. Install compressor unit on vibration isolators. Level and bolt in place.

E. Install line size ball valve and check valve on compressor discharge.

F. Place shut off valve on water inlet to after-cooler. Pipe drain to floor drain.

G. Direct condensate drains to nearest floor drain. Terminate with piping cut at 45 degree angle.

H. Install valved bypass around air dryer.

I. Factory insulate inlet and outlet connections.

J. Install valved drip connections at low points of piping system.

K. Install takeoffs to outlets from top of main, with shut off valve after takeoff. Slope takeoff piping to outlets.

L. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.

M. All air piping to system shall be sloped as shown on Plans at a minimum rate of 1/8"/ft. Provide manual drain valves at ow points.

N. Identify piping system and components. Refer to Section 22 05 53.

3.02 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

B. All air piping shall be subjected to a pressure test of 200 psi with cylinder nitrogen for a period of two-hours without a loss of pressure. Test to be witnessed by the Owner’s representative and Commissioning Agent.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

3.03 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing unit.

B. Prepare a manufacturer’s startup report; turn over to the Owner’s representative and Commissioning Agent.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial Electric Water Heater

B. Water Heater Drain Pan

C. Diaphragm-Type Compression Tank

D. In-Line Circulator Pump

E. Elevator Sump Pump

F. Submersible Sewage Ejector

1.02 RELATED REQUIREMENTS

A. Division 31 - Excavation, Trenching, Fill

1.03 REFERENCE STANDARDS

A. ASME CODE (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

B. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.

C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.

D. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

C. All Domestic Water Piping Equipment in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards, or be NSF-61-G certified to all requirements of NSF/ANSI 61 (health effects) and all requirements of Annex G and NSF/ANSI 372 (lead content) via third-party testing and certification.

D. Provide Thermostatic Mixing Valves at each water heater or as shown on Plans. See detail on Plans.

1.06 CERTIFICATIONS

A. All water heaters shall meet the requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.1-1999 and be so labeled. Controls shall

not allow water temperature to exceed 210 degrees F. Water heaters shall comply with all provisions of the Washington State Energy Code.

B. Water Heaters and Domestic Water Expansion Tanks shall be NSF approved.

C. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453 and ASME CODE labeled to ASME CODE (BPV VIII, 1).

D. Pressure Vessels for Heat Exchangers: ASME CODE labeled, to ASME CODE (BPV VIII, 1).

E. Water Storage Tanks: ASME CODE labeled, to ASME CODE (BPV VIII, 1).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Provide five (5) year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co

B. State Water Heaters

C. Lochinvar

D. Approved equal

2.02 COMMERCIAL ELECTRIC WATER HEATERS

A. Type: Factory-assembled and wired, electric, vertical storage.

B. Performance: See Schedule on Plans.

C. Maximum working pressure: 150 psig.

D. Electrical Characteristics: See Schedule on Plans.

E. Tank: Glass lined welded steel, ASME rated, with 4” diameter inspection port, thermally insulated with minimum 2” insulation, encased in corrosion-resistant steel jacket with baked-on enamel finish.

F. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nickel chrome elements, high temperature limit thermostat.

G. Water heaters shall be grid enabled and capable of demand response.

H. Provide with the following accessories:
1. Temperature and Pressure Relief Valve: ASME rated.

2.03 CERTIFICATIONS

A. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gages.

B. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with corrosion-resistant metal alloy, rated less than 75 watts per square inch.

2.04 WATER HEATER DRAIN PAN

A. Provide drain pan under all water heaters, constructed of welded, 18 gage stainless steel. Pan to be rectangular, 6" larger minimum each direction than the tank, 4" deep with top edge hemmed over for safety and strength. Pan is to be large enough to encompass the circulation pump and expansion tank when water heater is located on the second floor or higher.

B. Provide a pan drain connection, located as close to the bottom of the pan as possible. Provide sloped drain piping to nearest floor drain, floor sink, or as shown on Plans.

2.05 DIAPHRAGM-TYPE DOMESTIC WATER COMPRESSION/EXPANSION TANK

A. Manufacturers:
   1. Amtrol Inc.
   2. Armstrong
   3. ITT Bell & Gossett
   4. Taco, Inc.
   5. Approved equal.

B. Construction: Welded steel, rated for working pressure of 150 psig, with flexible EPDM or butyl rubber diaphragm sealed into tank, and steel legs or saddles. Tank shall be suitable for Potable Water Systems.

C. The tank shall be constructed, tested and stamped in accordance with Section VII, Division 1 of the ASME Code. All welds to conform to ASME Section IX.

D. The water connection shall be 304L Stainless Steel with a circulation device inserted to encourage reduction of stagnant water within the tank water chamber.

E. The internal water chamber shall include a molded polypropylene liner with a silver-ion based antimicrobial compound; tested to Standard JIS Z 2801 for efficacy in the reduction of Legionella (L. pneumophila). Staphylococcus (S. aureus) and Coliform (E. coli) bacteria on its surface

F. Tanks shall carry NSF Standard 61 and IAPMO Lead-Free listings.

G. Accessories: Pressure gage and air-charging fitting, tank drain.

H. Precharge to 50 psig.

I. Thermal expansion tank size shall be as shown on Schedule on Plans.

2.06 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Pumps Inc.
   2. ITT Bell & Gossett
   3. Grundfos
   4. Taco, Inc.
   5. Approved equal.

B. Construction
   1. Pump Body: Certified Lead-Free Bronze or stainless steel
   2. Impeller: Poly-phenylene Sulfide or Bronze
   3. Shaft: AISI 420 Stainless Steel
   4. Bearing: Carbon Sleeve
   5. Gasket/O-Ring: EPDM
   6. All Other Wetted Parts: AISI 304 Stainless Steel
   7. Motor Type: Electronically Commutated Motor
   8. Motor Insulation Class: F

C. Standard control modes
   1. Proportional pressure control
   2. Constant pressure control
   3. Manual set constant speed.
   4. Night mode
   5. Set Point Temperature control
   6. Advanced settings can be managed from a PC, tablet or smartphone, and are accessible via optional built-in Wi-Fi or Ethernet cable.
   7. Multiple inputs including start-stop, temperature control, pressure regulation and advanced Modbus or BACnet control provide dynamic system management.
   8. An external temperature probe can be added for more advanced Delta T control.

D. Performance: See Schedule on Plans.

2.07 ELEVATOR SUMP PUMP SYSTEM

1. Manufacturers:
   a. Stancor Oil Minder SE
   b. Approved equal.

B. Description: Submersible type pump with control panel, oil switch and liquid sensor. Compliant with ASME A17.1 Elevator Code.

C. Pump:
1. Casing: One piece cast iron volute type.
2. Impeller: Cast iron, semi open, non clog type, dynamically balanced.
3. Shaft Seal: Mechanical with silicon carbide seal lower seal and carbon ceramic upper seal faces. 300 series stainless steel metal parts, BUNA N elastomers.
4. Bearings: Upper and lower ball bearings.
5. Motor: Fully submerged type with Class E insulation. Corrosion resistant, stainless steel shaft. Built in overload with automatic restart. UL 778.
6. Power Cord: Severe duty rated, oil and water resistant. Epoxy seal on motor end. NEMA 3 prog grounding plug for motors 1 HP and smaller and bare lead cord ends for pumps 1 1/2 HP and larger. UL approved cable. Power to the pump to be supplied through the control panel to eliminate the need to have an outlet in the pit. Length to suit installation of system components. Contractor to verify routing for wire length prior to ordering of pump.
7. Sump: The system - including pumps 1 HP and smaller, oil probe and floats – shall fit within a 24” x 24” x 24” sump.

D. Control Panel: NEMA 4X corrosion resistant polycarbonate enclosure with hinged door. Control panel shall be factory wired (pump, oil probe and floats). The control panel shall have a warning horn with illuminated red light and alarm silencing switch. Control panel shall include self-test button that exercises the system and ensures proper installation by running pump and sounding audible alarm when activated. Include output connection for high water annunciation to Direct Digital Control (DDC) system.

E. Pump Control Float: Include factory mounted Pump On and Pump Off floats. UL 508.

F. Oil Sensor: Solid state, low voltage sensing device that differentiates between oil and water. Sensor shall be factory mounted and include self-cleaning functionality to ensure contaminants from oil exposure will not impair sensor performance. Optical sensing systems are subject of contamination and are not considered equal. System shall continue to pump out water down to the oil level. System shall not pump oil into the piping system.

PART 3 EXECUTION

3.01 INSTALLATION

A. A separate switch shall be provided to permit turning off the energy supplied to electric service water heating systems.

B. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

C. Anchor and/or strap water heaters to resist displacement due to earthquake motion. Contractor to determine extent of bracing required, based on actual location and adjoining equipment and/or piping.

3.02 SYSTEM STARTUP

A. Provide the services of a manufacturer's field representative for starting and testing equipment.

B. Prepare a manufacturer’s startup report and submit to the Owner’s representative and Commissioning Agent.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plumbing Fixtures.

B. Fixture Carriers.

C. Faucets and Trim.

D. Emergency Fixtures.

E. Water Efficiency Standards

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Domestic Water Piping.

B. Section 22 10 06 - Domestic Water Piping Specialties

C. Section 22 13 16 - Sanitary Waste, Vent Piping, and Storm Piping

D. Section 22 13 19 - Sanitary and Storm Piping Specialties

E. Section 22 30 00 - Plumbing Equipment

1.03 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.

B. ASHRAE Standard 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.

C. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute.

D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers.

E. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers.

F. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers.

G. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers.

H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers.

I. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers.

J. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers.

K. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. All Plumbing Fixtures in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards, or be NSF-61-G certified to all requirements of NSF/ANSI 61 (health effects) and all requirements of Annex G and NSF/ANSI 372 (lead content) via third-party testing and certification.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

A. Manufacturers: The following manufacturers' products are approved. Select products and provide submittals to suit specific requirements of Specifications and Plans.
1. Acorn
2. American Standard
3. Aquatic
4. Beneke
5. Brasscraft
6. Brocar Products, Inc.
7. Chicago Faucets
8. Delaney
9. Eastman
10. Eljer
11. Elkay
12. Fiat
13. Guy Gray/IPS
14. Halsey Taylor
15. Haws
16. Jay R. Smith
17. Josam
18. Just
19. Kohler
20. McGuire
21. Mifab
22. Precision Plumbing Products
23. Sloan
24. Truebro, Inc.
25. Wade
26. Watts
27. Zurn
28. Approved equal

B. Fixtures are specified in the plumbing fixture schedule, followed by the catalog designation of the listed manufacturers. Similar fixtures of equal quality and type from manufacturers listed above are acceptable alternates subject to final approval.

C. Fixtures shall be new, free from flaws and blemishes with bright, smooth surface. All vitreous ware shall be non-absorbent, even color, unwrapped, two-fired china. Enameled ironware shall be acid resisting porcelain enameled cast-iron.

D. Water closet seats shall be open front, less cover, with concealed stainless steel, self-sustaining check hinge and shall be sized to fit bowl size of water closet specified.

E. Fixtures shall be white unless noted otherwise.

F. All handicapped-accessible plumbing fixtures shall comply with the American With Disabilities Act (ADA) standards and procedures latest effective date. This Contractor shall verify these requirements with each manufacturer specified or acceptable alternate prior to the submittal process. All handicapped lavatories and sinks shall be provided with offset-type tailpieces.

G. Handicapped-accessible sinks shall meet the size requirement below and shall comply with the American With Disabilities Act (ADA) standards and procedures latest effective date. The depth of the sinks shall be no more than 6-1/2", the front to back shall be no more than 19-1/2", the left to right dimension may vary. See the Plumbing Fixture Schedule on the drawings. If the scheduled sink is greater than the dimensions listed above, the MC shall coordinate the larger sink sizes with the Owner's representative and GC prior to ordering.

H. All Plumbing Fixtures in contact with potable water shall be certified lead free (less than 1/4 of 1%). Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards via third-party testing and certification.

I. Flush control for manual handicapped water closets shall be mounted for use from wide side of the water closet area.

J. P-traps: P-traps shall be chrome-plated cast brass body with cleanout, 17 gauge seamless tubular wall bend with cast brass slip nuts. Trap shall be certified by CSA or other recognized testing authority. P-trap shall bear manufacturer and testing mark. P-traps shall be McGuire, Eastman, or approved equal.

K. Plumbing Fixture Schedule: See Schedule on Plans.

2.02 FIXTURE CARRIERS

A. Manufacturers
1. Jay R. Smith
2. Josam
3. Mifab
4. Wade
5. Watts
6. Zurn
7. Approved equal

B. Provide carrier types noted for the plumbing fixtures listed. Check and verify plumbing chase requirements with Plans. Provide back-to-back carriers where back-to-back fixtures are shown. Where floor mount carriers are called for, anchor foot assembly to floor per manufacturer's written instructions. Floor-mounted single water closet carriers shall be back-bolted to the floor with two bolts via factory-provided bracket. Loose carriers will require re-working at the Mechanical Contractor's expense.
1. Water Closet: Adjustable horizontal above floor or compact vertical carriers. Carrier shall be rated for 500 pounds. See plans and riser diagram for type of carrier required. Equal to Zurn Z1203-ND4, Z1203-N4, Z1204-ND4, Z1204-N4.
2. Urinals: Floor mounted with bearing plate.
3. Lavatories: Floor mounted with concealed arm carriers or exposed arm carriers, see schedule.
4. Drinking Fountain/Water Coolers: Floor mounted with bearing plate.

2.03 FAUCETS AND TRIM

A. Manufacturers
1. Elkay
2. Delta
3. Chicago Faucets

4. T&S Brass
5. McGuire
6. Brasscraft
7. Approved equal

B. Faucets and other trim shall be as listed in the Plumbing Fixture Schedule Similar faucets and other trim of equal quality and type from manufacturers listed above are acceptable alternates subject to final approval..

C. Provide all plumbing fixtures complete with all fittings, stops, risers, accessories, connections to waste, hot and cold water and /or flush connection as required to make each individual "P" unit pursuant to Plans a completely finished and working plumbing fixture. On retrofit projects, the water stops shall be replaced with new.

D. All trim and exposed piping shall be chrome-plated brass. Supplies, wastes and traps in cabinets or under counters shall be considered exposed to view.

E. All faucets shall have ADA-acceptable handles, even if the fixtures are not designated as ADA.

F. Piping for flush valves shall be anchored to prevent movement in the wall. Products such as Holdrite 114-C shall be acceptable for use with water closets.

G. Bubblers provided at sinks shall be provided with separate supply stops and risers.

H. Any product designed for dispensing potable water must meet both the NSF 61 and NSF 372 test standards via third-party testing and certification.

I. Provide insulation on exposed hot water supply, cold water supply and waste piping to ADA lavatory and ADA sink fixtures. Provide ADA pipe wrap for hot/cold/hot water recirculation/waste piping, on all exposed piping below any (ADA and non-ADA) lavatories and sinks.
1. Manufacturers
    a. Brocar Products, Inc.- Trap Wrap
    b. Truebro, Inc. - Handi-Lav-Guard
    c. McGuire - ProWrap
    d. Zurn ADA Products
    e. Approved equal.

2.04 EMERGENCY FIXTURES

A. Manufacturers:
1. Haws Corporation
2. Guardian Equipment
3. Speakman
4. Bradley
5. Acorn
6. Approved equal

B. Fixtures are specified in the plumbing fixture schedule followed by the catalog designation of the listed manufacturers. Similar fixtures of equal quality and type from manufacturers listed above are acceptable alternates subject to final approval.

C. Provide all emergency fixtures with testing tag, and identification sign.

D. Emergency Eye And Face Wash - Wall Mounted
1. Comply with ANSI Z358.1
2. Wall-mounted, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray, stainless steel dust cover, copper alloy control valve and fittings.
3. Provide thermostatic mixing valve with each emergency eye and face wash unit. Set the temperature between 70 and 90 degrees F. See Mixing Valve schedule on Plans.

E. Equipment is specified in the Plumbing Fixture Schedule followed by the catalog designation of the listed manufacturer. Similar fixtures of equal quality and type manufactured by the manufacturers listed for the items above are acceptable alternates.

2.05 WATER EFFICIENCY STANDARDS

A. All plumbing fixture water usage flow rates shall be in full compliance with the latest Washington State amendments to the Uniform Plumbing Code and/or requirements of local jurisdictions, whichever is more restrictive. Where more restrictive flows are shown on the Plumbing Fixture Schedule, these requirements shall take precedence.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

B. Handicapped Mounting Heights:
   1. Water Closets: Mounting height from floor to top of seat shall be a maximum of 19" and a minimum of 17".
   2. Urinals: Front lip of basin shall not exceed 17" above finished floor.
   3. Lavatories: Lavatory rim or counter surface shall not be higher than 34" above the finished floor.
   4. Mechanical Contractor to coordinate mounting heights with the Architectural Drawings and applicable codes for both ADA and standard fixtures.

3.03 INSTALLATION

A. Install each fixture with trap easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or braided stainless steel flexible supplies to fixtures with loose key stops, quarter-turn ball valves, reducers, and escutcheons. Where chrome-plated pipe and fittings are not available, typically commercial-type kitchen equipment installation, paint the pipe and fittings with chrome paint or provide stainless steel drain pipe and fittings.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant adhesive caulk, color to match fixture.

F. Install each fixture in accordance with architectural details. Unless otherwise noted, each fixture shall be located symmetrically, with its center line congruent with the center of windows, stall spaces, wall spaces, or casework. Unless noted otherwise, mounting height of fixtures shall be in accordance with the manufacturer's rough-in Standards.

G. Provide escutcheon plates for all lines through the walls and floors.

H. Connect hot water circulating piping to hot water piping within 24” of plumbing fixtures. Bring circulating piping down into wall as needed to meet this distance requirement.

I. Install carrier bolts in cured concrete only; test and prove to the Owner’s representative that all carrier bolts are secured in the floor. On the second floor and above, through-bolt the carrier feet with longer bolts, 2" x 2" heavy square washers, lock washers and double nuts. Contractor is responsible for following the manufacturer’s installation requirements and the installation results.

J. Test all Emergency fixtures for flow and temperature and give test results to engineer.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures so as to prevent splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

END OF SECTION

SECTION 23 00 10
GENERAL HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC) REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

A. Conform to General Conditions, Supplementary Conditions, and Division 01.

B. This section of the specification applies to the entire mechanical work, both interior and exterior, as specified herein after and shown on the plans.

1.02 SCOPE

A. Provide heating, ventilating, and air conditioning equipment, piping, ductwork, etc. as shown on Plans and as described in contract documents.

1.03 DEFINITIONS

A. The term "approved equal" means final approval by the Owner's representative of a material or piece of equipment substituted for that which is shown in the specifications or plans.

B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

C. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refers to those subcontractors working under the direction of the "General Contractor (GC)."

1.04 INTENT OF DRAWINGS

A. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in ductwork and piping. Contractor shall provide additional fittings, offsets and extensions in piping, ductwork and related mechanical insulation as required to meet the intent of the documents. Contractor shall include in his bid provisions to relocate or shift piping and ductwork where conflicts exist with Structural, Architectural, or Electrical.

B. Refer to the complete set of Architectural, Structural, Electrical, and Civil Plans and Specifications for additional details of the work. Review Plans and Specifications of other trades to identify other requirements. Discrepancies shall be reported to the Owner's representative immediately before ordering material or beginning work.

1.05 COORDINATION

A. Examine the complete set of drawings including all disciplines before work is started. Consult with each of the other Contractors regarding locations and spaces required for work and lay out work to avoid interference. Maximum clearance shall be maintained for service access and maintenance of all equipment. Failure to coordinate shall be justification to require Contractor, at his own expense, to move his work to provide the necessary space for the other contractors.

B. Mechanical systems have space priority as follows, listed with highest priority first: Graded Drainage Piping, then Ductwork, Drainage Vents, Hydronic Piping, Domestic Water Piping, Natural Gas Piping, and Fire Protection Piping. MC to make certain that priority access is maintained. This shall be coordinated by the GC and MC without assistance from Owner's representative, Engineer, or Architect.

C. Contractor shall be responsible for his own coordination between all other trades. Development of Shop Drawings shall be a collaborative effort between the General Contractor, Mechanical Contractor, Electrical Contractor and all other subcontractors working on the project. Shifting of piping, ductwork and other mechanical items shall be the responsibility of the Team to maintain the intent of the documents. Submit shop drawings to the Owner's representative.

1.06 WORK IN OTHER SECTIONS

A. Drawings and General Provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.07 CODES AND REFERENCES

A. Codes and Standards listed shall be the most current issue as adopted by the Local Jurisdiction. In the event of a conflict of codes, the most stringent code will apply.
1. International Building Code (IBC)
2. Uniform Plumbing Code (UPC)
3. International Mechanical Code (IMC)
4. Washington State Energy Code
5. SMACNA Duct Construction Standards, Metal and Flexible
6. National Electrical Code (NEC)

1.08 PERMITS AND FEES

A. Obtain and pay for all permits, licenses and construction or utility fees. Furnish final certificate to Owner showing compliance with code requirements.

1.09 SCHEDULING

A. Comply with requirements of General Specifications.

1.10 PRIOR APPROVALS

A. Specifications have been written around equipment and material selected for this project based on quality, size, capacity, and performance required to meet building design criteria. Any equipment and/or material used in this project, that is not as specified, must have prior approval from the Owner's representative.

B. Request for Approval must be submitted with substitution request form included in Division 0 to Owner's representative, a minimum of 10 calendar days prior to bid date. This letter shall be accompanied with complete information regarding items to be substituted.

C. Those items that receive prior approval, will be listed in the Mechanical Addenda.

D. Supplier, and/or Mechanical Contractor, shall be responsible for ensuring that substituted material or equipment is of the same size, quality, capacity, weight, and electrical characteristics as that specified. Any changes and costs required during construction, due to contractor's/supplier's neglect to properly select substituted equipment, shall be paid by the contractor/supplier.

E. Prior approval to bid does not mean automatic final approval of material or equipment by the Owner's representative. Final approval will be given after final submittal data has been presented to Owner's representative, with complete information regarding weights, capacities, size, electrical requirements and quality.

1.11 MATERIAL AND MATERIAL SUBMITTALS

A. All material used on the project shall be new material and free from defects. This Contractor shall submit catalog data and engineering data on all equipment as specified or having received prior approval.

B. Material and equipment specified is designated by various manufacturer's catalog numbers. Acceptable alternate manufacturers are also listed. Such manufacturers are exempt from the 10-day prior approval clause of these specifications, but must submit standard submittal data for final approval as otherwise noted.

C. Submittal shall be arranged in numerical order, according to specification section number and item number. Submittal shall be in PDF format complete with labeled bookmarks (minimum one per specification section).

D. Submittal shall be as follows: Before ordering or installing any of the materials, this Contractor shall submit copies of complete information on the materials to be used on the project. Submittal shall include, but not be limited to, the following.
1. Contractor's Cost Breakdown
2. Complete List of Subcontractors and Suppliers

3. HVAC Insulation
4. Heat Exchangers
5. All Air-Handling Equipment
6. Heat Pumps
7. Air Terminals
8. Air Filters
9. HVAC Ductwork
10. Dust Collection System
11. Tests and Adjustments
12. Integrated Automation - Energy management and control system

E. Owner's representative's review of submittals is for general conformance with the design concept and Contract Documents. Marking or comments shall not be construed as relieving the Contractor from compliance with the project Plans and Specifications, nor departures therefrom. The Contractor remains responsible for details and accuracy for confirming and correlating all quantities and assembly and for safe performance of his work.

F. The Owner's representative will return one set of this submittal to the contractor showing any corrections, additions, and/or deletions. This Contractor shall resubmit those items that need to be corrected or added.

1.12 CONTRACTOR'S COST BREAKDOWN

A. Mechanical Contractor shall submit, with the submittals, a cost breakdown of the major portions of his work, pursuant to the following outline.
1. Job organization and submittals.
2. Outside site utilities.
3. HVAC Equipment
4. HVAC ductwork and air terminals.
5. HVAC piping and insulation.
6. HVAC specialties
7. Tests and adjustments - air and hydronic balance.
8. Integrated Automation - Energy management and control system.

1.13 RECORD (AS-BUILT) DRAWINGS

A. This Contractor shall maintain a set of Contract Drawings at the site on which the actual installed location of piping, equipment, etc., shall be shown in a legible, neat manner. This set of plans shall show actual dimensions (including depth of bury) of underground piping from construction lines, so they can be readily found after covering. Upon completion of the project, the as-built information shall be transformed into AutoCAD version 2024 or greater. Record drawings shall be the same size as contract drawings. This set of plans shall be submitted for final approval. Drawings shall be one full size set, one half size set and on a USB flash drive in PDF and .dwg format. The contractor shall be ready for review of the on-site as-builts monthly prior to submitting his billing. Failure to have drawings available for review may delay monthly billings.

1.14 OPERATING INSTRUCTIONS

A. Operate all systems through complete cycles in the presence of designated Owner's representative. Give instructions for operation, care and maintenance. All systems shall be operated through complete operating cycles for a minimum period of 7 days in conjunction with the designated Owner's representative before acceptance.

1.15 TRAINING

A. The Mechanical Contractor shall digitally record all Owner Mechanical training sessions and shall provide copies on USB flash drives. Training sessions shall be provided for all mechanical systems. Three copies of these USB drives shall be turned over to the Owner at the completion of the project.

1.16 OPERATION AND MAINTENANCE MANUALS (O&Ms)

A. General: Provide one preliminary searchable PDF set of Operation and Maintenance Manuals including maintenance information and parts list furnished by the manufacturer with the equipment, together with supplementary drawings where necessary, to itemize serving and maintenance points. Include the Valve Tag list as posted in the Mechanical spaces. Filter list shall include all sizes and quantities for each unit and recommended filter maintenance schedule. Include methods of operation, seasonal requirements, manufacturer's data and warranty forms. Warranty forms are to be located in the front of the manuals as well as in each applicable specific section. Provide address and 24-hour phone number of the firms responsible under warranty. Items requiring service or correction during the warranty period shall be serviced within 24 hours of notification by Owner. Data in manuals shall be neat, clean copies, with operation and maintenance instructions for each item of equipment installed. Drawings shall be accordion folded. An index shall be provided with all contents listed in an orderly presentation with bookmarks according to specification section.

B. Number of Copies: A preliminary set of the O&M Manuals shall be submitted for approval. After this set has been approved, one hard copy and 3 electronic copies on USB flash drives shall be submitted.

C. Hard Copy Binding: Organize operating and maintenance data into suitable sets of manageable size. Copies shall be submitted in 3-ring binders. Covers shall include the name of the Job, Owner, Architect, Engineer, Contractor, and the year of completion. The back edge of the binder shall include a label with the name of the Job, the Owner and the year completed. Each copy shall have a typewritten index and tabbed dividers between equipment categories. Binders to be no more than 80% full; binders that are over 80% full will be sent back for dividing into additional binders.

1.17 CERTIFICATIONS

A. Provide written certification that work has been fully completed in strict accordance with Plans and Specifications and request final inspection.

B. Provide written certification that Contractor will replace materials and workmanship that prove defective for one (1) year after date of acceptance or extended warranty as listed in individual sections.

C. Provide written certification of inspection from the Authority Having Jurisdiction, stating that all work has been inspected, accepted, and approved as complying with existing governing ordinances and codes.

D. Provide written certification that Owner's representative has been fully instructed in the operation and function of all mechanical systems.

E. Provide copies of certification in the O & M Manuals.

1.18 DOCUMENTS

A. Present the following documents to the Owner's representative prior to final acceptance of buildings. Final payment of the Contract will be contingent upon receiving these documents:
1. Record (as-built) drawings.
2. Operation and Maintenance Manuals (3 sets).
3. Final material submittal.
4. Warranties and Extended Warranties.
5. Approved Final Balancing logs.
6. State of Washington certification of all pressure vessels installed on the project. Affix a copy to each tank.
7. Final certificates of inspection and code compliance.
8. RPBF device tests.
9. All applicable forms required by these specifications.
10. Provide copies of the above documents in O & M Manuals.

1.19 WARRANTY

A. All mechanical equipment and systems including Heating, Ventilating, and Air Conditioning systems, including controls and all parts thereof, shall be warranted (parts and labor), for a period of one (1) year after the date of substantial completion as determined by the documentation.

B. Contractor shall repair or replace to the satisfaction of the Owner's representatives any defective material, equipment, or poor workmanship, which may show itself during this warranty period.

C. All compressors used in HVAC equipment shall have an additional four-year parts warranty.

D. Controls shall be warranted for two (2) years total parts and labor, from date of final acceptance.

E. Test and Balance shall be warranted for two (2) years total, from date of final acceptance.

1.20 REQUIREMENTS PRIOR TO OCCUPANCY - OFF-GASSING AND BAKE-OUT

A. Mechanical Contractor shall provide in his bid provisions for Off-Gassing and Bake-out of new materials installed in this contract. HVAC systems shall be run continuously for a minimum of two (2) week period prior to occupancy, at the completion of each area of the project. HVAC systems shall maintain a constant temperature of 70 to 78 degrees F, in all zones at 60% minimum outside air. Coordinate this requirement with the General Contractor.

1.21 MECHANICAL ACOUSTICAL REQUIREMENTS

A. The noise criteria (NC) end resultant for each space shall be per Code as adopted by Local Jurisdiction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL

A. Owner's representative's review of submittals is for general conformance with the design concept and Contract Documents. Marking or comments shall not be construed as relieving the Contractor from compliance with the project Plans and Specifications, nor departures therefrom. The Contractor remains responsible for details and accuracy for confirming and correlating all quantities and assembly and for safe performance of his work.

END OF SECTION

SECTION 23 00 20
BASIC MATERIALS AND METHODS FOR HEATING, VENTILATING, AND AIR-CONDITIONING

PART 1 GENERAL

1.01 WORK INCLUDES

A. General requirements for basic materials and methods.

1.02 REFERENCES

A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

B. "Seismic Restraint Manual Guidelines for Mechanical Systems" by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

PART 2 PRODUCTS

2.01 GENERAL

A. See specific sections for this requirement.

2.02 PRODUCT TESTING

A. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection, such as fans, pumps, air handling equipment, etc., must be provided with an approval label from one of the agencies hereinafter listed.

B. Approval of agency must be for the total package; approval of individual components not acceptable. All labels must be located outside of equipment and shall be visible to inspector. Comply with all requirements of RCW 19.28.010 and NEC Sections 90-7 and 110-3 (1993).

C. It shall be the responsibility of the Mechanical Contractor or the equipment supplier to meet the requirements of this section. Any agency costs to provide an appropriate label for a piece of equipment must be included in this bid. Failure by Mechanical Contractor or supplier to obtain approval labels prior to bid shall be sufficient cause for the Mechanical Contractor/supplier to obtain all such labels at no additional cost to Owner. The following is a list of approval testing laboratories:
   1. Underwriters Laboratories, Inc., www.ul.com
   2. Canadian Standards Association, www.csagroup.org
   3. Factory Mutual Systems, www.fmglobal.com
   4. MET Electrical Testing, www.metlabs.com
   5. Intertek Testing, www.intertek.com

2.03 PRESSURE VESSELS

A. At the completion of the project, the Contractor shall provide State of Washington Certification of all pressure vessels installed on the project. Affix certification on the vessels and provide a copy to the Owner in the O & M Manual.

2.04 DAMAGED OR REJECTED MATERIALS

A. Remove from the site immediately.

2.05 STARTERS, DISCONNECTS AND VFDS

A. All starters shall be provided and installed by Electrical Contractor unless otherwise noted.

B. All disconnects shall be provided and installed by Electrical Contractor unless otherwise noted.

C. VFDs shall be provided by the Control Contractor, installed by the Electrical Contractor, and controlled by the Control Contractor unless otherwise noted.

D. Mechanical Contractor shall coordinate VFDs, based on direction provided in the Contract Specifications. All VFDs are to be of a single manufacture and/or provided by a specific contractor. The MC shall be responsible for compliance with the specification or shall correct problems at his expense.

E. The Mechanical Contractor shall coordinate with the Electrical Contractor and provide voltage, phase, horsepower, and amperage for all of the mechanical equipment being provided, based on approved submittals and the actual equipment being provided.

F. Starters, disconnects, and VFDs shall be provided in a timely manner, so as to not delay the Electrical Contractor's work.

2.06 FIRE INTEGRITY

A. Manufacturers
1. 3M Fire Products
2. Holdrite
3. Approved equal

B. The penetration sealing systems shall be provided with F-Rating and/or T-Rating as required by IBC Section 714.3 and 714.4 Penetrations include the following:
1. Through-penetration firestopping in fire-rated construction.
2. Construction-gap firestopping at connections of the same or different materials in fire-rated construction.
3. Construction-gap firestopping occurring within fire-walls, floor or floor-ceiling assemblies.
4. Construction-gap firestopping in smoke partitions.
5. Through-penetration smoke stopping in smoke partitions.
6. Construction-gap smoke stopping in smoke partitions.
7. All ductwork and piping penetrating mechanical spaces, mechanical mezzanines, mechanical lofts, mechanical boiler rooms, or other mechanical spaces, shall be fire caulked, even if the walls are not rated. Visible piping penetrations shall be covered by split chrome-plated floor and ceiling plates. Visible ductwork penetrations shall be covered by painted angle-iron frames.

C. All products shall be listed in Underwriters Laboratory Fire Resistance Directory. Firestopping for penetrations and voids shall be UL-tested systems.
1. Through-penetration firestop devices (XHCR).
2. Fire resistance ratings (BXUV).
3. Through-penetration firestop systems (XHEZ).
4. Fill, void or cavity material (XHHW).

D. All material shall be tested per American Society for Testing and Material Standards, ASTM E814: Standard test method for fire tests of through-penetration firestops.

E. Firestopping for penetrations and voids shall be UL-tested systems.

2.07 HANGERS

A. Manufacturers:
1. Grinnell
2. Michigan Hanger
3. Tolco
4. PHD
5. Anvil
6. Holdrite
7. Approved equal

B. Provide all anchors, hangers and all supports for piping and equipment included in contract.

C. It is the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using standard, commercially-accepted pipe hangers and accessories.

D. All pipe hangers and supports shall conform to the latest requirements of ASME B31.1 Code for Pressure Piping, and Manufacturers Standardization Society Documents MSS SP-58 and MSS SP-69.

2.08 INSERTS AT HANGERS AND SUPPORTS

A. Manufacturers:
1. Holdrite
2. Buckaroos
3. Cooper
4. Metro Supply Company
5. Value Engineered Products, Inc.
6. Hydra-Zorb Klo-Shure 7-series or 8-series strut-mount and Clevis
7. Approved equal

B. Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. The insert is to consist of either hydrous calcium silicate or polyisocyanurate foam insulation (urethane) encircling the entire circumference of the pipe with a 360-degree PVC (1/16” thick) or galvanized steel jacket (20 gauge minimum). Inserts are to be installed on piping during piping installation, by the Piping Contractor. Provide continuous insulation vapor barrier. Seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor retarder mastic.

C. For elastomeric insulation, provide Hydra-Zorb Klo-Shure 7-series 8-series strut-mount or Clevis Hanger Insulation Couplings or approved equal.

D. Insulation and covering shall meet the flame spread index and smoke developed index as noted in the International Building Code.

E. Insert thickness shall match Code-required insulation thickness as a minimum.

F. Provide pipe covering protection saddle for piping on rollers; Anvil figure 160 through 166A or approved equal.

G. Inserts for piping in plenums shall have appropriate flame/smoke spread rating.

2.09 SUPPORT FOR EXTERIOR GROUND MOUNTED PIPING

A. For piping run across grade, provide a support system, detail the type and locations of the different configurations required, and submit for approval prior to starting work:

B. System shall be securely mounted to concrete with unitstrut or other support material.

C. Secure piping to the support system.

2.10 ELECTRIC MOTORS

A. Minimum efficiencies of electric motors shall comply with the Washington State Energy Code.

2.11 ACCESS DOORS AND PANELS

A. Manufacturers:
1. Jay R. Smith
2. Milcor
3. Mifab
4. Approved equal.

B. 16 gauge steel door and frame with concealed hinge and cylinder lock. Provide matching latches/locks keyed the same for multiple panels in a project. When "B" dimension is 24" or more, provide additional latches at the top and bottom of door. Provide finish and material as noted in Part 3 – Execution.

2.12 CONCRETE INSERTS

A. Manufacturers:
1. Grinnell
2. Kinsdorf
3. Elcen
4. Approved equal.

B. Inserts in concrete for the suspension of piping and equipment shall be provided by this Contractor, unless otherwise noted on the Plans. Inserts in "poured-in-place" concrete shall be Grinnell 282 galvanized, or approved equal.

2.13 VIBRATION ISOLATION

A. Manufacturers:
1. Kinetics Noise Control, Inc.
2. Mason Industries
3. Amber-Booth
4. I.S.A.T.
5. Flexicraft
6. Twin City Hose
7. Approved equal.

B. General
1. If equipment is internally isolated by the manufacturer, internal isolation (base and isolator) shall be equivalent to the scheduled base and isolator and the isolator shall meet the scheduled spring static deflection.
2. Size anchoring bolts to withstand lateral seismic shear and isolate bolts from direct contact with structure using bolt isolation washer and bushing.
3. Bases specified in the schedule can be supplied by the manufacturer of the equipment if they meet the specification given herein.
4. Electrical connections shall be made with floppy length of flexible cable.
5. Piping in connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.
6. Provide seismic restraint for piping, equipment, and ductwork.
7. Submit all seismic restraint and vibration isolation components, calculations, and designs for approval. Do not install equipment or isolation until approval is received.
8. The Contractor shall coordinate with the Project Structural Engineer to ensure mounting attachment points for seismic restrained springs and seismic snubbers will withstand forces generated from the maximum acceleration rating of the restrained springs and snubbers.
9. Install in accordance with all codes, regulations and the requirements of the Authority Having Jurisdiction. Provide the Authority with copies of the components, calculations and design for their approval, if requested.
10. Seismic requirements for non-structural components, calculations shall utilize an "Importance Factor" of 1.5 for life safety systems and a factor of 1.0 for other systems.

C. Shop Drawings:
1. Provide schedule of vibration isolator type with location and load on each.
2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
7. Include the seal of the Professional Engineer registered in the State in which the Project is located, on the drawings and calculations which at a minimum include the following:
    a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.

b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
   1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
   2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
d. Detailed description of the equipment anchorage devices on which the certifications are based.

D. Pipe Isolation - General
1. Hung Type Isolators: Double-Deflection Neoprene Hanger to 4", Deflection - 30 degree Swing Spring and Double Deflection Neoprene Hanger - 6" and larger.
2. Isolator Deflection: 1/4” to 4", 1" - 6" and larger.
3. Motion Restraint Snubber: seismic restraint cable, rod clamp for standard 1-5/8" x 1-5/8" unistrut, and clevis cross brace.

E. Piping not requiring sway bracing is as follows:
1. Piping in mechanical spaces less than 1".
2. All other piping less than 2-1/2".
3. Piping suspended by hangers 12" or less in length measured from the top of the pipe to bottom of hanger support where the hanger is attached.

F. Air Handling Unit or Inline Fan
1. Base Type: Integral structural steel base. Structural steel support members with welded-on isolator support brackets and pre-located and drilled anchor bolt holes, supplied by the equipment manufacturer with the equipment.
2. Hung Type Isolator: 1" Deflection - 30 degree Swing Spring and Double Deflection Neoprene Hanger.
3. Floor Type Isolator: 1" Deflection - housed/restrained cast open-spring isolators.
4. Flex Connector: Flexible duct connection manufactured from UL listed fire-retardant neoprene-coated woven glass fiber fabric to NFPA 90A, with minimum density of 30 ounces per square yard.
5. Motion Restraint Snubber: Seismic Restraint - Cable.

G. Air Cooled Condensing Units
1. Base Type: Integral structural steel base. Structural steel support members with welded-on isolator support brackets and pre-located and drilled anchor bolt holes, supplied by the equipment manufacturer with the equipment.
2. Floor Type Isolator: Neoprene waffle pads, 40 durometer hardness, minimum1/2"; maximum loading 60 psi.
3. Flex Connector: Flexible pipe connection for refrigerant piping; see Section 23 23 00.
4. VRF Outdoor Roof mounted units: Provide with 1" Deflection - seismic and restrained/captive-spring isolators with neoprene cushion.

PART 3 EXECUTION

3.01 LAYING OUT WORK

A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work executed under the Contract. Exercise proper precautions to verify figures shown on drawings, before laying out work and be responsible for any errors resulting from failure to exercise such precaution. The coordination of the utility installation with the final site grading and elevation by the General Contractor shall be the responsibility of this contractor. Locate existing utility lines which will be affected by the building

location before any footing work begins. Report conflicts with the Plans to the Owner's representative for adjustment before proceeding with the work. Failure to follow this instruction will result in the contractor being required to alter his work at his own expense.

3.02 ELECTRICAL WORK

A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to all applicable codes.

3.03 WORKMANSHIP

A. Furnish and install all equipment for a neat and finished appearance. If, in the judgment of the Owner's representative, any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, Contractor will be required to remove and reinstall the equipment, and patch and paint surrounding surfaces in a manner satisfactory to the Owner's representative, without any increase in cost to the Owner.

3.04 EXCAVATION - GENERAL

A. Perform all necessary excavation, shoring and backfilling required for the proper installation of work inside the buildings and premises, or outside as may be necessary. Slope sides of excavation to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

B. Excess excavation shall be backfilled with gravel or sand and mechanically compacted to give full support to the piping. In case of sewer lines in rock excavation, the excavation shall be made at least 6" deeper than required and backfilled with sand to outside invert grades to provide cushion. No underground lines shall be covered until the installation has been approved by the Owner's representative, and the Authority Having Jurisdiction. Maintain sides and slopes of excavations in safe condition until completion of backfilling. All backfill shall be thoroughly compacted.

C. No cinders shall be used for backfilling where steel, iron or copper piping is used. All trenches near or under footings shall be cut only after approval of the Owner's representative, and all backfilling of such trenches shall be according to his direction.

D. All items of grading which will in any manner affect the bearing capacity of the soil foundations upon which will be placed floor slabs, walls, column footings or piping beds shall be performed to the satisfaction of the Owner's representative. All soil foundation areas which will in any manner support any of the above stated construction will be compacted by the use of mechanical tampers to at least 95% of the maximum density of the soil foundations, as determined by the compaction control test, in accordance with the "Method of test for Moisture Density Relations of Soils, ASTM Designation D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described " Compaction Control Test." Place fill in 8" loose layers, each layer compacted.

E. Division 31, (31 23 16 - Excavation, 31 23 23 Fill, 31 26 16.13 Trenching), shall provide Excavation, Fill and Trenching for the Mechanical Contractor, as needed to complete his work.

3.05 EXCAVATION DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations, and from a flooding project site and/or surrounding area.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions, outside excavation limits to convey rain water and water removed from excavations to collection points or run off areas. Do not use trench excavation as temporary drainage ditches.

3.06 EXCESS EXCAVATION MATERIAL

A. Dirt and debris from trench excavation shall be disposed of by this contractor, as directed by the Owner's representative.

3.07 PIPING INSTALLATION

A. Lay piping in straight lines with uniform slope, leave no pockets. Care shall be taken to keep all foreign materials out of the piping during installation. Where ground water is present, provide suction pumps to keep trenches free of water, and cap ends of piping exposed to ground water when work is interrupted.

B. All underground piping used for the distribution of HVAC systems located outside the building perimeter shall be buried a minimum of 36" from finish grade to top of piping.

C. Piping and ductwork run above the floor SHALL NOT BE LOCATED OVER ELECTRICAL PANELS OR SWITCHBOARDS, except where located above a structural ceiling, or with drain pans approved by the AHJ. This piping includes, but is not limited to, heating water lines.

D. All piping and ductwork SHALL BE ROUTED AROUND Elevator Equipment Rooms. Piping and ductwork may serve the room, but shall not pass through it. Follow all codes applicable to these areas.

E. Isolation valves: Provide isolation ball or butterfly valves with positive shutoff on all inlets and outlets of all major pieces of equipment to facilitate serving and removal of such equipment without the necessity of draining the associated system. These valves are required even if not shown on the Plans.

3.08 OPENINGS IN PIPING AND DUCTWORK

A. Keep all openings covered tightly with plastic during the work.

3.09 PIPE SLEEVES

A. General: Provide pipe sleeves for piping passing through foundations, walls, floors, partitions, and roof to allow piping to pass freely through.

B. Foundation Walls: Where piping passes through walls below finished grade, but does not enter the building spaces, the sleeves shall be Schedule 40 galvanized steel pipe. Provide a modular seal between the sleeve and the piping.

C. Building Walls (Below Grade) and Floor Slabs: Where piping passes through building walls below grade, and floor slabs on grade or below grade, the sleeves shall extend a minimum of 1" inside the building wall or above the finished floor level, and shall be made watertight and gas tight by the appropriate modular seal. Sleeves shall be Schedule 40 galvanized steel pipe. If the sleeve and modular seal are subject to trapping water on the top side, pack with water resistant foam and caulk with flexible caulking or grout.

D. Building Walls and Floor Slabs (Above Grade): Where piping passes through concrete walls or floors within the building, the sleeves shall be of sufficient strength to withstand the pressure and concrete pouring operation without deforming or rupturing. Sheet Metal Ductwork with end slit and formed into flanges is not acceptable. Sleeves shall extend 1" above the finished floor. Sleeves in walls shall be flush on both sides.

E. Piping Subject to Expansion: Where piping is subject to motion due to expansion, such as hot water heating mains, the sleeve shall be made large enough to allow free motion. Where piping passing through is insulated, the sleeve shall be large enough to permit the covering to pass through.

3.10 WALL/FLOOR PLATES AND ESCUTCHEONS

A. Where piping or ductwork passes through any wall, floor or ceiling, it shall be fitted with chromium-plated steel escutcheons or stainless steel angle/trim rings for ductwork, with suitable set screws or other approved holding device. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.11 HANGERS AND SUPPORTS

A. General

1. Submittals: The Contractor shall submit, prior to installation, the following information and data for approval.
   a. Data Sheets on all cataloged items to be used.
   b. Sketches covering all specially designed hanger assemblies and fabrications.
2. Where thermal movement will occur, the hanger assembly must be capable of supporting in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger location, in order to prevent excessive stress on piping, ductwork, and/or equipment.
3. Concrete Inserts: Where piping or ductwork is supported from the concrete structure, inserts shall be provided for rod sizes up to 3/4". Where support rod sizes exceeds 3/4" diameter or where load exceeds the recommended load for the inserts, use two inserts with a trapeze-type connecting member below the concrete.
4. Where piping or ductwork is to be supported from building steel, beam clamps shall be used. Beam clamp selection shall be for the required load and the configuration of the steel at the point of attachment. Drilling holes in the steel for hanger rod will not be permitted unless approved by the Structural Engineer. Use only adjustable side beam clamps (Type 25); standard beam clamps are not acceptable.
5. Angle Clips: Where piping or ductwork is to be supported from building wood structure, angle clips shall be used with lag bolts sized to support the load in shear. Any attachment to wooden structural members shall be subject to the approval of the Structural Engineer.
6. Hanger Rods: Hanger rod size shall be selected on the basis of loading from the following table:

3/8"	610#
1/2"	1130#
5/8"	1810#
3/4"	2710#
7/8"	3770#
1"	4960#

Hangers shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing. DO NOT BEND RODS.

7. All rods shall be electro-plated to prevent corrosion.
8. All rods shall be double-nutted with lock washer and cut washer, on both ends if applicable, and excess rod on the bottom shall be cut flush and ground for safety.
9. Brackets and Racks: Where piping or ductwork is run adjacent walls or steel columns, welded steel brackets shall be used as base supports. Multiple pipe racks or trapeze hangers shall be designed and fabricated to suit conditions.
10. Vibration Control: Provide a vibration control hanger at the first three hanger locations from any motor operated equipment. Hanger shall consist of steel frame and spring with neoprene washers.
11. Auxiliary Steel: All auxiliary steel necessary for the installation of the hangers and supports shall be designed in accordance with the AISC Steel Handbook, furnished by the Mechanical Contractor, and shall receive one shop coat of primer paint.

B. Hangers for Piping:
1. Riser Clamps (Vertical Piping): Piping shall be supported at each floor with a riser clamp or at sufficient intervals to carry the weight of the piping and that of its contents. Stacks shall be supported at their base by a concrete pier or by a suitable hanger located on the horizontal run, close to the riser. Riser clamp extensions shall rest on the building structure where possible; auxiliary steel supports shall be provided where it is impractical to rest directly on the building structure.
2. Hanger Spacing for Piping: The maximum allowable spacing for pipe hangers shall be in accordance with the following. Where concentrated loads of valves, fittings, etc., occur, closer spacing will be necessary and shall be based on the weight supported and recommended loads for the hanger components.

a. Copper Tube and Piping - Soldered, Brazed or Welded.
   1) Horizontally: 1-1/2" and smaller, 6'; 2" and larger, 10'.
   2) Vertically - Each floor, not to exceed 10'. See note 1.
b. Notes For Above:
   1) Vertical water lines may be supported in accordance with recognized engineering principles with regard to expansion and contraction when first approved by the Authority Having Jurisdiction.

3. Hangers - Horizontal Piping:
   a. General: All hangers shall be provided with means of vertical adjustment. The following schedule shall be followed to select acceptable hangers for the type of service.
      1) Insulated Copper Piping:
         a) Adjustable steel Band Hanger with Shield.
         b) Clevis hanger with Shield.
      2) Insulated pipe inserts shall be provided at hanger, support, anchor, and guide locations on piping requiring insulation. See paragraph “Inserts at Hangers and Supports” in this Section.
   b. Trapeze Hangers: Where piping is grouped in parallel, provide manufactured strut or trapeze hangers consisting of two steel angles bolted back-to-back, with space between for a hanger rod at each end. Where the length of angles is greater than 24", there shall be three rod supports. Piping shall be able to move independently, and hanger spacing shall be dictated by the smallest pipe.
   c. Anchors, Guides and Sliding Supports: Shall be as shown on the drawings or as necessary to prevent excessive stress in either piping or equipment.

C. Hangers for Ductwork:
1. Reference and comply with SMACNA HVAC Duct Construction Standards - Metal and Flexible Table 4-1 - Rectangular Duct Hangers Minimum Size, and Table 4-2 - Minimum Hanger Sizes for Round Duct for the following:
   a. Strap and Rod Sizes
   b. Hanger Spacing
2. Steel Cables
   a. Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 602
   b. Stainless-Steel ducts: Stainless steel complying with ASTM A 492.
   c. End Connections: Cadmium-plate steel assemblies with brackets, swivel, and bolts designed for duct hanger service, with an automatic locking and clamping device.
3. Duct Attachments: Sheet-metal screws, blind rivets, or self-tapping metal screws, compatible with duct materials.
4. Support materials shall match ductwork materials (i.e. provide stainless steel support materials for stainless steel duct, galvanized steel support materials for galvanized steel ducts, and aluminum support materials for aluminum ducts).
5. Hanger and Support Installation:
   a. Reference Table 4-1 - Rectangular Duct Hangers Minimum Size, and Table 4-2 - Minimum Hanger Sizes for Round Duct.
   b. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheetmetal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
   c. Install upper attachments to structure. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.12 CUTTING AND PATCHING

A. Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. Cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements, shall be done by the General Contractor at the expense of the Mechanical Contractor.

3.13 ACCESSIBILITY

A. Locate valves, damper operators, etc., so as to be easily accessible in mechanical spaces or through access panels, specified hereinafter. Otherwise, obtain Owner's representative's approval of location.

B. Any equipment requiring maintenance clearances for servicing of filters, motors, compressors, etc., shall be carefully coordinated to avoid servicing problems. Failure of contractor to comply with this requirement shall be sufficient cause for contractor to make all necessary changes at no cost to the Owner. To avoid problems with interpretation of the NEC, allow 42" for all electrical clearances.

3.14 ACCESS DOORS AND PANELS

A. Locations of panels shall be carefully selected during construction, so as not to be located behind cabinets, etc. Coordinate closely with the Architectural and Electrical Plans before installing panels.

B. In areas such as janitor's room or on painted walls, etc., access panels shall be prime-coated and painted by the General Contractor; install before surrounding surfaces have been painted. In areas such as toilet rooms, the access panels shall be stainless steel or chrome-plated. In other finished areas such as on ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.

C. Verify with the Owner's representative location and finish prior to ordering; failure to get the Owner's representative's approval may result in replacement of access panels at the Mechanical Contractor's expense. Minimum size of access doors is 12" x 12"; actual size depends on the specific circumstance, and panel shall be large enough to accomplish replacement or repair of the item requiring access. The Owner's representative shall have the final say on whether or not the access is of sufficient size.

D. Provide access panels for all concealed valves for all piping.

E. Doors shall have cylinder lock latches, all keyed alike.

F. Provide fire-rated access doors for one-hour or two-hour rated walls and ceilings; units shall be UL labeled.

3.15 MECHANICAL ACCESSES

A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair. In concealed spaces where access has not been provided by the Architect by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the Owner's representative, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades, to avoid conflict therewith, and such locations shall be approved by the Owner's representative prior to installation of access panels.

B. In addition to building access openings, provide access panels on ducts where required to service fire dampers, damper operators, and other associated equipment. All access doors providing access to mechanically furnished panels, control boxes and filter compartments shall be provided with fully-hinged, easily-opened access doors. Minimum size is 12" x 12", unless access area prevents that size. Consult Owner's representative prior to installing smaller sizes.

C. Maintain 6'-8" minimum head room in all Mechanical spaces, and 8’ in all other spaces. If minimum spacing is not possible, obtain the Owner's representative's permission, in writing, to install piping/ductwork/equipment at lower heights. Where ductwork is approved to be installed below 6’8” in mechanical spaces, utilize closed cell foam to provide corner/duct head protection.

3.16 PAINTING, TAGS, ETC.

A. Field painting of all mechanical equipment, piping etc., located in and exposed in occupied spaces, shall be by the General Contractor.

B. Paint all bare steel piping, equipment, etc. located where exposed to the elements.

C. Identification Tags: Provide identification tags for each main shutoff and control valve throughout the building indicating the system served. Tags shall be black phenolic plastic with white engraved inscription attached with chrome chain.

A. Mechanical Room: Provide valve tag lists laminated in mechanical room. Provide matching floor plan diagram showing locations for each valve on an overall floor plan. Locate as directed by the Owner's representative.

D. Each major item of Mechanical Equipment shall be provided with the name of the item, i.e., Exhaust Fan No. 2, etc., in labels of black phenolic plastic with white engraved inscription. Minimum size of lettering is 1" with a maximum of 2". Select appropriate sizes for the size of the equipment being labeled. Align labels with edges of equipment and locate labels so as to be visible. For ceiling exhaust fans, provide additional tag on grille.

E. Pipe Markers:

1. Piping throughout the building shall be equal to Brady Corporation No. B-946, M.S.I. No. MS-900, meeting or exceeding ANSI A13.10-1981. Pipe markers shall consist of two wraps of arrows in the direction of flow, color, and wording as indicated in the schedule following. Stencils shall be visibly located and spaced on maximum 20'-0" centers for long straight pipe runs. Stencils shall be located on both sides of a wall, within the first 3'.
2. Color Code Schedule: (Service, Color, Stencil)

Condensate	Yellow	COND
Refrigerant Liquid	Yellow	RL
Refrigerant Gas	Yellow	RG

3. Ceiling Tile Access Labels: Where it is necessary to remove ceiling tile(s) to access mechanical equipment, backdraft dampers, motorized dampers, remote control sensors, valves/controllers, filters, valves, volume dampers, etc., provide and install round 1/2" diameter, yellow, self-adhesive labels on the metal ceiling grid, visible near all four corners of each tile requiring removal.

3.17 TEMPORARY HEAT

A. Heating equipment may not be used as temporary heating units during construction.

3.18 FIRE INTEGRITY

A. All penetrations of fire-rated walls, ceilings, roofs or floors via ductwork, piping and air terminals must be protected by fire dampers, fire/smoke dampers, appropriately-rated assemblies, and caulking to maintain integrity of structure.

3.19 CLEANING UP

A. Comply with requirements of the General Specifications.

B. Ducts shall be maintained as clean as possible during erection, and shall be blown clean before the building painting operations are started. Ducts and apparatus casings shall be thoroughly cleaned before fans and filters are operated. Installed ductwork and equipment openings shall be sealed to prevent contamination of construction dust, debris and moisture. Uninstalled ductwork and equipment shall be securely covered to prevent contamination or the insulation getting wet. Uninstalled ductwork and equipment shall be stored on pallets or dunnage that prevents water reaching the ductwork. If ductwork or equipment is found to be dirty or wet, this contractor shall be responsible for replacing such items. Contaminated or wet duct shall be spray painted with high visibility paint and removed from the site immediately. After equipment has been used for any purpose, such as adjusting, testing, or temporary ventilation, filters shall be replaced and exhaust/return ducts shall be cleaned. Use temporary filters with 80% to 85% filter efficiency during construction. Cover all openings with temporary filters if startup, test and balance, or commissioning starts prior to all work being completed in the building.

C. Remove tags, shipping labels, etc., from all ductwork in exposed areas, whether ductwork is painted or not.

3.20 CAULKING

A. Caulk all openings and flash around all piping, equipment, and ductwork passing through roof, floor, and walls. All caulking shall be water resistant. See also paragraph "Fire Integrity" for rated walls, ceilings, roofs, or floor penetrations.

B. All piping and ductwork penetrations of walls, ceilings, and floors shall be caulked. A chrome-plated steel escutcheon plate shall be installed at each visible piping penetration of walls, ceilings, or floors. All duct penetrations of walls, ceilings or floors shall be flashed with 3" x 3" 18 gauge galvanized sheet metal angle for concealed ducts, and stainless steel angle for exposed ducts.

3.21 OPERATION OF EQUIPMENT AND SYSTEMS

A. Contractor is responsible during all periods of balancing and testing. Provide temporary utilities as required.

3.22 TESTS, ADJUSTMENTS AND INSPECTION

A. Test all work thoroughly and systematically, both during construction and after completion. Notify Owner's representative 48 hours in advance of all tests. Tests shall be maintained until approved. Tests shall be as hereinafter specified.

B. The Contractor shall test the completed installation as in regular service. Any defects or imperfections that may show up are to be promptly corrected. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from date of final acceptance. The Contractor shall repair or replace any part which may show signs of failure during that time, if such failure, in the opinion of the Owner's representative, is due to imperfections in material or to improper workmanship.

C. No system, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing, without first notifying the Owner's representative. Failure to notify the Owner's representative for inspection of concealed systems shall be cause to require this contractor to uncover and recover such systems at no additional cost to Owner.

D. A log of all tests shall be kept. The log shall note, dates, time of day test started, system or portion of system tested, length of test, test results, and who witnessed the test (AHJ, Owner's representative, or GC). Contractor shall insert legible name of witnesses. Contractor to submit a copy of the contractor's test log monthly to the Owner's representative.

E. Review the project to determine when final inspection is appropriate and advise Owner's representative. Mechanical Contractor is required to complete his work before requesting final inspection.

F. See specification section of piping used for test methods or procedures used.

G. Conduct refrigeration leak test on all DX equipment prior to installation on or in buildings.

3.23 FINAL INSPECTION

A. This contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall so advise the Owner's representative. It shall be understood that the work is to be essentially complete. If such is not the case and more than one final inspection and one backcheck are necessary, this Contractor may be billed for the additional backchecks at the then governing rate for the personnel involved. The final inspection punchlist shall be legibly signed on a copy of the punch list by a person responsible for the trade involved, and transmitted to the Owner’s representative, before a backcheck will be scheduled.

3.24 PROTECTION AND CLEANING

A. All equipment and material installed by this contractor shall be properly protected from damage during the course of construction.

B. In spaces where piping such as condensate drains, heating lines, refrigeration lines, etc. have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect this piping. Wood or other such material will be acceptable. Where duct plenums or duct runs interfere with normal traffic patterns of maintenance personnel, the sheet metal contractor shall provide a wooden "bridge" over the ducts to prevent damage.

C. Protect walking paths in mechanical spaces. Maintain 6'-8" headroom minimum, for all piping and ductwork. If required clearance is not possible, obtain permission from the Owner's representative to violate the above requirement, and comply with protective measures required.

3.25 SPECIAL PROTECTION

A. Exercise maximum precaution to protect the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.

3.26 BALANCING WORK

A. Provide Testing, Adjusting and Balancing as required in this section of the specification.

3.27 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's representatives.

B. General Description of Instruction Periods: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings, followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures, temperature control settings, and available adjustments.

C. Scheduling of Instruction Periods: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given to the Owner's representative at least two weeks prior to the instruction periods, and agreement reached as to the date at which the instruction periods are to be performed. Advise Owner's representative two weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

D. Schedule an additional instruction period for the off-season. That is, if initial instruction period takes place during the heating season, schedule another during the cooling season, or vice versa.

3.28 ON-SITE OBSERVATIONS AND SAFETY MEASURES

A. During its progress, all work shall be subject to observation by the Owner's representative, and of the National Board of Fire Underwriters, State and Local Inspectors. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor will be totally responsible for conditions of the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Owner's representative to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. It shall be the Contractor's responsibility to comply with "Safety and Health Regulations for Construction" in the Federal Register by the U.S. Department of Labor. Contractor shall be responsible for providing all such safety measures and shall consult with the State and/or Federal Safety Inspector for interpretation whenever in doubt as to whether he is or is not in compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damage or injury to any persons or property wherever located resulting from any action or operation under this contract or in connection with the work.

3.29 CONTINUITY OF BUILDING UTILITIES AND SHUTDOWNS

A. General: Continuity of utilities services in the building shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services shall be accomplished in accordance with the following requirements.

B. Shutdowns: While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings. The actual time and date is to be coordinated with and approved by the Owner's representative at least 72 hours in advance.

C. Costs: The Contractor shall include in his bid proposal, all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes, or failure to complete utilities connections within authorized shutdown periods.

3.30 DRAFT STOPS

A. It shall be the responsibility of each contractor performing his trade to verify with Architectural Plans and to maintain the integrity of draft stops, whenever his work requires penetration of these areas. Patch as required to maintain integrity of draft stops.

3.31 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing equipment.

B. Prepare a manufacturer's startup report, and turn over to the Owner's representative and Commissioning Agent.

3.32 COMMISSIONING

A. This Contractor will be required to participate in the commissioning process. See Section 23 08 00 and the Commissioning Section in the Architectural section of the Specification. The Mechanical Contractor shall complete the start-up forms and be available to assist in the commissioning process. The Mechanical Contractor shall include in his bid all cost associated with his portion of the commissioning process.

B. As a minimum, the following Mechanical Items shall be commissioned, see Commissioning section.
   1. All HVAC equipment.
   2. Heating/cooling systems.
   3. Exhaust fans.
   4. Energy management and control systems.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers and Arrows.

D. Ductwork Identification Nameplates.

E. Ceiling Tile Access Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

B. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification, including matching size and colored arrows.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves, on As-Builts.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation

B. Seton Identification Products

C. Marking Services, Inc.

D. Approved equal

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height, Equipment: 1 -1/2".
   3. Background Color: Black.

2.03 VALVE TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Tag Lettering: First Line = System Abbreviation; Second Line = Consecutive Valve Numbers, starting at 01.

C. Beaded Chain: #6 x 4-1/2" - Nickel Plated.

2.04 PIPE MARKERS & ARROWS

A. Color: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Tape Pipe Arrows: Nominal sizes and colors to match pipe markers. 1", 2" and 4".

D. Size of pipe markers:
   1. 3/4" to 1-1/4" OSD of Covering = 1/2" letters.
   2. 1-1/2" to 2" OSD of Covering = 3/4" letters.
   3. 2-1/2" to 6" OSD of Covering = 1-1/4" letters.
   4. 8" to 10" OSD of Covering = 2-1/2" letters.
   5. Over 10" OSD of Covering = 3-1/2" letters.

2.05 DUCTWORK IDENTIFICATION NAMEPLATES

A. Description:
   1. Plastic Laminate 1-1/4" letters and arrows.
   2. Vinyl Markers 1-1/4" letters and arrows.
   3. Color per ASME standards.

2.06 CEILING TILE ACCESS MARKERS

A. Description: Vinyl or plastic markers, 1/2" diameter minimum with color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Heating/Cooling Valves: Blue.

2.07 VALVE CHART FRAME

A. Description: Anodized aluminum frame, letter size, to hold typewritten chart, under clear plastic window.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates and markers with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.

B. Install tags with nickel plated chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions. Install a circular wrap of arrows at each end of the pipe marker.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify all mechanical equipment; air handling units, pumps, heat transfer equipment, tanks, and water treatment devices, etc. with plastic nameplates.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify ALL valves with tags.

H. Tag automatic controls, instruments, valves and relays. Key to control schematic, show on control As-Builts. Provide tags identical to valve tags. First line = abbreviation [EMCS]. Number consecutively starting at 01. Provide Valve Chart Frames and Control Device Lists on walls in an accessible location, well lighted space, in each Mechanical Space. (Does not include Janitor Rooms).

I. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20' on center for straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Identify all ductwork with plastic or vinyl nameplates. Identify with air handling unit identification number, system (Outside Air, Return Air, Exhaust Air, Supply Air, etc.) and area served. Locate identification as ducts leave or return to Air Handling Unit, on duct runs not to exceed 20' on center, adjacent each branch, at each side of penetration of structure or enclosure, and at each obstruction. air handling unit, at each side of penetration of structure or enclosure, and at each obstruction. Do not install labels on exposed ductwork.

K. Provide ceiling tile access markers to locate Mechanical Equipment, Filters, Valves, Dampers, etc., above T-bar type panel ceilings. Locate on the metal ceiling grid near all four corners of the tile requiring removal.

A. Install Valve Chart Frames and Valve Lists on wall in an accessible, well-lighted location in each Mechanical Space. (Does not include Janitor Rooms). Provide matching floor plan diagram showing locations for each valve on an overall floor plan. Locate as directed by the Owner's representative.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

C. Testing, adjusting, and balance of domestic water.

D. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Standard 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association.

E. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Qualifications: Submit name of Testing, Adjusting and Balancing agency and TAB supervisor within 30 days after award of the Mechanical Contract by the General Contractor. Include a list of the last 12 projects completed with a list of the respective Owner's representatives and a contact phone number for each.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit for Review.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Progress Reports. Provide preliminary/hand-written balance report no later than one (1) week after completion of work.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner’s representative and for inclusion in Operating and Maintenance manuals.
   2. Provide reports complete with index page and indexing bookmarks. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   3. Include actual instrument list with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Use report format recommended by TAB standard. If none of these apply, follow ASHRAE Standard 111.
5. Units of Measure: Report data in I-P (inch-pound) units only.
6. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name of project.
    e. Project location of project.
    f. Project Architect.
    g. Project Mechanical Engineer.
    h. Project General Contractor.
    i. Project Mechanical Contractor.
    j. Project Controls Contractor.
    k. Owner's Commissioning Agent.
    l. Report date.

F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.05 DALT DUCT AIR LEAKAGE TESTING - ASSISTANCE

A. M.C. to provide HVAC equipment mechanics to operate and assist with HVAC equipment and HVAC ductwork mechanics to provide the field required test ports and other modifications needed to perform the DALT. M.C. to ensure that these support personnel are present at the agreed upon times.

1.06 INSULATION PRIOR TO TAB OR DALT AIR LEAKAGE TESTING

A. Do not allow insulating of ductwork or piping prior to TAB and or DALT testing. If project is behind schedule, the Owner’s representative may agree to partial insulation prior to completion of testing, if the TAB contractor agrees.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. M.C. to provide conformed construction drawings and specifications to the TAB firm, if available. If not available, issue the same drawings that are being provided to the other Subcontractors, along with any RFIs or Change Orders that may affect their work. The M.C. is responsible to keep the TAB firm up to date with pertinent contract documents and correspondence.

C. M.C. to provide approved equipment submittals and project schedule for the use by the TAB subcontractor.

1.08 WARRANTY

A. Include a warranty for 24 months after final acceptance by the Owner, during which time the Owner may request a recheck, or resetting of any outlet, coil or device listed in the project test report. TAB contractor to contact other project subcontractors if their technical assistance is required to make any test or adjustments required. Maximum number of rechecks shall not exceed a yearly total of 5% of the entire project. However, if the balance reports are proved to be inaccurate, the Owner may request the entire project be re-balanced during the warranty period. See paragraph Commissioning in this Section for recheck and failure criteria. The above warranty shall be included in the original contract bid proposal.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
    1. AABC MN-1, AABC National Standards for Total System Balance.

2. ASHRAE Standard 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
1. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
   c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

D. TAB Supervisor Qualifications: Professional Engineer licensed in the State in which the Project is located.

E. TAB Team Members: Submit their qualifications along with the Companies qualifications and the TAB Supervisor qualifications. TAB team approved to accomplish work on this contract, must be full-time employees of the TAB agency. No other personnel are allowed to do TAB work on this contract.

F. Pre-Qualified TAB Agencies:
1. Neudorfer Engineering (Integra Testing) (206) 621-1810.
2. AirTest (425) 313-0172
3. United (800) 213-2195

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, have HVAC contractor replace or install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Confirm duct system leakage is minimized. Have HVAC contractor coat or recoat joints that may not be up to SMACNA standards prior to testing.
12. Confirm pumps and other equipment have been started by factory-trained personnel where required by specification.
13. Pumps are rotating correctly.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions, or that a letter allowing revised conditions has been received by the TAB contractor.

D. The TAB contractor shall exercise care while performing his work so as to avoid damaging the work of other trades, particularly paint and ceiling tile. If damage is incurred by the Test and Balance Contractor, repairs shall be made at their expense.

3.03 PREPARATION

A. Hold Pre-balancing meeting two weeks prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced, plus General Contractor, Owner's representative, and Owners Commissioning Agent.
   2. Complete Project Examination noted above prior to Pre-balancing meeting, so that any problems found that would prevent balancing can be dealt with at the meeting.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner's representative and Owner's Commissioning Agent to facilitate spot checks during testing.

C. Request HVAC contractor provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10% of design for supply, return, and exhaust systems.

B. Air Outlets and Inlets: Adjust total airflow to within plus or minus 10% of design to space. Adjust outlets and inlets in space to within plus or minus 10% of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark locations where traverse and other critical measurements were taken on the Plans and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order; replace belt guards, close access doors, close doors to electrical switch boxes, and restore thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner's representative and Owner's Commissioning Agent.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure performance capacity tests for all coils, confirm manufacturers capacities, single points test are acceptable for units below 7.5 tons, for units above 7.5 ton, average of multiple readings in compliance with acceptable standards, is required.

K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

L. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

M. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05” positive static pressure near the building entries.

N. At completion, be sure all test holes in low pressure duct have pressure sealing plugs installed; duct tape is not allowed. Test holes in high pressure duct shall employ threaded and capped duct air fittings.

3.07 WATER SYSTEM PROCEDURE

A. Adjust domestic water balancing valves and set aquastat setpoint, verify operation of aquastat and supply/return water temperatures on hot water recirculation systems.

3.08 COMMISSIONING

A. See Section 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Re-check final TAB report data as needed.
   1. Original TAB agency shall execute the re-checks.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10% of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10% of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20% of instrument reading; for inlet vane or VFD outside air compensation system using linear proportional control, deviation of more than 30% at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10% of full scale of test instrument reading.

D. In the presence of the Owners Representative verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity. This shall include a review of TAB methods and established control setpoints. Physically verify that at least one leg, from fan to diffuser, during full cooling, has all balancing dampers for terminal units taking off downstream of the static pressure sensor wide open, with the damper for the terminal unit on the critical leg 90% or more open.

E. No seasonal tests are required.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage from nameplate
   5. Phase, voltage, amperage from actual, no load conditions.
   6. RPM
   7. Service factor
   8. Starter size, rating, heater elements
   9. Sheave Make/Size/Bore

B. VFDs:
   1. Manufacturer
   2. Model
   3. Actual RPM
   4. Phase, voltage, amperage
   5. Operating Hz

C. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center-to-center distance, maximum, minimum, and actual

D. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP
   7. Actual flow rate, pressure drop, BHP
   8. Discharge pressure
   9. Suction pressure
   10. Total operating head pressure
   11. Shut-off, discharge and suction pressures
   12. Shut-off, total head pressure

E. Air Cooled Condensers:
   1. Identification/number
   2. Location
   3. Manufacturer
   4. Model number
   5. Serial number
   6. Entering DB air temperature, design and actual
   7. Leaving DB air temperature, design and actual
   8. Number of compressors

F. Heat Exchangers:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Model number

6. Serial number
7. Entering/leaving temperature for outside air
8. Entering/leaving temperature for exhaust air
9. Heat exchanger pressure drop

G. Cooling/Heating Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual
10. Saturated suction temperature, design and actual
11. Air pressure drop, design and actual

H. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Show filter static pressure, specified and actual
11. Inlet pressure
12. Discharge pressure
13. Sheave Make/Size/Bore
14. Number of Belts/Make/Size
15. Fan RPM

I. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow

J. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size

11. Fan RPM

K. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

L. Duct Leak Tests:
1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
    a. Blower
    b. Orifice, tube size
    c. Orifice size
    d. Calibrated
7. Test static pressure
8. Test orifice differential pressure
9. Leakage

M. Electric Unit/Wall heaters:
1. Manufacturer
2. Type
3. Identification/number
4. Location
5. Model number
6. Size
7. Air flow
8. Air temperature rise

N. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass Fiber Flexible Duct Wrap Insulation

B. Glass Fiber Rigid Duct Wrap Insulation

C. Jackets for Duct Wrap Insulation

D. Duct Liner

E. Plenum Waterproofing

F. Laminated Flexible Elastomeric Cellular Insulation for Exterior Use

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 23 31 00 - HVAC Ductwork and Casings:

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.

K. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide data for all materials.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on-site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Do not store excess material in the building. Provide secure dry storage on-site, to store material.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION INSTALLED INSIDE BUILDINGS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 MANUFACTURERS

A. Knauf Fiber Glass

B. Johns Manville Corporation

C. Owens Corning Corp

D. CertainTeed Corporation

E. Pittsburgh Corning Corporation

F. Armacell International

G. Approved equal.

2.03 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0% by weight.

B. Usage: HVAC Air Distribution Systems Ductwork - Interior - Medium to Low Temperatures.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.

E. Tie Wire: Annealed steel, 16 gage.

2.04 PLENUM WATERPROOFING

A. Coordinate installation of a continuous self-adhering rubberized asphalt flashing, extend up each side a minimum of 6" and extend from the weatherproof louver back 4' or to the end of the plenum and up 6"; corners to be sealed watertight. Mechanical Contractor to provide certification letter stating Plenum Waterproofing has been installed in all plenums; provide a copy to the Owner's Commissioning Agent and Owner's representative.

2.05 CLOSED CELL DUCT LINER INSULATION

A. Manufacture:
   1. Armacell International
   2. Approved Equal

B. Insulation: Closed Cell elastomeric duct insulation
   1. Fiber Free, Non-particulating, formaldehyde free
   2. Greenguard gold certified

3. Incombustible closed cell foam complying with ASTM C 1071, C 534; flexible insulation, shown to be mold, fungus and bacteria resistant by testing to UL 181, ASTM G 21/C1338, ASTM G22.
4. Apparent Thermal Conductivity: Maximum of 0.245 at 75 degrees F.
5. Temperature usage 220F to -297F
6. Water Vapor Permeability: 0.05 perm-in
7. Flame Smoke rating 25/50
8. Erosion resistance: ASTM C1071 – does not break away, flake off or show evidence of delamination at velocities of 10,000ft/min
9. Thermal: R-4.2 per inch.
10. Minimum Noise Reduction Coefficients: NRC=0.4 for 1” thickness

C. Usage: Line Duct as detailed in paragraphs below.

D. Adhesive: Waterproof, fire-retardant type.

2.06 LAMINATED FLEXIBLE ELASTOMERIC CLOSED-CELL INSULATION FOR EXTERIOR USE

A. Manufacturer:
1. Armacell International (Armaflex) Armatuff
2. Approved equal

B. Closed-cell insulation with 12 mil embossed laminate surface with self-adhesive backing, UV-resistant.

C. Usage: Wrap exterior ducts, including dust collector ductwork.

2.07 JACKETS

A. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
1. Thickness: 0.016".
2. Finish: Smooth.
3. Fittings: 0.010" thick die shaped fitting covers with factory attached protective liner.
4. Metal Jacket Bands: 3/8" wide; 0.010: thick stainless steel.

B. Prefabricated Flexible Self-adhering Membrane
1. Manufacturers/Product:
   a. MFM Building Products; Flexclad
   b. Polyguard; Alumaguard
   c. Venturetape; VentureClad
   d. Approved equal.
2. Composed of aluminum composite foil, polymer film, and rubberized asphalt adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ductwork pressurization has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards; have a copy on site for reference. Employ only skilled tradesmen specializing in this kind of work.

C. Insulated ductwork conveying air, below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, flexible connections, and expansion joints.

D. Insulated ductwork conveying air above ambient temperature:

1. Provide with standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ductwork Exposed in finished Spaces: Finish with stainless steel jacket.

F. Exterior Duct Insulation Applications: Provide laminated closed-cell insulation, locate seams so as to prevent water infiltration.
1. Secure insulation with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct Liner Application:
1. Adhere insulation with adhesive for 90% coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

H. Except for specific exceptions, insulate entire specified duct system. Insulate each duct individually. Do not use scrap pieces of insulation where a full length section will fit.

I. The insulation thickness, layers, and installation method shall be as recommended by the manufacturer to maintain the fire integrity and performance rating. Insulation shall be continuous through all sleeves and openings.

3.03 SCHEDULES

A. Provide thickness of insulation to meet or exceed Washington State Energy Code and or local codes whichever are more stringent.

B. Special Requirements - DUCT LINER.
1. Duct liner for this project will be 1" unless noted otherwise in Contract documents.
2. Line ALL of the following ductwork (see exceptions in #4 below);
    a. Rectangular Supply ductwork
    b. Rectangular Return ductwork.
    c. Rectangular Relief ductwork.
    d. Rectangular Exhaust ductwork, from the fan to the last air terminal, unless such ductwork contains corrosive gases.
        1) Do not line fume hood or dust collector ductwork.
    e. Rectangular Transfer Air ductwork.
    f. Rectangular Outside Air ductwork.
3. Additional requirements may be shown on the plans and are in addition to the requirements specified herein.

C. Special Requirements - DUCT WRAP.
1. Wrap all of the following ductwork:
    a. Outside air ductwork within 6' of an outside air intake.
    b. Concealed supply, return, and outside air ductwork and plenums, except within 10' of the floor in Mechanical spaces.
    c. Exposed supply, return and outside air ductwork and plenums, located within 10' of the floor in Mechanical spaces. Provide rigid insulation with vapor barrier jacket.

d. Ductwork that is located on the exterior of the building: Wrap with laminated flexible elastomeric cellular insulation.
e. Plenums.
f. Outside air and relief/exhaust air ductwork from damper to building opening, louver, or hood. Insulation R-value is to match building envelope insulation R-value regardless of location, per the requirements of the Washington State Energy Code.

2. Duct wrap shall not be used in the following applications:
   a. In conditioned spaces, do not wrap ductwork exposed to view within a zone that serves that zone.

D. Provide insulation thicknesses per Washington State Energy Code as a minimum.

END OF SECTION

SECTION 23 08 00
MECHANICAL COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Mechanical Contractor's responsibilities, and that of his subcontractors, for commissioning; each subcontractor or installer is responsible for the installation of a particular system or equipment item to be commissioned, and is responsible for the commissioning activities relating to that system or equipment item.

B. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment, including plumbing systems.
   4. Ductwork and accessories.
   5. Terminal units.
   6. Sound control devices.
   7. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
   8. Indoor Air Quality Procedures: The CA will coordinate and Contractor will execute; see Section 01 57 21.

C. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 23 09 93 - Sequence of Operations for HVAC Controls.

B. Section 23 05 93 - Testing, Adjusting, and Balancing.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996

1.04 SUBMITTALS

A. HVAC Control System Documentation: Submit detailed sequences of operation, control system drawings, and points list, as specified in Section 23 09 93.
   1. Incorporate the sequence of operation information specified in other HVAC specification sections.
   2. Incorporate the shop drawing submittal information specified in the HVAC control system section.
   3. Submittals prepared for other sections may be used in preparation of this documentation.

B. Updated Submittals: Keep the CA informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

C. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled.

D. System name.

E. List of devices.

F. Step-by-step procedures for testing each controller after installation, including:
   1. Process of verifying proper hardware and wiring installation.

2. Process of downloading programs to local controllers and verifying that they are addressed correctly.
3. Process of performing operational checks of each controlled component.
4. Plan and process for calibrating valve and damper actuators and all sensors.
5. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
6. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
7. Description of the instrumentation required for testing.
8. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

G. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of CA.

H. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Minimum air flow rate.
    h. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.

i. Program setups (software program printouts).

I. Project Record Documents: See Section 01 78 00 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and airflow stations on project record drawings.

J. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

K. Training Manuals: See Section 01 79 00 for additional requirements.
1. Provide three extra copies of the controls training manuals, to be include in the O & M manuals.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup, initial checkout, and required functional performance testing. Unless noted otherwise, such testing equipment will not become the property of the Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare a preliminary schedule for HVAC and domestic water piping, duct systems testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the CA; update the schedule as it changes.

B. Put all equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

C. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

D. Provide temperature and pressure taps in accordance with the contract documents.
1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests for each item of equipment or other assembly to be commissioned.

C. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use. This includes handheld control system interface for setting terminal unit boxes, etc.

E. Have all Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start functional testing until all controlled components have themselves been successfully functionally tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the functional testing of the control system.

D. Functional testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50% more points than specified.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test Procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Functional test the complete sequence of operations for all equipment.

G. Demonstrate during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

H. Demonstrate:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. All control sequence of operations function as designed.
   3. That scheduling features are fully functional and set up, including holidays.
   4. That all graphic screens and value readouts are completed.
   5. Correct date and time setting in central computer.
   6. That field panels read the same time as the central computer; sample 10% of field panels; if any of those fail, sample another 10%; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad. Demonstrate 100% of panels and 10% of ports; if any ports fail, sample another 10%; if any of those fail, test all remaining units at no extra cost to Owner.
   8. Power failure and battery backup and power-up restart functions.
   9. Global commands features.
   10. Security and access codes.
   11. Occupant over-rides (manual, telephone, key, keypad, etc.).
   12. Operation and maintenance schedules and alarms.
   13. Occupancy sensors and controls.
   14. Communications to remote sites.
   15. All control strategies and sequences not tested during controlled equipment testing.
   16. Trend logging and graphing features that are specified.
   17. Other integrated tests specified in the contract documents
   18. That control system features that are included but not specified to be set up are actually installed.

I. Perform and submit trend logging on the following using the control system, for minimum period of five (5) days including one weekend, if the control points are monitored by the control system:
   1. Sequential staging ON of equipment; optionally demonstrate manually.
   2. Optimum start-stop functions.
   3. Miscellaneous equipment current or status for duty cycling and demand limiting.
   4. Equipment optimum start/stop functions.

J. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 and 23 00 10 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 23 00 10 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner's personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the minimum durations of training, as called for in the individual equipment specifications.

E. TAB Review: Instruct Owner's personnel for minimum four (4) hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off site, the training may occur prior to final completion of the system installation.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of eight (8) hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be

considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
d. Every display screen, allowing time for questions.
e. Use of keypad or plug-in laptop computer at the zone level.
f. Use of remote access to the system via phone lines or networks.
g. Setting up and changing an air terminal unit controller.
h. Graphics generation.
i. Point database entry and modifications.

3. Phase 3 - Post-Occupancy: Six (6) months after occupancy conduct minimum of eight (8) hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer's representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Requirements for Field Devices
B. Automatic Control Dampers (Motorized Dampers)
C. Automatic Control Damper - Actuators
D. Control Panel
E. Input / Output Sensors
F. Miscellaneous Accessories
G. Switches - Electric
H. Temperature Sensors
I. Thermostats

1.02 RELATED REQUIREMENTS

A. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.
B. Section 23 09 23 - Direct-Digital Control System for HVAC.
C. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods for Testing Dampers for Rating; Air Movement and Control Association International, Inc..
B. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association.
E. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module used on this particular project.
B. Manufacturer's Instructions: Provide for all manufactured components.
C. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. Provide a two (2) year manufacturer’s warranty on equipment, covering parts and labor.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. The following field devices may or may not be used on this project. See Section 23 09 23.1 Direct Digital Control System for HVAC and 23 09 93 HVAC Sequence of Operation for specific field devices required. The following alphabetical listing of field devices is provided to establish a quality and operating range for commonly used devices.

C. Thermostats:
   1. Where thermostats are located on exterior walls, provide insulating pad behind thermostat.

2.02 AUTOMATIC CONTROL DAMPERS (MOTORIZED DAMPERS)

A. Manufacturers
   1. Ruskin
   2. Greenheck
   3. Vent Products
   4. Air Balance
   5. Johnson Control
   6. Honeywell
   7. Approved equal.

B. General:
   1. Performance: Test in accordance with AMCA 500-D.
   2. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage.
   3. Blades: Galvanized steel, maximum blade size 6" wide, 48" long, minimum 22 gauge, attached to minimum 1/2" shafts with set screws.
   4. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable. Suitable for 0 degrees F to 180 degrees F operating temperature.
   5. Jamb Seals: Spring stainless steel.
   6. Shaft Bearings: Oil impregnated sintered bronze.
   7. Linkage Bearings: Oil impregnated sintered bronze.
   8. Blade linkages shall be attached at mid-point of blade length.
   9. Leakage: Less than 1% based on approach velocity of 2000 ft/min and 4” wg.
   10. Maximum Pressure Differential: 6" wg.
   11. Temperature Limits: -40 to 200 degrees F.
   12. Provide actuators as required for application.
   13. Provide one actuator for every 20 sq. ft. of damper.
   14. Actuators shall utilize spring return on all outside air applications.
   15. Actuators shall be manufactured by Belimo or approved equal.

C. Low Leakage Two-Position type

1. Parallel blade type with construction and performance same as specified for low leakage modulating type.
2. Airfoil blades shall be equipped with 0.50" minimum thickness axles, stainless steel or bronze sleeve bearings, field-replaceable EDPM or vinyl edge seals, and a flexible aluminum or stainless steel compression type jamb seal.
3. Leakage shall not be greater than 4 cfm/square foot at 1.0” static pressure difference.
4. Damper shall have a maximum operating static pressure differential of 6.00" and be capable of operating with face velocities up to 3,000 fpm.
5. Unless otherwise indicated, dampers shall be same size as duct; where dampers are not installed in a duct, dampers shall be sized for a maximum pressure drop of 0.05" at maximum design airflow.
6. Actuators shall be manufactured by Belimo or approved equal.
7. Ruskin CD50 or approved equal.

2.03 AUTOMATIC CONTROL DAMPER - ACTUATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20% greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two-position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 20 square foot damper section.

B. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.
   2. Electric control actuation shall utilize direct coupled actuators. Belimo or approved equal.
   3. Damper actuators shall be Brushless DC Motor Technology with stall protection, bidirectional, fail-safe spring return (where shown on Plans or in sequence of operation as normally open or normally closed), all metal housing, manual override, and independent adjustable dual auxiliary switch. 120v
   4. The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard 1/2" diameter shaft or damper blade.
   5. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.
   6. Actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with damper shaft.
   7. All actuators having more than a 100 lb-in torque output shall accept a 1" diameter shaft directly, without the need for auxiliary adapters.
   8. All actuators shall be designed and manufactured using ISO900 registered procedures, and shall be listed under Standards UL873 and CSA22.2 No. 24-93 I.

2.04 CONTROL PANEL

A. NEMA 250, general purpose utility enclosures with enameled finished face panel.

B. Provide common keying for all panels.

2.05 GUARDS, GENERAL

A. Heavy-duty plastic-coated metal type with secure backing plate, removable with a Phillips screw driver.

B. Polycarbonate vented lockable guard for thermostats.

C. Provide where shown on drawings or as required in the Sequence of Operation.

2.06 LIQUID IMMERSION TEMPERATURE SENSOR

A. Temperature monitoring range: 20 degrees F TO 120 degrees F for cooling applications, and 70 degrees F TO 220 degrees F heating application.

B. Output Signal: compatible with domestic water recirculation pump

C. Calibration Adjustments: 0 and span (field adjustable).

D. Accuracy at Calibration point: +/- 0.5 degree F.

E. RTD Material: Platinum 100 ohm.

2.07 SWITCHES - ELECTRIC

A. Door
   1. Switch for installation in door jamb (concealed) with pushbutton, so that opening door causes switch action.

B. Wall, On/Off
   1. Standard wall box type switch, single pole, with illuminated switch to indicate that controlled item is on. Provide with stainless steel wall plate, labeled as to function. Leviton or approved equal.

C. Wall, Three-Position
   1. Standard wall box-type switch, with center “OFF” position, pole and throw to suit application. Provide with stainless steel wall plate labeled as to function and each switch position. Arrow-Hart 4356, 4357, 4361, 4371 or approved equal.

2.08 TEMPERATURE SENSORS

A. All temperature sensors shall be solid state electronic, factory-calibrated to within 0.5 degree F, interchangeable with housing appropriate for application.

B. Wall sensors to be installed as indicated on drawings. Mount 48" above finished floor.

C. Duct sensors to be installed such that the sensing element is in the main air stream.

D. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day. Provide element with sun shade to minimize solar effects. Mount sun shade at least 3” from building outside wall. Sun shade shall not inhibit the flow of ambient air across the sensing element. Shade shall also protect sensing element from snow, ice and rain.

E. Duct (single point) temperature:
   1. Temperature monitoring range: / -20 to 120 degrees F.
   2. Output signal / Changing resistance.
   3. Accuracy at Calibration point: +/-0.5 degrees F.

F. Duct Averaging temperature:
   1. Temperature monitoring range: -20 to 120 degrees F.
   2. Output signal: 4 - 20 ma DC.
   3. Accuracy at Calibration point: 0 .05 degrees F.
   4. Sensor probe length: 25' L.

G. Outside air temperature:
   1. Temperature monitoring range: -40 to 120 degrees F.
   2. Output signal: 4 - 20 ma DC
   3. Accuracy at calibration point: +/- 0.5 degrees F.

2.09 THERMOSTATS

A. Line-Voltage Thermostats:

1. Integral manual On/Off/Auto selector switch, single or two pole as required.
2. Dead band: Maximum 2 degrees F.
3. Cover: Locking with set point adjustment, with thermometer.
4. Rating: Motor load.

B. Reverse-acting Thermostats for exhaust fans
1. Integral manual On/Off/Auto selector switch, single or two pole as required.
2. Dead band: Maximum 2 degrees F.
3. Cover: Locking with set point adjustment, with thermometer.
4. Rating: Motor load.
5. Thermostat shall activate equipment when a preset high temperature is detected.

C. Room Thermostat Accessories:
1. Thermostat Covers: Brushed aluminum.
2. Insulating Bases: For thermostats located on exterior walls.
3. Thermostat Guards: Locking transparent plastic mounted on separate base.
4. Adjusting Key: As required for device.
5. Aspirating Boxes: Where indicated for thermostats requiring flush installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as, but not limited to, air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as, but not limited to, air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 48" above floor. Align with lighting switches and humidistats.

C. Mount freeze-protection thermostats using flanges and element holders.

D. Mount outdoor-reset thermostats and outdoor sensors inside building. Locate sensing elements on exterior of building; include sun shield.

E. Provide separable sockets for liquids, and flanges for air bulb elements.

F. Provide guards on thermostats in entrances, public areas, and where indicated.

G. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

H. Mount control panels adjacent associated equipment on vibration free walls or free-standing unistrut supports. A single cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

I. Install "HAND/OFF/AUTO" selector switches to override automatic interlock controls when switch is in "HAND" position.

J. Provide electrical material, conduit, electrical wiring, and installation in accordance with the Divisions 26, 27, and 28.

K. Provide insulating pad behind thermostat if thermostats are located on exterior walls.

END OF SECTION

SECTION 23 09 23.1
DIGITAL CONTROL – VRF SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System Description

B. Operator Interface

C. Controllers

D. Power Supplies and Line Filtering

E. System Software

F. Controller Software

1.02 RELATED REQUIREMENTS

A. 23 09 13 - Instrumentation and Control Devices for HVAC

B. 23 09 23 - Direct-Digital Control System for HVAC

C. 23 09 93 - Sequences of Operation for HVAC Controls

1.03 SCOPE

A. Provide a City Multi control system to monitor and control Variable Refrigerant Flow equipment provided in this contract. Controls system shall also include DI/DO, AI/AO, boards, PI controllers, etc as needed in order to control/monitor all equipment (including non-VRF equipment) provided as part of this contract. Provide Central head end AE200A system.

1.04 SECTION INCLUDES

A. Control equipment, a fully integrated Building Automation System, incorporating Direct Digital Control (DDC) for energy management, equipment monitoring, and control, and subsystems with native BACnet open communications capabilities, as here in specified.

B. Software, material and equipment shall be standard components, regularly manufactured for this and /or other systems and not custom or proprietary designed specifically for this project.

C. The BAS contractor shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

D. Provide all fire alarm detection and shutdown devices required for HVAC equipment. Provide all required wire and conduit up to fire alarm control panel, unless otherwise specified or shown.

E. The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®

F. The CITY MULTI Controls Network (CMCN) consists of remote controllers, schedule timers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, error email distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

G. All wiring is the responsibility of the Mechanical Contractor.

1.05 RELATED REQUIREMENTS

A. Section 23 81 29 - Variable Refrigerant Flow (VRF) HVAC System

B. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.06 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.07 WARRANTY

A. VRF units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.

B. In addition the compressor shall have a manufacturer's limited warranty for a period of six (6) years from date of installation.

C. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

D. This warranty does not include labor.

1.08 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of twenty-five years of HVAC experience in the U.S. market.

B. The CITY MULTI VRF system shall be installed by a Mitsubishi authorized CITY MULTI Diamond Dealer with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

1.09 SUBMITTALS

A. Product Data: Provide data for each system component and software module. Provide names and pertinent information on any sub tier subcontractors you plan to hire.

B. Shop Drawings:
   1. Submit 5 complete sets of documentation within 31 days after the notice to proceed date. Provide System schematic drawings within 90 days after the notice to proceed date.
   2. Provide 11" x 17" drawings or larger.
   3. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   4. List connected data points, including connected control unit and input device.
   5. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
   6. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
   7. Indicate description and sequence of operation of operating, user, and application software.
   8. Reference Plans for system piping/wiring diagram.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

E. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.10 SYSTEM DESCRIPTION

A. The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

B. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

C. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.

D. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

E. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

F. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

G. System shall be capable of email generation for remote alarm annunciation.

H. Control system start-up is a required service which is to be completed by the manufacturer or a duly-authorized, competent representative that has been factory trained in Mitsubishi controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi CMCN Essentials Training and/or CMCN Hands-On Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

PART 2 PRODUCTS

2.01 CMCN - CITY MULTI CONTROLS NETWORK

A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

B. Electrical Characteristics
   1. The CMCN operates at 30VDC. Controller power and communications shall be via a common non-polar communications bus.
   2. Wiring:
      a. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
      b. Control wiring for the Smart ME remote controller shall be from the remote controller to the first associated indoor unit (TB-5) M-NET connection. The Smart ME remote controller shall be assigned an M-NET address.
      c. Control wiring for the Simple MA and Wireless MA remote controllers shall be from the remote controller (receiver) to the first associated indoor unit then to the remaining associated indoor units in a daisy-chain configuration.
      d. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

e. The AE-200, AE-50, and EW-50A centralized controller shall be capable of being networked with other AE-200, AE-50, and EW-50A centralized controllers for centralized control.

3. Wiring type:
   a. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
   b. Network wiring shall be CAT-5 with RJ-45 connection.

2.02 REMOTE CONTROLLERS

A. Smart ME Remote Controller (PAR-U01MEDU)
1. Capable of controlling up to 16 indoor units (defined as 1 group).
2. Approximately 5.5” x 5” in size and white in color with an auto-timeout touch screen LCD display.
3. Shall support a selection from multiple languages (English, Spanish or French) for display information.
4. Shall support temperature display selection of Fahrenheit or Celsius.
5. Shall control the following grouped operations: On/Off, Operation Mode (cool, heat, auto*, dry, fan and setback* (*R2/WR2-Series Simultaneous Heating and Cooling only)), temperature set point, fan speed setting, and airflow direction setting.
6. Shall support timer settings of on/off/temperature up to 8 times in a day in 5-minute increments.
7. Shall support an Auto Off timer.
8. Shall be able to limit the set temperature range from the Smart ME Remote Controller, or via a PC through a licensed EW-50A. Additionally, the temperature range can be set from a touch screen panel on the TC-24.
9. Room temperature shall be sensed at either the Smart ME Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting.
10. The ME Remote Controller shall only be used in same group with other ME Remote Controllers with a maximum of two ME Remote Controllers per group.
11. The ME Remote Controller shall require manual addressing using rotary dial switch to the M-NET communication bus. The ME Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB5 connection terminal on the indoor unit.

B. Backlit Simple MA Remote Controller (PAC-YT53CRAU)
1. Shall be capable of controlling up to 16 indoor units (defined as 1 group).
2. Shall support temperature display selection of Fahrenheit or Celsius.
3. Shall allow the user to change on/off, mode (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, and fan speed setting and airflow direction.
4. Shall be able to limit the set temperature range from the Backlit Simple MA.
5. Shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting.
6. Shall only be used in same group with Wireless MA Remote Controllers (PAR-FL32MA-E / PAR-FA32MA-E) or with other Backlit Simple MA Remote Controllers (PAC-YT53CRAU), with up to two remote controllers per group.
7. Shall require no addressing.
8. Shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. Shall require cross-over wiring for grouping across indoor units.

PAC-YT53CRAU (Backlit Simple MA Remote Controller)			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation for a single group	Each Group	Each Group

PAC-YT53CRAU (Backlit Simple MA Remote Controller)			
Item	**Description**	**Operation**	**Display**
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display “test run”).	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

2.03 INPUT/OUTPUT (IO) BOARDS

A. Advanced HVAC Controller (AHC)
   1. The AHC shall be capable of providing programmable binary and analog inputs and outputs to control general equipment in conjunction with indoor unit functions and states.
   2. Input and output states and values shall be monitored through the EW-50A or the Smart ME Remote controller.
   3. The Smart ME remote controller shall be able to adjust temperature and humidity set points for equipment controlled by the AHC.
   4. In addition to analog and binary inputs the AHC can monitor M-NET equipment states and sensor values.
   5. Available inputs include room temperature, room humidity, occupancy, brightness, outdoor temperature, inlet/outlet water temperature (PWFY), on/off state, mode, ventilation on/off, error status.
   6. In addition to programmable analog and binary outputs, the AHC can control indoor unit on/off, mode, temperature set point, fan speed, LOSSNAY on/off and LOSSNAY fan speed.
   7. Sequence of Operation shall be specified by the end user and programmed by MEUS Controls Engineer.

B. Digital Input Digital Output (DIDO) Board
   1. The DIDO board shall be capable of providing On/Off control for non-Mitsubishi equipment via the AE-200/AE-50/ EW-50A Centralized Controller’s licensed web browser functions, the touch screen of the AE-200, AE-50, and TC-24 Centralized Controller, the interlock function of the AE-200/AE-50/ EW-50A.

2. Each DIDO board shall have two digital inputs and two digital outputs. Each digital output shall be capable of supporting an independent schedule via the AE-200/AE-50/ EW-50A Centralized Controller's web browser functions and the TG-2000 software. Status indication of the On/Off state of the non-Mitsubishi equipment shall be either via the On/Off status of the digital output or by receipt of a digital input to the DIDO board.
3. The DIDO board shall be capable of receiving a digital input for interlock settings with the CITY MULTI indoor units or digital outputs on the DIDO board. Based on the digital input status the DIDO board shall be capable of setting the following parameter on the indoor unit On/Off, Mode, and Set Temperature to predefined settings. The DIDO board shall also be capable of interlocking the On/Off state of a digital output on the DIDO board based on an onboard channel digital input status or a free contact input status from system indoor units.

C. Analog Input (AI) Board
1. The AI board shall be capable of monitoring temperature or humidity via the AE-200/AE-50/ EW-50A Centralized Controller's web browser functions and the TG-2000 software.
2. Each AI board shall have two analog inputs. Each input shall be capable of receiving a 4/20mA, 0/10 VDC, or 1/5 VDC signal for monitoring temperature or humidity.
3. The AI board shall be capable of monitoring the temperature or humidity input and shall be capable of displaying graphical trending of the temperature or humidity values via the AE-200/AE-50/ EW-50A Centralized Controller's web browser functions and the TG-2000 software.
4. Notification of user adjustable high and low level alarms shall be capable of being emailed to distribution list or outputted via a digital output.
5. The AI board shall be capable of setting the following parameters on the indoor unit On/Off, Mode, and Set Temperature to predefined settings based on the input value of the temperature or humidity. The AI board shall also be capable of interlocking the On/Off state of a digital output on the input value of the temperature or humidity.

2.04 CENTRALIZED CONTROLLERS

A. TE-400 Centralized Controller
1. The TE-400A Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple CITY MULTI outdoor units with the use of three (3) AE-50A expansion controllers.
2. The TE-400A Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply.
3. The TE-400A Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring.
4. Provide licensing fee and enable for all BACnet points to be connected to the building central DDC system.
5. When being used alone without the expansion controllers, the TE-400A Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the AE-200 Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting.
6. Since the TE-400A provides centralized control, it shall be able to enable or disable operation of local remote controllers.
7. In terms of scheduling, the TE-400A Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.
8. All TE-400A Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to

a network switch for IP communication to up to three AE-50A expansion controllers for display of up to two hundred (200) indoor units on the main TE-400A interface.

9. The TE-400A Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.
10. Standard software functions shall be available so that the building manager can securely log into each TE-400A via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs.

TE-400 (Centralized Controller)			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group

TE-400 (Centralized Controller)			
Item	**Description**	**Operation**	**Display**
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *3. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	ET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between “Hi”, “Low” and “Stop”. When setting a group of only free plan LOSSNAY units, you can switch between “Normal ventilation”, “Interchange ventilation” and “Automatic ventilation”.	Each Group	Each Group
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: “Batch start/stop”, “Batch emergency stop” By pulse: “batch start/stop”, “Enable/disable remote controller” Output: “start/stop”, “error/Normal” Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

B. AE-50A Expansion Controller
   1. The AE-50A Expansion Controller shall serve as a an expansion module to the TE-400A Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface of the TE-400A. Up to three (3) AE-50A expansion controllers can be connected to the TE-400A via a local IP network (and their IP addresses assigned on the TE-400A) to the TE-400A to allow for up to two hundred .(200) indoor units to be monitored and controlled from the TE-400A interface.

C. Provide the following software functions per TE-400:
   1. Personal Web Browser: The CMCN shall be capable of allowing up to 50 individual users to monitor and control user defined zones via a network PC or MAC’s web browser.

2.05 SYSTEM INTEGRATION

A. CMCN: System Integration: The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

B. BAC-HD150: BACnet® Interface:
   1. The Mitsubishi Electric Cooling & Heating BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories.
   2. Shall support BACnet Broadcast Management (BBMD).
   3. Shall support a maximum of 50 indoor units.
   4. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.
   5. BACnet control points shall be as follows.

BACnet™ Object ID = Object Type + Instance Number
BACnet™ Instance Numbers

XX XX XX

1st two digits: 01-50, 99 identifies the BAC-HD150 (most often "01")

2nd two digits: 01-50, 99 identifies the group#

Final two digits: 01 – 99 identifies the control point

Control item	Object type	Instance number	Unit					Notes
			Inactive	Active				
			Text-1	Text-2	Text-3	Text-4	Text-5	
On Off Setup	BO	xxxx01	Stop	Run				
On Off State	BI	xxxx02	Stop	Run				
Alarm Signal	BI	xxxx03	Normal	Error				
Error Code	MI	xxxx04	Normal	01: Normal 02: Other errors 03: Refrigeration system fault 04: Water system error 05: Air system error 06: Electronic system error 07: Sensor fault 08: Communication error 09: System error				
Operational Mode Setup	MO	xxxx05	Cooling	Heating	Fan	Auto	Dry	
Operational Mode State	MI	xxxx06	Cooling	Heating	Fan		Dry	
Fan Speed Setup	MO	xxxx07	Low	High	Mid 2	Mid 1		
Fan Speed State	MI	xxxx08	Low	High	Mid 2	Mid 1		
Room Temp [Water Temp]	AI	xxxx09	°F/°C					
Set Temp [Set Water Temp]	AV	xxxx10	°F/°C					
Filter Sign [Circulating Water Exchange Sign]	BI	xxxx11	OFF	ON				
Filter Sign Reset [Circulating Water Exchange Sign Reset]	BV	xxxx12	Reset	Void				
Prohibition On Off	BV	xxxx13	Permit	Prohibit				
Prohibition Mode	BV	xxxx14	Permit	Prohibit				
Prohibition Filter Sign Reset [Prohibition Circulating Water Exchange Sign Reset]	BV	xxxx15	Permit	Prohibit				
Prohibition Set Temperature	BV	xxxx16	Permit	Prohibit				
M-NET Communication State	BI	xxxx20	Normal	Error				
System Forced Off	BV	xxxx21 999921	Reset	Execute				
Air Direction Setup	MO	xxxx22	Horizontal	Downblow 60%	Downblow 80%	Downblow 100%	Swing	
Air Direction State	MI	xxxx23	Horizontal	Downblow 60%	Downblow 80%	Downblow 100%	Swing	
Ventilation Mode Setup	MO	xxxx35	Heat exchange	Bypass	Auto			
Ventilation Mode State	MI	xxxx36	Heat exchange	Bypass	Auto			
Air To Water Mode Setup	MO	xxxx37	Heating	Heating ECO	Hot Water	Antifreeze	Cooling	
Air To Water Mode State	MI	xxxx38	Heating	Heating ECO	Hot Water	Antifreeze	Cooling	
Expansion Controller Communication State	BI	xx9981	Normal	Error				

Figure 1. BACnet Points List

2.06 POWER SUPPLY

A. Power Supply (PAC-SC51KUA)

B. The power supply shall supply 24VDC (TB3) for the TE-400/AE-50 centralized controller and 30VDC (TB2) voltage for the central control transmission.

C. The power supply shall supply 24VDC for the PI controller.

D. Note: The EW-50A has a built-in power supply.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, and wiring, is installed prior to installation proceeding.

3.02 INSTALLATION

A. Third Party Controls: Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

B. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

C. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to Sequence of Operation. Refer to Section 23 09 93.

D. Provide power to each programmable control unit.

E. Provide conduit and electrical wiring in accordance with Division 26. Electrical material and installation shall be in accordance with appropriate requirements of the Electrical Division.

F. Identify equipment, boxes, panels, etc. with permanently mounted phenolic engraved labels.

G. Provide all and quantity of accessory devices (PI controllers, DI/DO, AI/AO boards, etc.) as needed to complete the control sequence of operations see section 23 09 93.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning as described in Section 23 08 00 prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representatives in operation of systems plant and equipment for 24-hours of training, dates and times to be selected by the Owner.

3.04 TEMPERATURE CONTROL SYSTEM ADJUSTMENT

A. After entire heating and ventilating system is operational, the Control Contractor shall calibrate all sensing and readout devices not pre-calibrated at the factory and shall observe the operation of each and every item of equipment and shall submit a report that all items furnished under this contract are functioning according to the intent of the above specifications. The report shall be signed by the individual directly responsible for the supervision of the installation of the Temperature Control System.

B. In addition this Contractor shall schedule and coordinate with the HVAC system Balancer to have a field technician on-site to place all systems in operation as required and to perform necessary adjustments to facilitate the complete balancing of all HVAC systems. The field technician shall be required to be on-site until the entire system is balanced, or provide the Balancer with access to the control system, the Balancer may require the technician be present anyway, if the system fails to operate properly. Scheduling of the foregoing shall be at a time mutually acceptable to the HVAC System Balancing Contractor and the Control Contractor as approved by the Owner’s representative.

C. In addition to above, the Control Contractor will provide a qualified technician to operate and adjust the system while the Owner's Commissioning Agent observes the sequence of operation and the operation of each piece of equipment.

D. Unless stated otherwise, adjust as follows; Control Temperatures within plus and minus two (2) degrees F, Humidity within plus or minus 3% of the set point and Static Pressure within 10% of set point.

3.05 DEMONSTRATION AND INSTRUCTIONS

A. As part of the Owner's training, demonstrate complete and operating systems to the Owner's maintenance personnel.

3.06 COMPLETION

A. Start the Control System Design immediately upon award of the General Contract.

B. Notify the Owner’s representative if a Subcontract has not been provided to the Control Subcontractor within 4 weeks of award of the General Contract.

C. Complete the controls system in a timely manner. Allow time for Balancing and Commissioning to take place prior to substantial completion.

D. Notify the Owner’s representative if the General Contractors Schedule does not allow time to complete the Control work, Balancing, or Commissioning.

E. The Control Contractor has a performance contract and as such is required to complete his work, to allow Balancing and Commissioning to be completed prior to Substantial Completion. Should job conditions delay the project and not allow enough time for the Control Contractor to complete his work, notify the Owner’s representative immediately upon first instance of schedule creep, request additional time from the General Contractor to offset these delays. Continue to notify the Owner’s representative and the General Contractor if the schedule does not improve. The Control Contractor is responsible to be done per the original time line, any delays will need to be established as caused by others and not by the Control Contractor. Future specifications and contracts depend on the Control Contractor performing as contracted on this project.

3.07 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

3.08 COMMISSIONING

A. See Section 23 08 00 for commissioning requirements.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SCOPE

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections. These sequences are for use with an Energy Management Control System (EMCS), incorporating Direct Digital Control (DDC) for energy management, equipment monitoring, and control.

B. Sequence of operation for:
   1. Alarm Reporting
   2. Carbon Dioxide (CO2) Sensors
   3. Dedicated Outside Air System (DOAS)
   4. Door Switch
   5. Ductless Split Systems Electrical/MDF Room
   6. Elevator Machine Rooms
   7. Elevator Sump Pumps
   8. Exhaust Fan - General Instructions
   9. Exhaust Fan - Reverse-Acting Thermostat
   10. Exhaust Fan - Ventilation
   11. Fire Alarm Monitoring and Air Handling Equipment Shutdown
   12. Global Controls
   13. Heat Pumps - VRF Units
   14. Destratification Fans
   15. HVAC Load Management
   16. Night Setback
   17. Occupancy Sensor
   18. Optimum Start/Stop
   19. Outside Air Duct Dampers
   20. Unit Heaters
   21. Unoccupied Mode
   22. Warm-Up Mode - Mechanical Equipment
   23. Water Heaters - Domestic Water

1.02 RELATED SECTIONS

A. Section 23 09 23.1 - Direct-Digital Control System for HVAC.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 SUBMITTALS

A. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. Preface: One or two paragraph overview narrative of the system describing its purpose, components, and function.
   2. State each sequence in small segments, and give each segment a unique number for referencing in Functional Test procedures. Provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.

B. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Provide 5-degree adjustable deadband to meet requirements of Washington State Energy Code.

3.02 ALARM REPORTING

A. Report alarm conditions indicated on the Input/Output Summary to the Operator Station.

3.03 CARBON DIOXIDE (CO2) SENSORS

A. Provide CO2 sensors where scheduled and/or shown on Plans. The average range of the CO2 monitor and percentage of outside air override shall be adjustable at the EMCS.

B. When in the occupied mode, ERV fan speed shall be set at minimum. When the CO2 level rises above 1000 parts per million (PPM), the ERV fan speed shall increase to maximum.

3.04 DEDICATED OUTDOOR AIR SYSTEM (DOAS)

A. Startup/Shutdown: The equipment shall be started and stopped based on an occupied and unoccupied schedule. This schedule and routine shall be capable of easy modification by any user. Upon fan shutdown, the outside damper shall close, exhaust air damper shall close, and return air damper shall be open.

B. Morning Warm-up cycle: Unit shall remain inactive.

C. Provide CO2 control for spaces where shown on plans

3.05 DOOR SWITCHES

A. Provide door switches on garage bay door.

B. Once door has been open for 5 minutes.
   1. Disable the mechanical heating for the electric heaters.

C. After door is closed for 5 minutes, return to normal operation.

3.06 DUCTLESS SPLIT SYSTEMS ELECTRICAL/MDF ROOM

A. Units shall cycle to maintain space temperature setpoint. Connect to central DDC for control/monitoring.

B. Provide high temperature alarm at 85F.

C. Units shall not setback for unoccupied mode.

3.07 DUST COLLECTOR

A. Dust collector shall start automatically upon activation of any piece of woodshop equipment.

3.08 ELEVATOR MACHINE ROOM

A. Ductless split system heat pump shall maintain machine room temperature at temperature range required by elevator machinery manufacturer.

B. Unit shall run continuously; i.e. not shall not shut down for unoccupied mode.

3.09 ELEVATOR SUMP PUMPS

A. Pumps shall operate based on their own internal control system.

B. Pumps shall monitor oil and pump only water.

C. DDC system to monitor pump status/alarm through dry contact interface in pump control panel.

3.10 EXHAUST FAN - GENERAL INSTRUCTIONS

A. Provide control for each fan as scheduled on the drawings.

B. ALL exhaust fans provided on this project shall be interlocked with the VRF central controls system.

C. VRF central control system shall monitor status of each fan. Fans not listed to be interlocked or controlled via thermostat or switch shall be controlled directly from the EMCS (schedule shall be adjustable). Provide adjustable reverse-acting thermostats for all fans as scheduled. Refer to Schedule on Plans for additional control requirements.

3.11 EXHAUST FAN - REVERSE-ACTING THERMOSTAT

A. On rise in temperature to above setpoint (adjustable), the exhaust fan shall be energized, and any associated outside air damper shall open. On a drop in temperature, fan shall be de-energized, and associated damper closed. Fans shall not be de-energized for unoccupied mode.

B. Typical Areas Where Used
1. Shop (Set temp at 70F) EF-2,4

3.12 EXHAUST FAN – VENTILATION EF-1,3

A. Ventilation fans shall operate as scheduled for occupied/unoccupied mode.

B. Occupied mode: Motorized exhaust air and corresponding outside air damper shall open. Fan shall operate.

C. Unoccpied mode: Motorized exhaust air and corresponding outside air damper shall close. Fan shall be disabled.

D. Typical Areas Where Used
1. Shop

3.13 FIRE ALARM MONITORING

A. Monitor fire alarm system for alarm and trouble conditions such that either of these conditions will be communicated to the EMCS host computer equipment.

B. Upon signal from the fire alarm panel, stop all air-handling units, fan coil units, and exhaust fans, supply fans, etc. through software.

3.14 GLOBAL CONTROLS

A. Global shutdown shall be through a software point easily located on the main page for the controls display.

B. Global variables for controls shall include master change for all setpoints together such as: heating/cooling setpoints and offsets, override time, nighttime setbacks, minimum and maximum room setpoints, heating and cooling lockouts, etc., as well as manual overrides for significant outputs such as heating and cooling modes, etc.

3.15 HEAT PUMPS – VRF UNITS

A. The unit shall be controlled by the VRF system EMCS for all modes of operation, functions, and controls. The safeties and shall be controlled with resident control logic and shall be capable of operating in standalone mode if DDC trunk communication is lost. All safeties shall be monitored by the EMCS.

B. Occupied Mode: Cycle fan with compressor to maintain occupied space temperature.

C. Unoccupied Mode: Cycle fan with compressor to maintain unoccupied space temperature.

D. Provide internal safety timers to allow a minimum On and Off time for compressors and fans. Turn off compressor if an operational alarm is detected.

E. Provide "Condensate Out Of Normal Condition" for each heat pump when condensate pan fills to unacceptable levels. Display condition at operator’s terminal.

F. Revert to temporary Occupied Mode when space temperature sensor night override button is pushed; override initially set at 2 hours (adjustable).

3.16 DESTRATIFICATION FANS

A. Fans shall be controlled by wall mounted controller.

B. Controls shall monitor space temperature and humidity and adjust fan speed as need to provide a simulated space temperature.

C. Manual speed override shall be adjustable at wall mounted station (verify final location with owner).

3.17 HVAC LOAD MANAGEMENT

A. Provide connection to a utility demand response/price response signal/peak price period time HVAC load management shall be provided in compliance with Section C406.3.2 of the Energy code

B. Load management shall be activated by utility demand response utility demand response, utility price response signal, peak price period time control, or local building demand monitoring. Provide connection to the utility demand/pricing response program connection. If the utility does not offer such a program, provide a digital input to allow the control in the future.

C. Automatic controls shall:
1. Where electric cooling is used, be configured to gradually increase, over a minimum of three hours, the cooling setpoint by at least 3°F during the summer peak periods.
2. Where electric heating is used, be configured to gradually reduce, over a minimum of three hours, the heating setpoint by at least 3°F during winter peak periods.

3.18 MOTORIZED DAMPERS ON OUTSIDE AIR DUCTS

A. Motorized dampers shall be provided on the outside air ducts (see Plans for locations). Dampers shall open when air handing units being served by that outside air source are energized.

3.19 NIGHT SETBACK

A. Apply to each heating and ventilation zone.

B. Night Setback shall be configured and interlocked with the building schedule.

C. Night Setback temperature shall be adjustable.

D. Building schedule shall be fully configurable allowing for each day and hour per year.

3.20 OCCUPANCY SENSOR

A. Where indicated on Electrical Plans, occupancy sensors will be furnished under Division 26. Where the sensors are provided with auxiliary contacts do the following.

B. On indication that the zone is unoccupied for a set time interval (initially set at 5 minutes, adjustable), set DOAS unit fan speed to minimum speed setting and increase the deadband width for heating and cooling to 2 degrees (adjustable) below and above setpoint.

C. When the zone becomes occupied, revert to normal control.

3.21 OPTIMUM START/STOP

A. Apply the Optimized Start/Stop program to each heating and ventilation zone.

B. Optimized Start/Stop shall be fully configurable; provide all required hardware, sensors and programming to enable Optimum Start/Stop.

C. Optimized Start/Stop shall automatically adjust start time for each individual unit to achieve setpoint temperature 30 minutes prior to occupancy.

D. Building schedule shall be fully configurable allowing for each day and hour per year.

3.22 OUTSIDE AIR DUCT DAMPERS

A. Motorized dampers on the outside air ducts (see Plans for locations) shall open when air handing units being served by that outside air source are energized and in an occupied or economizer cooling mode.

3.23 UNIT HEATERS

A. Units shall be controlled from wall mounted thermostat.

B. Maintain constant space temperature by cycling unit fan motor and energizing electric heating elements. Integral thermostat continues fan operation until element temperature falls below 100 degrees F (adjustable).

C. Maintain unoccupied setback temperature in unoccupied mode.

3.24 WALL HEATERS

A. Units shall be controlled built in thermostat set at 45F.

B. Maintain constant space temperature by cycling unit fan motor and energizing electric heating elements. Integral thermostat continues fan operation until element temperature falls below 100 degrees F (adjustable).

3.25 UNOCCUPIED CYCLE

A. Occupied/Unoccupied mode shall be based on scheduling.

B. ERV’s shall be Off

C. All Outside and exhaust air dampers shall be closed

D. Ventilation fans shall be off.

E. VRF shall cycle to maintain setback space temperatures.

F. Revert to temporary Occupied Mode when space temperature sensor night override button is pushed; override initially set at 2 hours (adjustable).

3.26 WARM-UP MODE - MECHANICAL EQUIPMENT

A. Control system optimum-start controls shall provide warm-up switching for all items indicated as having a warm-up cycle. The outside air dampers and ERV’s shall remain off/fully closed during the warm-up cycle until the space temperature heating setpoint is reached or occupied period begins, whichever occurs first.

3.27 WATER HEATERS, DOMESTIC WATER SYSTEM

A. Water heater shall remain in continuous operation (24/7) in order to avoid allowing growth of Legionella. Set water temperature as shown in Schedule on Plans. If no temperature is shown, minimum water temperature shall be 120 degrees; 140 degrees storage temperature is preferred.

B. Occupied Mode: Water heater is enabled. Start hot water circulator before occupancy, initially set at 30 minutes (adjustable). Provide aquastat to sense return water temperature and cycle the pump.

C. Unoccupied Mode: Water heater is enabled and pump is off.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING AND SPECIALITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping

B. Refrigerant

C. Valves

D. Flexible Connections

E. Insulation

F. Jackets

1.02 RELATED REQUIREMENTS

A. Section 23 00 20 - Basic Materials and Methods; Inserts

B. Division 31 - Excavation, Fill, Trenching

1.03 REFERENCE STANDARDS

A. ASHRAE Standard 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; (ANSI/ASHRAE Standard 15).

B. ASHRAE Standard 34 - Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

D. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes; The American Society of Mechanical Engineers.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers.

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

H. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

I. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; and errata.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

K. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

L. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

M. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical

N. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SYSTEM DESCRIPTION

A. Valves:

1. Use service valves on suction and discharge of compressors.

B. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.05 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Test Reports: Indicate results of leak test, acid test.

D. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

E. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures shall conform to ASME (BPV IX) and applicable state labor regulations.

C. Provide Welder Certification in accordance with ASME (BPV IX).

D. Products Requiring Electrical Connection shall be listed and classified by UL as suitable for the purpose indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers; seal prior to shipment and keep sealed until connected into system.

PART 2 PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B 280, H58 hard drawn cleaned, dehydrated and sealed marked ACR on hard tempered straight tubing.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy, with between 5% & 15% silver.

B. Condensate
   1. Copper Tube: ASTM B 88, Type L (B), drawn.
   2. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   3. Joints: ASTM B 32, Lead Free Solder.
   4. Insulation: Condensate piping shall be insulated end to end with closed-cell pipe insulation with a minimum of ½” thick insulation.

C. Mitsubishi VRF System

1. Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.
2. Refrigerant pipe for CITY MULTI shall be made of phosphorus deoxidized copper, and has two types.
    a. ACR Type-L “Annealed Temper”: Soft copper pipe, can be easily bent with human hand.
    b. ACR Type L “Drawn Temper”: Hard copper pipe (straight pipe).
3. The maximum operation pressure of R410A air conditioner is 4.30 MPa [623psi] . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications in Mitsubishi Electric’s engineering manual. Pipes of radical thickness 0.7mm or less shall not be used.
4. Insulation: Refrigerant lines, as well as any valves, shall be insulated end to end with closed-cell pipe insulation, thickness as required by the Washington State Energy Code or local jurisdiction, whichever is more stringent.

D. ETL tested to UL 207 and ETL listed copper to copper fittings for connecting copper-to-copper refrigerant piping.

E. Pipe Supports and Anchors:
1. Conform to ASME B31.5.
2. Hangers for Pipe Sizes 1/2" to 1-1/2": Malleable iron adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2" and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3": Cast iron hook.
6. Wall Support for Pipe Sizes 4" and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded. Zinc plated.

2.02 REFRIGERANT

A. Refrigerant: R454B and R32. Verify with equipment manufacturer prior to charging.

2.03 VALVES

A. Manufacturers:
1. Sporlan Valve Company
2. Approved equal

B. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals. Maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

2.04 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Circuit Hydraulics, Ltd.
2. Flexicraft Industries
3. Penflex
4. Reflock
5. Approved equal

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9" long with copper tube ends; for maximum working pressure of 500 psi.

C. Double braided stainless steel flexible pipe connections with Reflock end connections.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible. ASTM E84 25/50 for use in plenums.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Usage: Refrigeration/Condensate Piping - Interior / Exterior.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Interior pipe installations: No finish is required over concealed insulation indoors. Apply two coats of manufacturer's recommended finish, where insulation is exposed indoors.

E. Interior pipe installations within 10’ of finished floor in the shop. Provide with stainless steel jacketing.

F. Inserts: Provide inserts at all support locations; see Section 23 00 20.

G. Exterior pipe installations:
   1. Apply one coat of manufacturer's recommended finish
   2. Apply lineset covers

2.06 JACKETS

A. PVC Plastic.
   1. Covering Adhesive Mastic:
      a. Compatible with insulation.
   2. Usage: Interior fittings

B. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
   1. Thickness: 0.016”.
   2. Finish: Smooth.
   3. Metal Jacket Bands: 3/8” wide; 0.010” thick stainless steel.
   4. Usage: Interior shop space within 10’ of finished floor.

C. Lineset Covers
   1. Manufacturers
      a. Fortress
      b. SpeediChannel
      c. SlimDuct
      d. Approved equal
   2. Sized to cover refrigerant piping and insulation.
   3. Zinc-coated sheet metal ducting. SlimDuct RD-series or approved equal.
   4. Usage: Exterior Piping

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Slope condensate piping to drain. Where air gaps are utilized cut condensate piping termination at 45 degree angle.

D. Install piping to conserve building space and avoid interference with use of space.

E. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
   4. Place hangers within 12" of each horizontal elbow.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Provide vibration isolation hangers for all refrigeration piping. Refrigeration piping shall not be attached to the building structure.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 31 00.

K. Flood copper piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

N. Insulate piping and equipment

O. Follow ASHRAE Standard 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

Q. Fully charge completed system with refrigerant after testing.

R. Provide electrical connection to solenoid valves.

S. Mitsubishi VRF Systems:
   1. Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer’s installation manual for full instructions.
   2. Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen according to manufacturer’s installation instructions and warranty requirements. Test to no leakage.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct Materials

B. Ductwork Fabrication

C. Manufactured Metal Ductwork and Fittings

D. Duct Cleaning

1.02 RELATED REQUIREMENTS

A. Section 23 00 20 - Basic Materials And Methods for HVAC

B. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

C. Section 23 33 00 - Air Duct Accessories.

D. Section 23 37 00 - Air Outlets and Inlets.

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

F. Division 31 - Excavation, Fill, Trenching.

1.03 REFERENCE STANDARDS

A. ASTM A 36 - Standard Specification for Carbon Structural Steel.

B. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.

D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.

E. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association.

F. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.

H. All codes and reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission of the Architect and Engineer. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. Meet or exceed SMACNA requirements for all sheet metal systems.

B. Leakage Testing (High Velocity): Test the system for leaks in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Maximum permissible leakage shall be 1% of the total system flow. All audible leaks shall be eliminated.

C. Leakage Testing General Requirements: Maximum permissible leakage shall be as noted in the Washington State Energy Code, or as noted in these specifications, whichever is more stringent.

1.05 SUBMITTALS

A. Product Data: Provide data for all materials.

B. Shop Drawings: Indicate ducts, fittings, and particulars such as gage, sizes, welds, and configuration prior to starting work on systems. Duct design pressure rating is posted on contract drawings, shop drawings shall reflect pressure class as shown. Shop drawings are to clarify duct routing taking into consideration structural members, electrical equipment, and other mechanical equipment. Shop drawings shall callout heights for all exposed ductwork, ductwork shall be as high as possible, ducts/grds/equipment shall be above 6’8 in mechanical spaces, 8’ in all other spaces. Contractor to highlight all exposed duct/GRD’s/equipment that is lower than 8’6 on drawings. Contractor to submit shop drawings for review.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

D. Manufacturer's Installation Instructions.

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, 90B, 96 and SMACNA standards.

1.08 FIELD CONDITIONS

A. Do not install lined duct in wet locations. Contractor to keep ends of lined duct covered at all times. If lined duct becomes wet or dirty, remove from jobsite and replace with new duct. The General Contractor to provide weather protection if his schedule requires the sheet metal subcontractor to working ahead of the building being dried in.

B. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Provide duct assemblies as shown on Plans.

2.02 MATERIALS

A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653 FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

C. Insulated Flexible Ducts:
   1. Manufacturers:
      a. Thermaflex Model G-KM
      b. Approved equal
   2. Chlorinated polyethylene core supported by helically wound coated spring steel wire; fiberglass insulation; black polyethylene vapor barrier film.
      a. Pressure Rating: 6" wg positive and 1" wg negative.
      b. Maximum Velocity: 5000 fpm
      c. Temperature Range: -20 degrees F to 200 degrees F continuous.
      d. R-4.2, meeting UL 181, & NFPA 90A - 90B fire codes, self-extinguishing.
      e. GREENGUARD certified for Children and Schools.

f. Acoustically rated.
g. Warranted for 10 years
h. Maximum length 6'.
i. Install per manufacturer's recommendations.
j. Run insulated flexible duct as straight as possible.

D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

E. Outside/Exhaust Air: +/-2” w.g. pressure class, galvanized steel.

F. Supply/Return Air: +/-2” w.g. pressure class, galvanized steel.

G. Dust collector ductwork: See section 23 35 14

H. Hanger Rod: ASTM A 36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and SMACNA High Velocity Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

E. T's, bends, and elbows: Construct according to SMACNA (DCS).

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide minimum 12" long plenum same size as the louver, sloped to drain to the exterior. Line plenum with self-adhering rubberized asphalt flashing as shown on Plans; seal plenum to louver frame and duct. Connect duct to plenum with 45 degree divergence fittings.

J. Contractor may use the Ductmate connection system at his option. System consists of flanges with integral sealants, corner pieces, clips, bolts, cleats and gaskets.

2.04 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacturers
1. Metal-Fab, Inc.
2. SEMCO Incorporated
3. United McGill Corporation
4. Local shop fabrication by installing contractor.
5. Approved equal

B. Manufacture in accordance with SMACNA HVAC Duct Construction Standards as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated on drawings.

C. Single Wall Round Duct And Fittings: Materials shall be per SMACNA HVAC Duct Construction Standards, Metal and Flexible, Galvanized Sheet Metal. Provide spiral duct.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. General:
1. Install in accordance with manufacturer's instructions.
2. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
3. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
4. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
5. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
6. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
7. Use crimp joints with or without bead for joining round duct sizes 8" and smaller with crimp in direction of air flow.
8. Use double nuts and lock washers on threaded rod supports. Cut rods flush with second nut.
9. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
10. Connect diffusers to low pressure ducts directly or with 6' maximum length of flexible duct held in place with strap or clamp.
11. At exterior wall louvers, provide minimum of 12" long plenum same size as louver and sloped to the exterior. Plenum shall be lined with self-adhering rubberized flashing as detailed on Plans. Seal plenum to louver. Connect duct to plenum with 45 degree divergence.
12. Install ductwork and equipment to maintain maximum clearance above floor.

3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Repair any damage caused to duct lining caused by cleaning operation.
1. Duct cleaning required, when contractor fails to protect duct prior to installation and or keep ends covered once duct is installed.

B. Remove all labels from exposed ductwork, including ductwork in mechanical spaces. Labels may remain on ducts in concealed locations only.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air Turning Devices
B. Backdraft Dampers
C. Duct Access Doors
D. Duct Test Holes
E. Flexible Duct Connections
F. Motorized Dampers
G. Remote Access For Volume Control Dampers
H. Sleeves For Ducts Through Non-Fire-Rated Walls
I. Volume Control Dampers

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.
B. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences.
C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.
D. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Krueger
   2. Price Industries
   3. Ruskin Company
   4. Titus
   5. Approved equal
B. Multi-blade device with blades aligned in short dimension, steel construction, with individually adjustable blades and mounting straps.

C. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
1. Greenheck Fan Corporation
2. Louvers & Dampers, Inc.
3. Nailor Industries Inc.
4. Ruskin Company
5. Approved equal

B. Gravity Backdraft Dampers, Size 18” x 18” or smaller, furnished with air moving equipment shall be air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Backdraft Dampers - Vertical:
1. Maximum Leakage: 15 cfm @ 1”. w.g. Tested in accordance with AMCA standard 500-D.
2. Maximum Differential Pressure Rating: 2.5” w.g.
3. Maximum Velocity Rating: 2000 feet per minute
4. Construction:
    a. Damper Frame: 0.063” extruded aluminum
    b. Blades: 0.050” extruded aluminum, 6” maximum blade width
    c. Blade Edge Seals: Vinyl, mechanically fastened to blade
    d. Linkage: Plated steel.
    e. Axles:. Aluminum
    f. Bearings: Synthetic polycarbonate
    g. Finish: Mill finish
5. Counter-Balance required for applications that do not include forced air (i.e. do not have a fan).
6. Similar to Greenheck ES series.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
1. Acudor Products Inc.
2. Greenheck Fan Corporation
3. Nailor Industries Inc.
4. Ruskin Company
5. Approved equal

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1" thick insulation with sheet metal cover.
1. Less Than 12" Square: Secure with sash locks.
2. Up to 18" Square: Provide two hinges and two sash locks.
3. Up to 24" x 48": Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 MOTORIZED DAMPERS

A. See Section 23 09 13 Instrumentation and Control Devices for HVAC.

B. All motorized dampers shall be installed under this specification unless specified as a standard integral component of a particular piece of equipment, e.g., packaged kitchen heat recovery unit. Installation shall be under the supervision of the Automatic Temperature Control Contractor.

C. Dampers shall be full size of duct, be sealed between damper frame and duct, and shall operate without binding on duct wall. Provide access panels for motorized dampers, 12" x 12" minimum.

2.06 REMOTE ACCESS FOR VOLUME CONTROL DAMPERS

A. Manufacturers:
1. Ventlock
2. Young Regulator
3. United Enertech
4. Approved equal

B. Provide Ventlock Model 666 concealed damper regulator, where dampers are located above a hard lid ceiling or are otherwise inaccessible.

2.07 SLEEVES FOR DUCTS THROUGH NON-FIRE-RATED WALL

A. Provide sheet metal sleeves around ducts, penetrating through walls or floors. Pack opening around duct with fiberglass and caulk with resilient acoustical caulk and then install 3" x 3" - 18 gage sheet metal closure angle all around duct, overlapping corners, secure to duct and wall. Caulk and install closure angle on both sides of wall. When insulated on the exterior, butt to closure angles. See Section 07 84 00 for Fire Caulking requirements, Fire Caulking installation by Section 07 84 00 Subcontractor or General Contractor.

2.08 VOLUME CONTROL DAMPERS AND SPLITTER DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc.
2. Nailor Industries Inc.
3. Ruskin Company
4. Greenheck Fan Corporation
5. Approved equal

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Volume Control Dampers, shall be installed on all branch duct take-offs to diffusers, grilles and registers. Do not provide or use dampers at the face of the diffuser, grilles or registers for balancing.

D. Single Blade Dampers: Fabricated for duct sizes up to 6" x 30"

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8" x 72". Assemble center and edge crimped blades in galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ducts 12" and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30", provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide additional backdraft dampers on exhaust fans or exhaust ducts nearest to the outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8" x 8" size for hand access, 18" x 18" size for shoulder access, and as indicated. Provide 4" x4" for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent the equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

G. Provide balancing/volume dampers on all branch duct take-offs to diffusers, grilles, and registers. These will be used in addition to dampers at the face of the devices.

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS - CENTRIFUGAL AND AXIAL FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet and Ceiling Exhaust Fans.

B. Destratification Fans

1.02 RELATED REQUIREMENTS

A. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.

I. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck

B. Loren Cook
C. Panasonic
D. Fantech
E. PennBarry
F. ACME
G. Twin City Blower
H. Approved equal

2.02 CABINET AND CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
C. Grille: Molded white plastic.
D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid adjustment. Fan shaft with self-aligning pre-lubricated ball bearings.
E. Speed Controller: Provide speed controllers for all direct drive cabinet and ceiling exhaust fans. Speed controllers are for the purpose of balancing exhaust air quantities and shall be factory mounted on the fan housing.
F. Variable speed motor - electronically commutated motor (ECM)
   1. Greenheck Vari-Green
   2. Approved equal
G. Motorized Damper: Line-voltage or low-voltage motor drive, power open and spring return.
H. Backdraft Damper: Gravity actuated, aluminum construction, felt edged with offset hinge pin, nylon bearings.

2.03 DESTRATIFICATION FANS

A. Manufacturers
   1. Airius LLC
   2. Approved equal.
B. Housing: The fan housing shall be made of ABS resin, rated 5VA for flame resistance off white color.
C. Hardware: Stainless steel for increased corrosion resistance.
D. Safety Cable: Supplied with 6’-0” steel cable fastened to seismic restraint point integrated into the fan housing. Safety restraint attached to primary mounting handle will not be accepted.
E. Motor Mounting: Enclosed in housing, above stator.
F. Stator: The fan shall be equipped with a curved multiple-vane stator coordinated with fan design for maximizing columnar laminar flow.
G. Certification: UL Standard 507 for Safety Electric Fans, CAN//CSA-C22.2 No. 1113 and UL 94 5VA as certified by nationally recognized testing laboratory. Acceptable laboratories include ETL, UL or other nationally recognized testing laboratories.
H. Identification: Permanently affixed manufacturer’s nameplate including the following: Model Number, Serial Number, Motor Power Specifications, Country of Manufacture and Safety Marks: ETL (US & CA) & CE (EU).
I. Power Cord: 6 foot, 300-volt AC, UL rated. Motors within the voltage range of 100-130VAC are provided with a standard 3-prong plug. Motors within the voltage range of 200-277VAC are not provided with a plug.

J. Size and Weight: Standard: 22 inch height to bail; 16 inch height to rim; 13 inch diameter; 9 lb (4.1 kg).

K. Motor (EC): Electronically commutated motor, up to 92% efficient, 230mm in diameter. Plastic blades and hub. Ball bearings shall be permanently lubricated and shielded. Up to 421 cfm, 1700 rpm, 69 dBA. Thermally protected motor with an operating range of -22° F (-30° C) to 122° F (50° C).
   1. Recommended ceiling height up to 25 feet (7.6 m) and area coverage up to 1200 sq. ft (112 sq. m); 20 feet (6 m) from the fan's center in all directions.
   2. Electrical Requirements: 100-130V AC, single phase, 60 Hz.; 0.46 Amps; 31 watts
   3. Controls: Provide with an Airius Delta T Controller with automatic temperature-based control. Utilizes two manufacturer supplied temperature sensors for mounting at ceiling and floor to vary fan speed based on temperature delta.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with stainless steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Fans:
   1. Install fans with vibration mounts and with flexible electrical leads.
   2. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Install backdraft dampers on inlet to roof and wall exhausters.

F. Provide safety screen where inlet or outlet is exposed.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

H. Destratification Fans:
   1. Install destratification fan according to manufacturer's written recommendations.
   2. Fan to be mounted at a maximum of 2’-0” from ceiling deck to ensure thermal/humidity equalization from ceiling to floor.
   3. Adjust unit as required for proper operation in accordance with manufacturer’s installation instructions.

3.02 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing unit.

B. Prepare a manufacturer’s startup report and turn over to the Owner.

END OF SECTION

SECTION 23 35 14
DUST COLLECTION EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Industrial exhaust fans

B. Ductwork and duct fittings

C. Inlet fittings

D. Dust elimination and collection devices

E. Accessories

1.02 REFERENCE STANDARDS

A. ACGIH (IV) - Industrial Ventilation, A Manual of Recommended Practice; American Council of Governmental Industrial Hygienists.

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength.

G. AWS D9.1M/D9.1 - Sheet Metal Welding Code; American Welding Society.

H. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

I. SMACNA (ROUND) - Round Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association.

J. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

L. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections. Submit construction layout and details for inlet fittings.

C. Product Data: Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.

D. Provide fan curves with specified operating point clearly plotted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Camfil Farr Company
B. Sternvent
C. Approved equal

2.02 CENTRIFUGAL FANS

A. Manufacturers:
   1. Loren Cook Company
   2. PennBarry
   3. Greenheck
   4. Approved equal
B. Base performance on sea level conditions.
C. Wheel and Inlet:
   1. Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
   2. Radial: Steel construction with inlet flange, back plate, plate blades with reinforcing gussets welded or riveted to back plate and flange; cast iron hub riveted to back plate and keyed to shaft with set screws.
D. Housing: Heavy gage steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat. Provide bolted construction with horizontal flanged split housing.
E. Motors and Drives:
   1. Motors: As indicated, explosion proof
   2. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings or roller bearings.
   3. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
   4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed; variable and adjustable pitch for motors 15 hp and under; fixed sheaves for motors 20 hp and over, matched belts, and rated minimum 1.5 times nameplate rating of motor.
   5. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage, 3/4” diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.

2.03 DUCTWORK AND DUCT ACCESSORIES

A. Materials:
   1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M, FS Type B, with G90/Z275 coating.
B. Thickness as required per SMANCA at -12” SP
C. Ductwork:
D. Fabricate and support in accordance with:
      a. SMACNA HVAC Duct Construction Standards - Metal and Flexible.
      b. SMACNA Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard.
      c. ACGIH Industrial Ventilation Manual.
   2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   4. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Prime coat welded joints.

5. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
6. Joints: Minimum 4 inch cemented slip type, brazed, or electric welded to AWS D9.1M/D9.1.
7. Duct takeoffs shall occur in diverging 30 or 45 degree wye combination transitions/reducers, unless otherwise indicated.

E. Flexible Connectors: UL listed, fire-retardant chloroprene or chlorosulfonated polyethylene impregnated fabric, minimum density 20 oz per sq yd, approximately 2 inches wide, crimped into metal edging strip.

F. Angle rings: Carbon Steel, unpainted, leg out, drilled with bolt holes.

G. Blast Gates: Half collar of cast aluminum, with galvanized steel slide, set screw.

H. Flat Back Elbows: Long radius rectangular elbow at duct material with heavy gage, removable, stainless steel back strip.

I. Ball Joints: Cast iron with tubular studs for connecting ducts, allowing 25 degree angle off center.

2.04 INLET FITTINGS

A. Fabricate of minimum 16 gage galvanized steel.

B. Fabricate with hemmed edges, closed corners, and reinforced for span and attachment; with duct connection; prime coated.

2.05 CENTRIFUGAL SEPARATOR

A. Cyclone dust collector consisting of cyclone with integral fan and structural stand incorporating dust storage, filter shaker, 55 gallon drums, controls and safeties.

B. Collector shall be self-cleaning fabric type complete with cotton filters, backward inclined blower, motorized shaker, factory wired controller and external discharge silencer. Manufacturer’s literature shall state that dust collector and selected filter spacing is designed for the collection of wood dust.

C. Dust collector shall be airtight, all steel construction with sealed seams and gasketed quick opening doors with 1/4 turn knobs. Housing shall be a minimum of 14-ga. mild steel. Unit shall consist of a filter section, with sloped roof to shed rain and a funnel bottom section without slide gates or doors to allow downflow of dust directly into 55-gallon drums furnished by manufacturer. Inlet, with baffle for even distribution of dust to the drums. Designs with inlet on narrow side shall not be accepted. Include an explosion relief vent, in the dirty section of the filter housing, per NFPA #664.

D. 55 Gallon drums shall be provided with each dust collector. The funnel shall connect to a 14” flexible connector and be fully welded to the 55 gallon drum lid. Funnel, flexible connector, and drum lid shall be shipped from the manufacturer as one full piece. On site assembly with self tapping screws and caulk is not allowed.

E. Unit to include a multi-pocket filter modules, which is sewn from 8-ounce cotton sateen fabric designed to deliver in excess of 99.5% efficiency by weight on industrial dusts. The filters shall have closed bottom and open top pockets, for the wood waste to remain on the outside surfaces of the filter media. Inside of each pocket shall be a rigid insert separator to prevent collapse of filters and loss of the effective filter area. Flat shaker fingers located at the bottom of the filter module shall prevent adjoining pockets from touching one another and blanking off. The filter pocket spacing shall be wide spacing to permit the collected dust to be shaken off the exterior of the filters and recommended by the manufacturer for the collection of wood dust. Total airflow to filter fabric area (air to cloth ratio) shall not exceed 10 CFM per square foot.

F. Filter designs with open bottoms that allow the wood waste to enter the inside of the filters will not be accepted, because of the potential for wood waste to bridge and not shake down

G. Each filter module shall be secured in place by two lever, operated over-center, locking mechanisms to assure a positive seal and allow for easy removal of filters from outside of unit.

Designs which require entry into unit (confined space) or require hand tools to remove the filters, for filter maintenance, are not acceptable.

H. Filters will be cleaned automatically after a fifteen second delay following the shutdown of the blower, by the oscillating action delivered by the motorized eccentric driven shaker assembly, which imparts a rapid and strong vibratory force throughout the entire surface of each individual filter pocket to dislodge the dust. Filters that are suspended from bungee cords or rubber bands are not acceptable.

I. Operation of the automatic shaker shall be controlled by a solid state, dual mode timer with adjustable shaker cycle range from 1.8 - 180 seconds. Magnetic starters with overload relays for the blower and shaker motor and control transformer shall be factory wired in a NEMA 4 control panel mounted on the unit for single point wiring. Outdoor NEMA 3R safety disconnect switch shipped loose for field mounting & wiring by contractor. Also included shall be a push button station for remote mounting.

J. The control panel wiring shall be either UL or ETL labeled for compliance with 508A. Control panels not labeled by dust collector manufacturer shall be labeled, in field, by a certified UL or ETL representative, prior to placing equipment in operation.

K. The integral non-sparking AMCA Type C direct drive blower shall be located on the clean air side of the filters, top mounted at the factory and be of the backward inclined design with a dynamically balanced impeller. It shall be driven by a 3450 RPM, TEFC motor. The blower shall be tested in accordance with AMCA Standard 210. A factory-supplied cover shall protect the motor cooling fan from ice.

L. Discharge noise from the blower shall be attenuated by an external field supported duct silencer fabricated with 4.75 lb. density inorganic mineral or glass fiber. This media shall be protected from erosion by the air flow through the use of galvanized perforated metal with aerodynamic leading and trailing edges to insure maximum acoustical insertion loss at minimum static pressure drop. Lining of the fan scroll, instead of an external silencer, shall not be accepted.

M. Interior and exterior carbon steel surfaces shall be coated with two part epoxy primer and exterior painted with Sternvent gray two part urethane enamel.

N. Dust Switch
   1. Electrically interlock each woodworking machine with the dust collector so that, when a machine is turned on, the dust collector comes on automatically.
   2. Include an adjustable delay timer that will keep the dust collector on for 15-120 seconds after the last machine is switched off, to minimize the dust collector cycling and allow the dust in the duct system to be evacuated.
   3. Provide the Sternvent Dust Switch with UL label.
   4. Section 503.1 of the Uniform Mechanical Code and the International Mechanical Code requires interconnection of equipment controls, so equipment cannot be operated unless the ventilation/product conveying system is in operation.

O. Spark Detection System
   1. FUX 3001 type spark detector is highly sensitive and reacting without delay upon detection of any infrared radiation for temperature up to 176 degrees F
   2. Single sparks or showers of sparks are detected immediately and transmits an electrical signal to the control panel to shut down entire system
   3. Manual reset is then required for system operation
   4. For use only in dark, closed environments where no ambient light can reach the detector
   5. Two (2) detectors located 180 degrees apart are required
   6. Detectors provided with quick release mounting brackets for ease of cleaning and inspection
   7. Fle 5000 control panel

P. Fire Abort Damper
   1. 18-gauge galvanized steel panel construction
   2. Exhaust upblast hood with birdscreen and drain

3. Heavy duty dampers with seals in both positions, open or abort for immediate action upon detection of a spark or fire
4. Automatic reset

Q. Return Air Filter Bank
1. Model P & G Glide Pack with MERV 15 final filters
2. Housing dimensions: See plans
3. 99% efficient on one-micron particles
4. Dwyer A3000 Series Photohelic switch provided to be installed on filter bank, shuts down the system when reaches set maximum pressure drop

R. Back-Draft Damper
1. Designed with closing and locking blade with counter weighted arm
2. Equipped with a limit switch to run the start/stop circuit through if desired
3. Explosion vent out the top of back-draft damper to relieve pressure in case of an explosion event
4. In event of reverse airflow through the back-draft damper the blade will slam shut and latch in the closed position and the explosion vent may deploy. Blade must be manually reset after event.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions

B. Provide all interconnecting wiring for the dust collector controls, switching, fire abort dampers, spark detection system, filter bank etc..

C. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

D. Install fans with resilient mountings and flexible electrical leads.

E. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.02 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing unit.

B. Prepare a manufacturer’s startup report and turn over to the Owner Agent.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Round Ceiling Diffusers.

B. Rectangular Ceiling Diffusers.

C. Ceiling Supply Registers/Grilles.

D. Ceiling Grid Core Exhaust and Return Registers/Grilles.

E. Wall Supply Registers/Grilles - Heavy Duty

F. Wall Supply Registers/Grilles.

G. Wall Exhaust and Return Registers/Grilles.

H. Louvers, Mechanical.

I. Roof Hoods.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute.

C. ASHRAE Standard 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

E. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, throw, drop, terminal velocity and noise level.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Test and rate air outlet and inlet performance in accordance with ASHRAE Standard 70.

C. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grilles/Registers/Diffusers
   1. Titus
   2. Price Industries
   3. MetalAire by Greenheck
   4. Kees
   5. Krueger
   6. Carnes Company
   7. Tuttle & Bailey
   8. Approved equal

B. Louvers/Louvered Penthouses
   1. Ruskin Manufacturing
   2. Greenheck
   3. Carnes Company
   4. Loren Cook
   5. Approved equal

2.02 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than 1” above ceiling.

B. Fabrication: Steel with baked enamel off-white finish.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Frame: Surface mount type.

C. Accessories: Provide radial opposed-blade, butterfly, and combination splitter volume control damper; removable core, sectorizing baffle, equalizing grid, operating rod extension, anti-smudging device, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

D. Fabrication: Steel with baked enamel off-white finish.

2.04 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2” x 1/2” x 1/2” grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Frame: 1-1/4” margin with countersunk screw mounting.

D. Frame: Channel lay-in frame for suspended grid ceilings.

E. Accessories:
   1. Provide integral gang and face operated opposed-blade damper.

2.05 WALL SUPPLY REGISTERS/GRILLES - HEAVY DUTY

A. Type: Heavy duty aluminum solid airfoil blades, 3/4" minimum depth, 1-1/4” spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4" margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage minimum frames and heavy duty solid aluminum blades, with factory off-white enamel finish.

D. Accessories: Provide integral gang and face operated opposed-blade damper.

2.06 WALL EXHAUST AND RETURN REGISTERS/GRILLES - HEAVY DUTY

A. Type: Steel grille with 3/8” bar spacing and 0°deflection.

B. Frame: 1-1/4" margin with countersunk screw mounting.

C. Fabrication: 16 gauge steel frames and 14 gauge steel blades, with factory off-white enamel finish. Bars shall be reinforced by perpendicular, steel support bars spaced on 6” maximum centers.

2.07 DOOR GRILLES

A. Type: V-shaped louvers of 20 gage thick steel, 1” deep on 1/2” centers.

B. Frame: 20 gage steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

C. Color and finish type to be selected by Architect.

D. Equal to Titus CT-700L.

2.08 WEATHERPROOF LOUVERS

A. Louvers shall be furnished for installation in exterior walls as shown on the Plans. Louver blades shall be fabricated from anodized aluminum or galvanized steel sheets, and shall be provided with a frame of galvanized steel or aluminum structural shapes. Sheet metal thickness and fabrication shall conform to SMACNA HVAC Duct Construction Standards-Metal and Flexible. Blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Louver shall be provided with bird screen. Louvers shall bear AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

B. Louver Types
   1. 5” deep, extruded aluminum, Wind Driven Rain Louver, Equal to Greenheck EVH-501
      a. Frame
         1) Downspouts and caulking surfaces provided.
         2) Wall Thickness: 0.081" nominal.
      b. Blades:
         1) Vertical rain resistant style, ¾” spacing
         2) 6005-T5 extruded aluminum.
         3) Wall Thickness: 0.050" nominal.
      c. Screen: 3/4" x .051" expanded, flattened aluminum bird screen in removable frame. Screen adds approximately 1/2" to louver depth.
      d. Mounting: Furnish with screw holes in jambs.
      e. Finish: Architect/Owner to select finish from manufacturer’s standard finishes.
      f. Performance: Beginning point of water penetration shall be above 1250fpm free area velocity. Pressure drop shall be 0.15”WG at 900fpm free area velocity.
      g. Variations (provide as needed for installation)
         1) Extended sill.
         2) Integral flange for face installation.

2.09 ROOF HOODS

A. Spun Aluminum Intake or Relief Gravity Ventilator
   1. General Description:
      a. For intake applications with natural gravity or negative pressure system
      b. Hood: Constructed of aluminum; internal structure is constructed of galvanized steel
      c. Birdscreen: Constructed of 1/2” Aluminum mesh, mounted horizontally across the intake area of the hood.
   2. Housing:
      a. Curb Cap type: Hinged or Not Hinged
      b. Constructed of aluminum, including windband and curb cap. Windband to be one piece spun aluminum construction and maintain original material thickness throughout the housing, and to include an integral rolled bead for strength
      c. Curb cap to have integral deep spun inlet venturi and prepunched mounting holes.
   3. Options/Accessories:
      a. Curb Seal: Rubber seal between fan and the roof curb
   4. Roof Curbs:
         1) Mounted onto roof with fan
         2) Material: Aluminum
         3) Insulation thickness: 1”
      b. Dampers:
         1) Type: Gravity or motorized as shown on Plans.

2) Galvanized frames with prepunched mounting holes
3) Finishes: As selected by Architect from standard finishes.

c. Flashing Flange:

1) Constructed of aluminum
2) Pre-punched holes for installation without a roof curb
3) Hood Insulation: 1” fiberglass insulation.
4) Tie-Down Points: Four aluminum brackets located on windband

d. Reducer/Adapter:

1) Material type: Aluminum

B. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Mount unit on minimum 12" high curb base with insulation between duct and curb.

D. Install Roof Hoods level. Slope bottom of curb to match roof slope.

2.10 WALL CAPS

A. Aluminum construction hooded wall cap with integral duct connection.

B. Integral birdscreen and backdraft damper

C. Wall caps shall be installed and sealed to the building exterior in accordance with manufacture recommendations for the type of wall installed in.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Air Terminals

1. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
2. When installed in T-bar ceilings, provide pans as necessary.
3. Terminals installed in suspended ceiling systems shall be attached or supported as required by the latest appropriate Building Code for "Suspended Acoustical Ceilings.”
4. Install diffusers to ductwork with air tight connections.
5. Install insulated diffuser boxes as detailed on the contract drawings.
6. Install grilles and registers to ductwork with air tight connections. Use screws and foil tape only; do not use duct tape.
7. Provide balancing/volume dampers on all branch duct take-offs to diffusers, grilles and registers.
8. Paint ductwork visible behind air outlets and inlets matte black.
9. Where grilles, registers, and diffusers are installed on exposed ductwork, care shall be completed to maintain head clearance. Utilize short diffuser cans where needed.

C. Duct Openings: Where no grille, register, or diffuser is called out at duct openings, provide 1/2” hardware cloth over openings.

D. Louvers

1. Louvers shall be installed in exterior walls utilizing framed openings. The duct or plenum attached to the louver shall have the bottom surface sloped toward the louver and shall be rigidly secured and sealed watertight to the exterior wall, such that any entrained water will drain through the louver. The louver frame shall be sealed watertight to building surface. See details on Plans.
2. Install plumb, level, and free of rack and twist. Use only stainless steel fasteners to secure louvers to the building. Fasteners are to be removable from the exterior of the building.
3. Flashings as required by building architectural details are to be provided by G.C. Caulk and make watertight.

4. Provide 3" continuous galvanized closure angles and closure plates on inside head, inside jambs, and inside sill of exterior wall louvers. Caulk angles and plates prior to installation.
5. Install self-adhering rubberized asphalt flashing (Ice & Water Shield or approved equal) on the interior of plenum as shown on the Mechanical Details.
6. After installation, clean all exposed surfaces per manufacturer’s recommendations and protect from damage until completion of project.

END OF SECTION

SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Washable permanent panel filters.

1.02 REFERENCE STANDARDS

A. AHRI 850 - Performance Rating of Commercial and Industrial Air Filter Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

B. ASHRAE Standard 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

C. ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

D. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Including All Revisions.

E. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.03 PERFORMANCE REQUIREMENTS

A. Conform to AHRI 850 Section 7.4.

B. Dust Spot Efficiency: Plus or minus 5 %.

1.04 SUBMITTALS

A. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

D. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

E. Operation and Maintenance Data: Include a list of all filters and sizes provided, breakdown by individual pieces of equipment.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.06 EXTRA MATERIALS

A. Provide five sets of disposable filters, for each HVAC unit provided on project. One set to be used during construction. One set after the building is clean and prior to balancing. Deliver two sets to the owner for their installation as needed. Provide one additional set of MERV 13 filters for the ERV’s that can be utilized during wildfire smoke events. Coordinate with the Owner, a location, to store the extra filters, prior to delivery. Provide the Owner with a Filter Inventory and an Installed Filter List arranged by quantity and size for each type of equipment provided. Provide copies of the Inventory and Installed Filter List to the Owner and include in the O & M manuals.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

A. Camfil Farr Inc.

B. Eco-Air Products
C. Flanders Precision Aire
D. Vital Air
E. Approved equal.

2.02 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid by corrugated aluminum separators.
   1. Frame: Non-flammable.
   2. Nominal size: 12 x 24”.
   3. Nominal thickness: 1”.
B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE 52.2.
C. Rating, per ASHRAE Standard 52.1:
   1. Dust spot efficiency: 20%.
   2. Weight arrestance: 85%.
   3. Initial resistance at 500 FPM face velocity: 0.20” w.g.
   4. Recommended final resistance: 0.9” w.g.

2.03 DISPOSABLE PANEL FILTERS.

A. 2" Filter
   1. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive. Filters to have a minimum efficiency reporting value of MERV 8 (ASHRAE Standard 52.2-1999) 25 to 30% efficiency.
      a. Nominal Size: 12 x 24” or as required by equipment provided.
      b. Thickness: 2" Filter.
      c. Equal to Camfil Farr 30/30.
   2. Performance Rating:
      a. Face Velocity 500 FPM.
      b. Initial Resistance: .28" w.g.
      c. Recommended Final Resistance: 1.0" w.g.
      d. Guarantee the integrity of the filter pack to 2.0" w.g.
   3. Casing: A high (28-point), wet-strength beverage board frame, with welded wire grid, spot welded and treated for corrosion resistance. The frame shall be bonded to the media to prevent air bypass.
   4. Certification: Manufacturer shall provide evidence of facility certification to ISO 9001:2000, as a minimum.
B. 2" Filter :
   1. Media: UL 900 Class 1, organic synthetic media, Filters to have a minimum efficiency reporting value of MERV 13 (ASHRAE Standard 52) 85 to 90% efficiency.
      a. Nominal Size: 24 x 24” or as required by equipment provided.
      b. Thickness: 2" Filter.
      c. Viledon Mini 85 or equal.
   2. Performance Rating:
      a. Face Velocity 500 FPM.
      b. 43 sqft filter area for 2’x2’ filter
      c. Initial Resistance: .26" w.g.
      d. Recommended Final Resistance: 1.5" w.g.
      e. Guarantee the integrity of the filter pack to 4.0" w.g.
   3. Casing: Lightweight plastic with polyurethane seal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION

SECTION 23 72 23
AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air to Air Energy Recovery Units.

1.02 RELATED REQUIREMENTS

A. Section 23 23 00 - Refrigerant Piping and Specialties

1.03 REFERENCE STANDARDS

A. AHRI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

B. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE)

C. NFPA 70 - National Electrical Code; National Fire Protection Association.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.

E. AMCA 500-D - Laboratory Methods of Testing Dampers for Ratings.

F. AMCA 500-L - Laboratory Methods of Testing Louvers for Ratings.

G. AHRI 1060 - Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

H. ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

I. ASHRAE Standard 84 - Method of Testing Air to Air Heat Exchangers.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

M. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Standard 90.1.

B. Scheduled Performance: ARI 210/240 Test Conditions. See schedule.

1.05 SUBMITTALS

A. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.06 REGULATORY REQUIREMENTS

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Equipment shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

D. All wiring shall be in accordance with the National Electrical Code (NEC).

1.07 QUALITY ASSURANCE

A. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

B. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.

C. Unit shall be Listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers. The unit must pass commercial flammability requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.09 WARRANTY

A. Lossnay Ventilation Equipment
   1. The Lossnay® units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
   2. The Lossnay® Energy Transfer Core shall have an additional nine year warranty against defects in material or workmanship. The total warranty period shall be ten years from date of installation.

PART 2 PRODUCTS

2.01 MANUFACTURES

A. Mitsubishi

B. Trane

C. Renewaire

D. Approved Equal

2.02 LOSSNAY VENTILATION SYSTEM (HEAT EXCHANGER)

A. General
   1. The fresh air ventilation system(s) shall utilize the Mitsubishi Electric LOSSNAY total heat exchanger with outside air bypass damper and energy recovery ventilation. These units shall be selected in accordance with the building ventilation requirements.
   2. The ventilation equipment shall be Energy Recovery Ventilator (s) (ERV) as manufactured by Mitsubishi Electric (From now on referred to as “Lossnay® ERV”).
   3. The Lossnay® ERV shall be equipped with an M-Net data network control and will be directly connectable to the City Multi M-Net Data communication control network and will be able to be electronically interlocked with City Multi indoor units.

B. General
   1. The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. Each unit will have an automatic by-pass damper system for economic operation under certain conditions. The unit shall have factory installed control board with functions for local, remote, and optional control modes.

C. Unit Cabinet: The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached

D. Construction
   1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.
   2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in both winter and summer conditions without generating condensate.
   3. The unit case shall be constructed of 24-gauge steel, with lapped corners and zinc plated screw fasteners. The case shall be finished with textured, powder coat paint (GR90 case shall be constructed of G90 galvanized steel.)
   4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets.
   5. Case walls and doors shall be fully insulated with 1 inch, expanded polystyrene foam insulation faced with a cleanable foil face on all exposed surfaces.
   6. The ERV cores shall be protected by a MERV-8 rated, spun polyester, disposable filter in both airstreams.

E. Blowers:
   1. The unit shall be furnished with multiple direct-drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.
   2. The blower motors shall be directly connected to the blower wheels.
   3. The blowers and motors shall be mounted for quiet operation.

F. Heat Exchanger
   1. The Lossnay® heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible plus latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.
   2. The Lossnay® element shall have protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.

G. Bypass Damper
   1. The ERV shall have an automatic supply side by-pass damper to allow inbound ventilation air to by-pass the Lossnay® energy transfer core when outside weather conditions warrant.
   2. The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to an mechanical damper flap to allow fresh air to bypass the Lossnay® element.
   3. Supply and return air thermistor shall control the damper and may be interlocked with a Mitsubishi Electric PZ Series LCD remote controller.

H. Filters
   1. The ERV shall be equipped with factory installed air filters located at each intake face (both supply and exhaust sides) of the Lossnay® core.

I. Mounting
   1. Mounting of the Lossnay® ERV shall be as indicated in the plans and drawings. The ERV shall not require and condensate pan or receptacle nor condensate drain or piping. Mounting may be horizontal or vertical and the unit may be inverted as required by ductwork connection.

J. Control
   1. This equipment shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system automatically with a remote controller.
   2. Provide with Lossnay PZ-62DR-EA programmable controller.
   3. Provide with PZ-70 CO2 sensor for varying fan speeds.
   4. Controller shall operate all functions including operating the outside air and exhaust air shut off dampers.

a. Dampers shall be powered with relays. Coordinate damper voltage with electrical contractor prior to ordering. Dampers power shall come from lossnay unit circuit.

2.03 VIBRATION ISOLATION

A. Vibration Isolation: Provide whole unit vibration isolation with the energy recovery unit assembly.
1. Utilize factory supplied vibration isolation kit following instructions.
2. Provide flexible duct connections at unit duct flanges.

B. Construct with appropriately-sized, seismic-rated, corrosion-resistant captive-spring isolators.

PART 3 EXECUTION

3.01 INSTALLATION

A. General
1. Provide a factory-trained technician to ensure operability of control systems.
2. Installation, commissioning and testing shall be carried out by licensed installers in accord with all Codes and requirements.
3. The installation of all units, duct work, all interconnecting control and power wiring, commissioning and testing shall be carried out by licensed installers in accord with all Codes and requirements.
4. The installer shall supply, install, test and commission all interconnecting ductwork for the units.
5. Slope outside air and exhaust air ductwork from units toward building exterior.

B. Commissioning
1. Provide building commissioning support as specified in Section 23 08 00.

C. Equipment Manufacturer's Participation In Project Commissioning
1. Assist in developing the final functional test procedures as specified in Section 23 08 00.
2. Provide authorized startup technician to perform functional performance testing as specified in Section 23 08 00.
3. Provide building commissioning support as specified in Section 23 08 00.

END OF SECTION

SECTION 23 81 01
TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric Unit Heaters

B. Electric Wall Heaters

1.02 RELATED REQUIREMENTS

A. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.

C. Manufacturer's Instructions: Indicate installation instructions and recommendations.

D. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

A. Provide five (5) year manufacturer’s warranty on units, covering parts and labor.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company)
   2. Marley Engineered Products
   3. Qmark
   4. The Trane Company
   5. Approved equal.

B. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Cabinet: 18 gage steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload. Provide wall mounted thermostat.

I. Electrical Characteristics: See Schedule on Plans.
   1. Disconnect Switch: Factory mount disconnect switch.

2.02 ELECTRIC WALL HEATERS

A. Manufacturers:
   1. Cadet
   2. INDEECO (Industrial Engineering and Equipment Company)
   3. Marley Engineered Products
   4. Trane
   5. Qmark
   6. Approved equal.

B. Fan forced electric air heaters shall be UL listed, self-contained and completely separate from the wall mounting can.

C. Construction
   1. Element: Nichrome-type wire wrapped on mica insulators with a 16 amp rated, at 240V, high temperature manual power reset limit switch, and a one-time over temperature thermal back-up fuse
   2. Blower: Two-stage centrifugal blower isolated from the heating chamber.
   3. Grille: One-piece, 20-gauge construction with powder coat paint.

D. Electrical Characteristics: See Schedule on Plans.

E. Options
   1. Provide with recessed wall can.
   2. Provide with integral thermostat.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Division 26.

F. Wall mounted electric heaters shall be mounted at 12” AFF to the bottom of unit, unless otherwise noted.

3.02 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing unit.

B. Prepare a manufacturer's startup report, and turn over to the Owner’s representative and commissioning agent.

3.03 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 23 81 27
SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured Air-Source Split-System Heating and Cooling Units

B. Indoor Units for Ductless Systems

C. Outdoor Unit - Air Cooled Remote Condensing Unit

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Domestic Water Piping: Indoor coil condensate drain.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute.

C. AHRI 610 - Performance Rating of Central System Humidifiers for Residential Applications; Air Conditioning, Heating, and Refrigeration Institute.

D. ASHRAE Standard 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

E. ASHRAE Standard 23 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

F. ASHRAE Standard 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

G. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Including All Addenda (ANSI/ASHRAE)

H. ASHRAE Standard 90.2 - Energy-Efficient Design of New Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

I. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.

K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.

L. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

M. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five (5) years of documented experience.

1.06 WARRANTY

A. Provide five year manufacturer’s warranty on units, covering parts and labor. Compressors shall have a warranty of seven years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Mitsubishi
2. Fujitsu
3. Daikin
4. Approved equal.

2.02 SPLIT-SYSTEM HEATING AND COOLING UNITS

A. The Heat Pump system shall be split system with variable speed inverter compressor. The system shall consist of an outdoor unit, and a matched capacity indoor section that shall be equipped with a wired wall-mounted, remote controller.

B. Provide refrigerant lines between indoor and outdoor units, factory cleaned, dried, pressurized, sealed, and insulated. Provide insulation inserts as noted in Section 23 00 20.

C. Performance Requirements: See Drawings for additional requirements.
   1. Efficiency: Energy Efficiency Rating (EER/SEER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Standard 90.1; seasonal efficiency to ASHRAE Standard 103, Washington State Energy Code, or local jurisdiction energy code, whichever is the most stringent.
   2. Air Handling: See schedule.
   3. Heating Performance Requirements: See schedule on Plans.
   4. Cooling Performance Requirements: See schedule on Plans.

D. Electrical Characteristics: See schedule on Plans.

E. Basis of design is Mitsubishi.

2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the remote controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry air before shipment from the factory.

B. Unit Cabinet: Casing shall be ABS plastic. Cabinet shall be designed for suspension mounting from above and horizontal operation. Indoor unit shall have removable mounting brackets. A mounting template with suspension bolt locations shall be furnished with indoor unit. Mounting bolts or threaded rod of 3/8” diameter shall be used to suspend unit and unit shall not require direct contact with ceiling or panel for proper operation.

C. Fan: The indoor unit fan shall have multiple high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have multiple speeds plus

AUTO fan setting. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and sensed space temperature.

D. Vane: Unit shall include a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control, and swing. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

E. Filter: Return air shall be filtered by means of an easily removable, washable filter.

F. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Drain pan level switch, designed to connect to the control board, shall be provided and installed on the condensate pan to prevent condensate from overflowing. A drain lift mechanism (condensate pump), capable of lifting condensate 23-5/8” above the drain pan, shall be provided.

G. Electrical: The electrical power shall be as noted on Plans. Power to the indoor unit shall be supplied from the outdoor unit; wiring shall provide power feed and bi-directional control transmission between the outdoor and indoor units. If code requires a disconnect mounted near the indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.

H. Condensate Pump: Provide with manufacture provided condensate pump mounted inside the unit.

I. System Control:
   1. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output.
   2. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

J. Remote Controllers
   1. Wired Remote Controller (PAR-21MAA)
      a. Include a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature changes shall be by increments of 1°F. Controller shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices.
      b. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

c. Indoor units shall be equipped with an optional "i-see® Sensor" kit for automatic response to adjust the set temperature and provide uniform comfort from floor to ceiling.

2.04 OUTDOOR UNITS - AIR COOLED REMOTE CONDENSING UNIT

A. Outdoor Units: The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
1. Comply with AHRI 210.
2. Refrigerant: R-454B or R32.
3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Standard 23 and UL listed.

B. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units. System shall operate at up to a maximum refrigerant tubing length of 100 feet without the need for line size changes, traps or additional oil. Contractor to provide any additional required refrigerant for proper operation.

C. The outdoor unit shall be capable of cooling operation down to 0°F ambient temperature without additional low ambient controls (provide with wind baffle).

D. Cabinet
1. Casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating.
2. Provide mounting feet welded to the base of the cabinet, of sufficient size for stability.
3. Provide with removable panel sections for servicing.
4. The fan grill shall be of ABS plastic.
5. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

E. Fan
1. Units shall be furnished with DC fan motor(s).
2. Fan blade(s) shall be of aerodynamic design, and the fan motor bearings shall be permanently lubricated.
3. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard.

F. Coil
1. Condenser coil shall be of copper tubing with flat aluminum fins. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV).The LEV shall be controlled by a microprocessor-controlled step motor.
3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than requirements of the Washington State Energy Code, Seattle Energy Code, or local jurisdiction energy code, whichever is more stringent.

G. Compressor
1. Compressor shall have variable speed inverter drive to control compressor speed. The compressor speed shall dynamically vary to match the room load.
2. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
3. The compressor shall be mounted to avoid the transmission of vibration.
4. The outdoor unit shall have an accumulator and high pressure safety switch.

H. Electrical
   1. Power for the indoor unit shall be supplied from the outdoor unit.
   2. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
   3. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

D. Verify equipment locations on the drawing, and in the field, do not exceed the manufacturer’s maximum refrigeration pipe length, including elevation and fitting allowance. MC to coordinate with GC, CC and EC, prior to rough-in.

E. Verify equipment wiring and coordinate with EC, some units have power to one location, with a intertie between units and others have power to both unit locations, with control intertie.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local Authorities Having Jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Condensate piping shall be sloped to drain. Piping terminated with an airgap shall be cut at a 45 degree angle.

D. Install refrigeration systems in accordance with ASHRAE Standard 15.

E. Pipe drain from condensate to nearest floor drain. Piping shall be cut at a 45 degree angle at the termination point.

F. Pressurize and test in accordance with manufacturer’s installation instructions and warranty requirements.

3.03 SYSTEM STARTUP

A. Provide the services of manufacturer's field representative for starting and testing unit.

B. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire system.

C. Prepare a manufacturer’s startup report and turn over to the Owner and Commissioning Agent.

END OF SECTION

SECTION 23 81 29
VARIABLE REFRIGERANT FLOW (VRF) HVAC SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable capacity heat pump heat recovery air conditioning system.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 40 00 - HVAC Air Cleaning Devices.

C. Section 23 09 23 - Digital Control Equipment.

D. Section 23 09 23.1 - Digital Controls - VRF System

E. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

F. Section 23 23 00 - Refrigerant Piping and Specialties

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute.

D. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE)

E. NFPA 70 - National Electrical Code; National Fire Protection Association.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.

G. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc..

H. Reference standards shall be the latest revision as accepted by the local Authority Having Jurisdiction.

1.04 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Standard 90.1.

B. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

C. Heating Capacity: See Schedule on Plans.

D. Cooling Capacity: See Schedule on Plans.

E. Scheduled Performance: ARI 210/240 Test Conditions. See schedule.

1.05 SUBMITTALS

A. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.06 REGULATORY REQUIREMENTS

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Equipment shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

D. All wiring shall be in accordance with the National Electrical Code (NEC).

1.07 QUALITY ASSURANCE

A. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

1.08 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.09 WARRANTY

A. Air Handlers and Condensing Units/Heat Pumps
   1. Units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.
      a. If the systems are designed by a certified CITY MULTI Diamond Designer, installed by a certified CITY MULTI Diamond Dealer, AND verified with a completed commissioning report submitted to Mitsubishi Electric Service Department, then the units shall be covered by an extended manufacturer's limited warranty for a period of five years from date of installation.
      b. In addition, the compressor shall have a manufacturer's limited warranty for a period of seven years from date of installation.
   2. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
   3. This warranty does not include labor.

B. Lossnay Ventilation Equipment
   1. The Lossnay® units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
   2. The Lossnay® Energy Transfer Core shall have an additional nine year warranty against defects in material or workmanship. The total warranty period shall be ten years from date of installation.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Basis of design is Mitsubishi CITY MULTI.

B. The CITY MULTI VRF system shall utilize the R2-Series (simultaneous cooling and heating) split system heat pump.

C. The R2-Series system shall consist of a PURY outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and M-NET DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. Each indoor unit or group of indoor units shall be

independently controlled and capable of changing mode automatically. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

2.02 R2-SERIES OUTDOOR UNIT

A. General:

1. The R2-Series PURY outdoor unit shall be used specifically with CITY MULTI VRF components. The R2-Series shall consist of the PURY outdoor unit, Branch Circuit (BC) Controller, indoor units (-E models), and M-NET DDC (Direct Digital Controls). The PURY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
2. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.
3. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.
4. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation.
5. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated.
6. There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.
7. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
8. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
9. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
10. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
11. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls.
12. Low Ambient Operation
    a. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer-supplied low ambient kit.
    b. Manufacturer-supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
    c. Manufacturer-supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
    d. Manufacturer-supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
13. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
14. The outdoor unit shall be provided with a manufacturer-supplied 20 gauge hot dipped galvanized snow/hail guard to protect the outdoor coil surfaces from hail damage and snow build-up.
15. Unit must defrost all circuits simultaneously.

B. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Unit cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models).

C. Fan:
1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0” WG external static pressure, but capable of normal operation under a maximum of 0.24” WG external static pressure via dipswitch.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Coil:
1. Nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. Factory applied corrosion resistant blue-fin finish on coil fins.
3. Protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. Four circuits with two position valves for each circuit, except for the last stage.

E. Compressor:
1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor.
2. Crankcase heater shall be factory-mounted on the compressor.
3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
4. Equipped with an internal thermal overload.
5. Mounted so as to avoid the transmission of vibration.
6. Field-installed oil equalization lines between modules are not allowed.

F. Electrical:
1. Unit electrical power shall be as scheduled on Plans.
2. Unit shall be controlled by integral microprocessors.
3. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor twisted-pair shielded cable.

G. Controls:
1. The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system.

2.03 BRANCH CIRCUIT (BC) CONTROLLERS FOR R2-SERIES SYSTEMS

A. General:
1. The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or sub-cooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be sub-cooled for optimal indoor unit LEV performance; alternate branch devices with no sub-cooling risk bubbles in liquid supplied to LEV and are not allowed.
2. The BC (Branch Circuit) Controllers shall be specifically used with R2-Series systems. These units shall be equipped with a circuit board that interfaces to the M-NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:
   1. The casing shall be fabricated of galvanized steel.
   2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
   3. The unit shall house two tube-in-tube heat exchangers.
   4. Refrigerant shall be R410A.

C. Refrigerant valves:
   1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and/or three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
   2. Each branch shall have multiple two-position valves to control refrigerant flow.
   3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
   4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

D. Provide with mitigation valves, refrigerant controls/sensors and ventilation enclosure kit to allow for exhaust of A2L fumes during a leak.

E. Integral Drain Pan: An integral condensate pan and drain shall be provided.

F. Condensate pump: Provide with packaged condensate pump wired back to the BC controller.

G. Future Use: Each VRF system shall include at least one (1) unused branch or branch device for future use. Branches shall be fully installed and wired in central location with capped service shutoff valve and service port.

H. Electrical:
   1. Unit electrical power shall be as scheduled on Plans.
   2. The BC Controller shall be controlled by integral microprocessors.
   3. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor twisted-pair shielded cable to provide total integration of the system.

2.04 PKFY (WALL-MOUNTED) INDOOR UNIT

A. General:
   1. The PKFY shall be a wall-mounted indoor unit section and shall have a modulating linear expansion device and a flat front. The PKFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PKFY shall support individual control using M-NET DDC controllers.

B. Indoor Unit
   1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:
   1. White finish
   2. Multi directional drain and refrigerant piping offering four directions for refrigerant piping and two directions for draining shall be standard.
   3. Separate back plate for securing the unit to the wall.

D. Indoor Fan:
   1. Shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.
   2. Shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
   3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
   4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

5. Include factory-provided washable filter.

E. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. Tubing shall have inner grooves for high efficiency heat exchange.
3. Tube joints shall be brazed with phos-copper or silver alloy.
4. Coils shall be pressure tested at the factory.
5. Condensate pan and drain shall be provided under the coil.
6. Both refrigerant lines to the PKFY indoor units shall be insulated.

F. Electrical:
1. Unit electrical power shall be as scheduled on Plans.
2. Connect condensate pump to power.

G. Condensate Pump:
1. Provide condensate pump capable of being wired to indoor unit.

H. Controls:
1. This unit shall use controls provided by Mitsubishi Electric Cooling and Heating to perform functions necessary to operate the system. Reference Section 23 09 23.1.
2. The unit shall be able to control external backup heat.
3. The unit shall have a factory built in receiver for wireless remote control.
4. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
5. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
6. Indoor unit shall include no less than four digital inputs capable of being used for customizable control strategies.
7. Indoor unit shall include no less than three digital outputs capable of being used for customizable control strategies.

2.05 PLFY (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT

A. General:
1. The PLFY shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
1. The cabinet shall be a compact 22-7/16” wide x 22-7/16” deep so it will fit within a standard 24” square suspended ceiling grid.
2. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:
1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three speeds, Low, Mid, and High.
4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
5. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.
6. Filter: Factory-provided washable filter.

D. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4” above the condensate pan.
7. Both refrigerant lines to the PLFY indoor units shall be insulated.

E. Electrical:
1. Unit electrical power shall be as scheduled on Plans.

F. Controls:
1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three digital outputs capable of being used for customizable control strategies.

2.06 PEFY (CEILING-CONCEALED DUCTED) INDOOR UNIT

A. General:
1. The PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers.

B. Indoor Unit.
1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:
1. The unit shall be, ceiling-concealed, ducted.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:
1. PEFY-NMAU models shall feature external static pressure settings from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
3. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
4. The indoor fan shall consist of three speeds, High, Mid, and Low plus the Auto-Fan function
5. The indoor unit shall have a ducted air outlet system and ducted return air system.

E. Filter:
1. Return filter box (rear or bottom placement) with high-efficiency filter.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the PEFY indoor units shall be insulated.
8. Provide condensate drain pan overflow switch to disable unit upon activation, model #DPLS1

G. Electrical:
1. Unit electrical power shall be as scheduled on Plans.

H. Controls:
1. This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Reference Section 23 09 23.1.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three digital outputs capable of being used for customizable control strategies.

2.07 PEFY (HIGH STATIC OPTION), CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:
1. The PEFY (High Static Option) unit shall be a ceiling concealed ducted indoor fan coil that mounts above the ceiling with a fixed rear return and a horizontal discharge supply, and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers. PEFY models shall feature external static pressure settings up 1.00 in. WG. Units shall have the ability to control supplemental heat via connector CN24 or CN4F and a 12 VDC output.

B. Indoor Unit.
1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:
1. The cabinet shall be ceiling-concealed, ducted.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:
1. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor unit shall have a ducted air outlet system and ducted return air system.

E. Filter:
1. Rear return filter box with long-life filter.

F. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism able to raise drain water 21” above the condensate pan.
7. Both refrigerant lines to the PEFY indoor units shall be insulated.
8. Provide condensate drain pan overflow switch to disable unit upon activation, model #DPLS1

G. Electrical:
1. Unit electrical power shall be as scheduled on Plans.

H. Controls:
1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system. Reference Section 23 09 23.1.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three digital outputs capable of being used for customizable control strategies.

PART 3 EXECUTION

3.01 INSTALLATION

A. General
1. A full charge of refrigerant for condensing unit(s) only is to be provided in the condensing unit by the manufacturer. Additional refrigerant required for system operation is to be provided by Contractor.
2. The City Multi VRF system shall be installed by a Mitsubishi authorized City Multi Diamond Dealer with extensive City Multi install and service training. The mandatory contractor service and install training should be performed by the manufacturer.
3. Provide a factory-trained technician to be on site to coordinate with the EMCS contractor, to ensure operability of control systems.
4. Installation, commissioning and testing shall be carried out by licensed installers in accord with all Codes and requirements.

B. Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

C. Commissioning
1. Provide building commissioning support as specified in Section 23 08 00.

D. Equipment Manufacturer's Participation In Project Commissioning
1. Assist in developing the final functional test procedures as specified in Section 23 08 00.
2. Provide authorized startup technician to perform functional performance testing as specified in Section 23 08 00.
3. Provide building commissioning support as specified in Section 23 08 00.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 26 05 33, Raceway and Boxes for Electrical Systems

B. Section 26 51 00, Interior Lighting

C. Section 26 56 00, Exterior Lighting

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00, Cast-in-Place Concrete.

1.5 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 150% Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00, Metal Fabrications.

C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:

    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    d. Thomas & Betts Corporation: www.tnb.com.
    e. Substitutions: See Section 01 60 00, Product Requirements.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

1. Manufacturers:

    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    d. Thomas & Betts Corporation: www.tnb.com.
    e. Substitutions: See Section 01 60 00, Product Requirements.

E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.
2. Channel Material:

    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

3. Manufacturers:

    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Thomas & Betts Corporation: www.tnb.com.
    c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.
    e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

    a. Equipment Supports: 1/2 inch diameter.
    b. Busway Supports: 1/2 inch diameter.
    c. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
    d. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
    e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    f. Outlet Boxes: 1/4 inch diameter.
    g. Luminaires: 1/4 inch diameter.

G. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.

1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:

    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
    d. Substitutions: See Section 01 60 00, Product Requirements.

H. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.

c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:

a. Hilti, Inc: www.us.hilti.com.
b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.
c. Powers Fasteners, Inc: www.powers.com.
d. Substitutions: See Section 01 60 00, Product Requirements

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: Also comply with Section 26 05 33, Raceway and Boxes for Electrical Systems.

J. Box Support and Attachment: Also comply with Section 26 05 33, Raceway and Boxes for Electrical Systems.

K. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00, Interior Lighting.

L. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00, Exterior Lighting.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners according to manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00, Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0536 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install a complete cable tray system as shown on the Drawings.

1.2 SUBMITTALS

A. Shop drawings.

B. Product data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. B-Line, Cablofil, Mono-systems or approved equal.

B. Other Manufacturers: Submit Substitution Request prior to Base Bid date in accordance with Section 01 25 00, Substitution Procedures.

2.2 TRAYS

A. Center supported, ventilated bottom, nominally 6 inches deep by 36 inches wide with 6 inches transverse member spacing, all aluminum construction, solid bottom, solid sides, non-ventilated.

B. Cable tray shall be capable of carrying a uniformly distributed load of 50 pounds per lineal foot with supports spaced on 10-foot centers with less than .750-inch maximum deflection.

2.3 ACCESSORIES

A. Splicing plates, tees, hanger assemblies, bends, and offsets as required shall be the Manufacturer’s standard for the system supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cable tray, attach to building structure for support, routed as shown on the Drawings. Coordinate with mechanical ductwork and luminaire layout in above ceiling installation.

B. Install support brackets, maximum 10 feet on center, maximum 2 feet from any fitting or end.

END OF SECTION

SECTION 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Description

1. This Work includes providing ductbanks as shown and as specified. Each ductbank consists of raceways and fittings, concrete, and reinforcement steel where required. Ductbank construction includes excavation, bedding material, preparation, and backfill.
2. Raceways emerging from ductbanks and direct-buried shall comply with the requirements of Section 26 05 33, Raceway, Boxes, and Conduits for Electrical Systems.

B. Related Sections

1. Section 01 33 00, Submittal Procedures
2. Section 01 78 39, Project Record Documents
3. Section 03 11 00 Concrete Forming
4. Section 03 21 00 Reinforcement Bars
5. Section 03 30 00, Cast-in-Place Concrete
6. Section 26 05 00, Common Work Results for Electrical
7. Section 26 05 33, Raceway and Boxes for Electrical Systems
8. Section 31 20 00 Earth Moving

C. Measurement

1. Comply with requirements of Section 01 22 00, Unit Prices.

D. Payment

1. The Contract Price will be payment in full for furnishing all labor, materials, tools, equipment and incidentals necessary to complete the Work as specified.

1.2 REFERENCED STANDARDS

A. NEMA TCB2 - NEMA Guidelines for the Selection and Installation of Underground Nonmetallic Raceways

1.3 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Section 01 33 00, Submittal Procedures and Section 26 05 00, Common Work Results for Electrical except as modified herein.

B. Submit Product Data on the following items:

1. Raceway spacers.
2. Warning tape.

1.4 PROJECT RECORD DOCUMENTS (AS-BUILT DRAWINGS)

A. Project Record Documents (As-Built Drawings) shall be provided in accordance with the requirements Section 01 78 39, Project Record Documents and Section 26 05 00, Common Work Results for Electrical except as modified herein.

B. Project Record Documents shall show the location of all underground ductbanks and the number and size of conduits therein.

C. Section drawings shall show the configuration of conduits in the ductbank throughout its length.

D. Tabulations shall show the number of spare conduits available at the time of project completion at all locations throughout the ductbank systems.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Raceways, corrosion protection, fittings, and labels shall comply with Section 26 05 33, Raceway and Boxes for Electrical Systems.

B. Raceway spacers shall be plastic, lock together, and sized to create clear spaces between raceways as indicated on the Contract Drawings. Acceptable manufacturers: Carlon, PW Pipe, or approved equal.

2.2 WARNING TAPE

A. Tape shall be heavy-gauge, yellow, and plastic for direct burial, 6 inch minimum width for use in trenches containing electric circuits.

B. Tape shall be made of material resistant to corrosive soil.

C. Tape shall have printed warning that an electric circuit is located below the tape.

D. Approved manufacturers and types shall be ITT Blackburn Type YT, Griffolyn Co., Terra-Tape, or approved equal.

2.3 ENCASEMENT AND REINFORCEMENT

A. Concrete encasement and steel reinforcement shall be in accordance with Section 03 30 00 Cast-in-Place Concrete and Section 03 21 00 Reinforcement Bars.

B. Concrete shall have a 2,500 psi minimum, twenty-eight (28) day strength. Slump shall be 7 inch with a 1 inch tolerance.

C. Install reinforcing steel for concrete encased ductbank only where shown on the Contract Drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. Where required to support trench, construct formwork in accordance with Section 03 11 00 Concrete Forming.

B. Coordinate installation of underground raceways with other construction work. Maintain any existing utilities in operation unless otherwise directed by the Resident Engineer.

C. Concrete encasement shall be limited to the neat lines shown on the Contract Drawings. The Contractor shall be responsible for coordinating placement of the concrete with other work. If the ductbank conflicts with other work, it shall be relocated by Contractor at no additional expense to owner.

D. Protect and maintain all new or existing benchmarks or other reference points necessary for the completion of the work.

3.2 TRENCH EXCAVATION AND BACKFILL

A. Follow the requirements of Section 31 20 00 Earth Moving except blasting will not be permitted. Provide a minimum cover of 30 inches over all underground ductbank unless otherwise indicated.

B. When trench walls are stable, use the walls of the trench as forms for concrete encasement. The trench shall be made no wider than necessary to provide the nominal concrete encased ductbank.

C. Excavations shall be dewatered in accordance with Section Section 31 20 00 Earth Moving and the excavation cleaned prior to raceway and concrete placement.

D. Provide a compacted base per Section 31 20 00 Earth Moving under the duct bank.

E. Install yellow warning tape 12 inches above ductbanks.

3.3 REQUIREMENTS FOR RACEWAY TYPES

A. In concrete-encased ductbanks, use Schedule 40 PVC conduit,

B. GRS conduit or PGRS conduit shall be used for ells in PVC conduit runs where the bend radius is less than 6 feet. Minimum permissible bend radius is 36 inches.

C. Schedule 40 PVC conduit may be used for bends in PVC ductbanks if the bend radius is greater than six feet (90 degrees of bend in 9.5 feet of conduit length).

1. Bends in PVC conduit shall be factory ells or field bent.
2. Field bends in PVC conduit with less than 100 foot radius shall be formed hot using only a heater recommended by the conduit manufacturer.

3. Use conduit plugs during bending for conduit 2 inches and larger. Remove plugs only after conduit has cooled. Field bends with radius greater than 100 feet may be formed cold. When placing cold bends, maintain adequate spacing from the inside of the bend to excavation walls for the required 3 inches of concrete.

3.4 RACEWAY PLACEMENT

A. Raceways shall be arranged as shown on the Contract Drawings.

B. Slope all raceway for drainage to manholes or handholes and away from buildings. Minimum slope is 3 inches per 100 feet.

C. Where raceways in a ductbank terminate in a building, any raceways under the building shall be installed as a continuous ductbank.

D. Raceway spacers shall be placed at a maximum of 5 foot intervals.

E. Bending radii indicated on Contract Drawings and specified herein are to be considered minimum, unless noted otherwise.

F. Secure raceways to prevent displacement during concrete encasement or earth backfilling. Make minor changes in location or cross-section as necessary to avoid obstructions or conflicts. Where raceway runs cannot be installed as shown because of conditions not discoverable prior to trenching, refer the condition to the Resident Engineer for direction before further work is done.

G. When placing concrete around the raceways, adjust the delivery chute so the fall distance of the concrete into the trench is minimal.

1. Concrete direct fall distance shall be 2 feet or less.
2. Use a splash board to divert the flow of concrete away from the trench sides and avoid dislodging soil and stones.
3. Concrete shall be incorporated in accordance with Section 03 30 00, Cast-in-Place Concrete.

H. All plastic raceways may expand or contract as concrete is placed and cured. Therefore, when placing concrete encasement, always encase from one end of the duct section toward the other end to allow the free end to move. Never encase from each end of the section toward the center.

1. Place concrete continuously between manholes, handholes and pullboxes. If the placement stops for more than 2 hours, 8 foot lengths of No. 4 reinforcement steel shall be placed longitudinally around the perimeter of the concrete envelope on 12 inch centers and with 2 inches minimum cover. Half of each 8 foot length shall be in each pour.
2. Where concrete encased ductbanks are terminated for future extension, stub out and cap all conduits at least one foot beyond the end of ductbank concrete. With top row closest to the end of concrete, stagger ends of horizontal rows of conduits for ease in making future ductbank extensions. Extend reinforcement steel with numbers and arrangement as

in 3.02-H.1 to a point beyond all conduit ends, leaving at least four feet of each rebar embedded in ductbank concrete.

a. Prior to backfilling, record location of end of ductbank as determined by surveying from some existing survey station which will remain at least until Contract completion. Submit to Resident Engineer for approval prior to beginning any such surveying, a plan indicating how surveying will be carried out, including survey stations to be used to determine ductbank end locations. Provide to Resident Engineer copies of all survey data.
b. Prior to completion of contract, re-survey ductbank endpoints and provide a 4 inch x 4 inch x 6 feet treated wood post painted white to mark the ductbank termination location. Permanently label each such post with brass screws and a brass tag stamped with the ductbank number and coordinates per schedule, and the ductbank burial depth. Install the marker post two feet in the ground centered between tracks.

I. Mandrel raceways and provide seals in accordance with Section 26 05 33, Raceway, Boxes, and Conduits for Electrical Systems

3.5 INSPECTION

A. Ductbanks shall be inspected and approved by the Resident Engineer before placing concrete encasement. Notify the Resident Engineer seven (7) days before placing concrete. Clean trenches, dewater, and adjust clearances as directed to obtain the minimum concrete dimensions shown on the Contract Drawings.

B. Concrete shall be placed the same day as Resident Engineer's approval.

3.6 COMMUNICATION COMPANY DUCTBANKS

A. Ductbanks for communication company circuits shall have the following additional material and construction requirements:

1. All raceways shall be GRS conduit or PVC schedule 40 or 4 inch PVC with 3 – 1-1/4 inch SDR 13.5 innerducts as indicated on the Contract Drawings.
2. All 90 degree elbows shall be GRS conduit or PGRS conduit.
3. Communications Companies involved with this project include Integra, TW Telecom/ ATT, ELI, Centurylink (CTL formerly Qwest), Comcast and Clackamas County. Other third-party companies may be involved in selected portions of the project.
4. Construction and material for communication company ductbanks shall comply with that company's specifications and requirements and are subject to their inspection and approval.

END OF SECTION

SECTION 26 0575 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Perform field tests and operational checks to assure that all electrical equipment, both contractor and Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

B. The tests and operational check shall determine the suitability for energization.

C. Schedule tests and give a minimum of one week's advance notice of time and date to the Architect and Owner for any major systems tests specified in this Section.

1.2 INDEPENDENT TESTING AGENCY

A. Where indicated in Part 3 of these Specifications, the test and/or operational check shall be performed by a recognized independent testing agency engaged and paid for by the Contractor.

B. The testing agency shall meet Federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the National Electrical Testing Association constitutes proof of meeting such criteria.

C. The testing agency shall be responsible for implementing final settings and adjustments on equipment and protective devices in accordance with the Engineers specified values or as recommended by the device or systems manufacturer after system testing.

1.3 SUBMITTALS

A. Test Reports: Submit three copies of the completed report to the Architect no later than fifteen (15) days after completion of test unless directed otherwise. The test reports shall be bound and its contents certified.

B. The test report shall include the following:

1. Summary of project.
2. Description of equipment tested.
3. Description of test.
4. List of test equipment used in calibration and calibration date.
5. Test results.
6. Conclusions and recommendations.
7. Appendix, including copies of appropriate test forms used in the field.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT

A. The testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field Instruments: 6 months maximum.
2. Laboratory Instruments: 12 months.
3. Leased Specialty Equipment: 12 months (where accuracy is guaranteed by lessor). Dated calibration labels shall be visible on all test equipment.

PART 3 - EXECUTION

3.1 SHORT-CIRCUIT STUDY

A. Provide a current and complete short-circuit study and equipment withstand evaluation for the electrical distribution system. The study shall be in accordance with applicable ANSI and IEEE Standards.

B. The study input data shall include the utility company's short-circuit single and three-phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.

C. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.

D. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents. Any problem area or inadequacies in the equipment shall be promptly brought to the Owner/Engineer's attention.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Coordination study shall be prepared for the electrical overcurrent devices to assure proper equipment and personnel protection.

B. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source. The study shall reflect the operation of each device during normal and abnormal current conditions.

C. The coordination study shall be prepared by qualified engineers of the switchgear Manufacturer, Electro-Test, Electrical Systems Analysis, Inc., Power Field Services, Inc., or approved. The contractor is responsible for providing all pertinent information required by the preparers to complete the study.

D. The complete study shall include a system one-line diagram and protective coordination curves.

E. Coordination curves shall be prepared to determine the required settings of protective devices to assure selective coordination. The curves shall graphically illustrate on log-log paper that adequate time separation exists between each protection device shall be plotted in such a manner that all upstream devices will be clearly depicted on one sheet. The following specified information shall also be shown on the coordination curves:

1. Device identification.
2. Voltage and current ratio for curves.
3. 3-phase and 1-phase ANSI damage points for each transformer.
4. No-damage, melting, and clearing curves for fuses.
5. Cable damage curve.
6. Transformer in rush points.
7. Maximum short circuit cut-off point.

F. A table shall be developed to summarize the settings selected for the protective devices. Included in the table shall be the following:

1. Device identification.
2. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
3. Fuse rating and type.
4. Ground fault pickup and time delay.

END OF SECTION

SECTION 26 0926 - LIGHTING CONTROL PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide programmable lighting control system in accordance with the Contract Documents.

B. The programmable lighting control system shall be a stand alone system operating independently of other control systems. The system shall be the distributed processing type, allowing each lighting relay cabinet to function as an independent programmable lighting control system.

1.2 QUALITY ASSURANCE

A. Manufacturer and equipment supplier shall have a minimum of five years prior experience.

B. Components and assemblies shall be factory pretested and burned in prior to installation.

C. Factory trained technicians and applications engineers shall be available to provide initial programming, field testing, system start up, training and operation assistance.

D. Equipment shall be certified for use in the State of the project and shall meet the State energy code.

1.3 STANDARDS

A. Lighting Relay Cabinets: UL 916.

B. Emissions Standard: FCC Part 15, Subpart J, Class A.

1.4 SUBMITTALS

A. Manufacturer’s product data sheets.

B. Riser diagram showing lighting relay cabinets, control devices, PC interface equipment, telephone override equipment, and interconnecting conduit and wire.

C. Wiring diagram for each type of control device.

D. Detailed project specific narrative system sequence of operation.

E. Lighting relay cabinet schedules indicating relay number, system address, branch circuit panelboard and circuit number, control device, and specific description of load controlled.

1.5 FIELD TESTING

A. Wiring shall be inspected and tested for continuity and short circuits.

B. Field Test Reports:

1. Certification that equipment has been properly installed and programmed and is in satisfactory operating condition.
2. Detailed operational test report in matrix form indicating each relay and each control device. Report shall certify the following:

a. Successful operation of each relay.
b. Successful operation of each control device.
c. Successful operation of automatic control sequences.
d. Successful operation of telephone override control.

1.6 IDENTIFICATION

A. Provide an identification nameplate for each lighting relay cabinet.

B. Provide a directory card in each lighting relay cabinet indicating relay number, system address, branch circuit panelboard and circuit number, and specific descriptions of loads controlled.

1.7 OPERATION

A. The lighting relay cabinets shall switch relays ON and OFF in response to commands initiated from control devices, user defined time of day schedules, and commands from the hand held controller. Switch input control devices shall be capable of providing ON only, ON/OFF, and ON/OFF (with time override OFF of 2 to 999 minutes delay should switch be left on) control actions.

B. Time of day schedules shall be developed within logic circuits of each lighting relay cabinet. Each lighting relay cabinet shall have capacity for nine separate daily schedules, including one holiday schedule. Weekly schedules and twenty holidays shall be developed from combinations of the daily schedules, up to one year in advance. Schedules shall contain provisions for daylight savings time and leap year adjustment.

C. Prior to turning off lights from any time based command, the lighting relay cabinet shall momentarily “flash” lights signaling occupants to initiate an override command. Time interval before turning off shall be programmable from one to nine minutes or “flash” may be disabled.

D. The hand held controller shall be used to set operating schedules, review status of any relay, define switch functions, change a relays status (ON or OFF) and perform systems diagnostics. Prompt messages shall be provided at each step on the LCD screen.

E. Telephone override shall allow control of any relay or any preset group of relays utilizing a standard building telephone.

F. Off sweep function to line voltage shut off switches shall open and close relays serving associated branch circuits for the time interval required by the line voltage shut off switch.

G. Exterior lighting shall automatically turn on in response to exterior photocell and automatically turn off in response to preprogrammed schedule.

1.8 WARRANTY

A. Provide a two year system warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. System: GE TLC, MicroLite 1000, Powerline Communications Watchkeeper, The Wattstopper, Complete Control or Intelligent Lighting Controls.

B. Line Voltage Shut Off Switch: Sentry Switch.

2.2 LIGHTING RELAY CABINETS

A. General:

1. Relays and logic circuits shall utilize quick connectors on factory wiring to facilitate replacement.
2. Logic functions, schedules, and switch definitions shall be protected from loss of power for periods up to ten years.
3. Each lighting relay cabinet shall have an RJ11 receptacle for connection of a portable hand held controller for schedule and switch definition.

B. Enclosure:

1. NEMA 1, surface wall mounted steel enclosure, finish coated with ANSI 61 grey enamel over a rust inhibitor.
2. Enclosure faceplate shall be secured to the enclosure with captive screws. Provide a hinged, locking door for access to the low voltage compartment.
3. Low voltage compartment shall be physically separated from two line voltage wiring areas by steel barriers.

C. Relays:

1. Provide relays in quantities indicated on the lighting relay cabinet schedules.
2. Each relay shall have a single set of contacts rated for 20 amps at 120 VAC or 277 VAC, tungsten and ballast rated. Coil shall be 24 V, mechanically or electrically held.
3. Each relay shall have a LED indicator to display ON/OFF status of each relay.

D. Switch Inputs:

1. Provide a programmable low voltage switch input for each relay. Half of the switch inputs shall be two wire type and half of the switch inputs shall be the universal type.
2. Two wire switch inputs shall accommodate two wire maintained contact (SPST) low voltage switching devices or two wire momentary contact (push ON/push OFF) low voltage switching devices.
3. Universal switch inputs shall be the same as two wire switch inputs and in addition shall accommodate three wire momentary contact low voltage switching devices.

E. Hand Held Controller:

1. 16 key, environmentally sealed keypad.
2. 4 line, 20 characters per line liquid crystal display.
3. 6 foot control cord with RJ11 connector.
4. Magnetic mounting strips on rear.
5. Provide two hand held controllers (one is spare).
6. Network Option: Each lighting relay cabinet shall be tied together by a shielded, twisted pair cable run in conduit and terminated in an RJ11 connector in the ECC. Programming shall be accomplished by connecting the hand held controller into the RJ11 connector. System diagnostics shall check the integrity of the network data line continuously and report abnormal conditions.

2.3 PC INTERFACE

A. Each lighting relay cabinet shall be tied together by a shielded, twisted pair cable run in conduit and terminated in personal computer (PC) workstation located in the ECC.

B. PC shall be Pentium/300MHz class with 19 inch super VGA color monitor, minimum 4.0 GB hard disk, 64 MB RAM, 3.5 inch insertable disk drives, CD ROM, IOMEGA one step back-up, 56K (V.90) Robotics modem, enhanced keyboard, mouse, mouse pad, operating system as specified by programmable lighting control system vendor, and compatible antivirus software.

C. Provide a portable UPS with battery backup capable of maintaining operation of the PC interface equipment for 15 minutes in the event of a failure of the normal power supply.

D. Provide a HP4000 Series printer or approved equal in the ECC.

E. Provide telephone override interface (three lines) including telephone outlet and cable run in conduit to nearest telecommunications backboard.

F. System Software:

1. Main menu selections shall include VIEW, ACTIVATE, EDIT, and MAINTENANCE.
2. Password protection shall be keyed to the main menu to allow four levels of authorized system use.
3. Ability to group relays by function or zone for automatic or manual control from the PC or a low voltage switching device.
4. Ability to establish relay group ON/OFF patterns as presets for automatic of manual control from the PC or a low voltage switching device to simultaneously set lighting conditions for the entire facility.
5. Diagnostic function shall monitor the integrity of the network and display the status of each relay in the system.
6. Reporting and Monitoring Software: Automatically log data and generate reports to be used for lamp maintenance, monitoring usage, or chronologically recording system events.
7. Interactive Graphics Software: Include twelve custom full color graphic screens to provide a visual representation of the facility to assist in the development and monitoring of system functions.

2.4 CONTROL DEVICES

A. Low Voltage Wall Switch:

1. Similar in appearance to lighting switches specified under Section 26 27 26.
2. Two wire, maintained contact type.
3. Three wire momentary contact type where multiple location is indicated.

B. Photocell:

1. Interior or exterior weatherproof type for automatic ON/OFF control of lighting fixtures in response to ambient lighting levels.
2. Adjustable time delay and footcandle level set points.
3. Interior type shall include separate ON and OFF set points to prevent control from toggling inadvertently as the sensor passes through the control threshold.

C. Line Voltage Shut Off Switch:

1. Provide line voltage shut off switches to control lighting loads from 0.1 amperes to 5.0 amperes or from 1.0 amperes to 20.0 amperes based upon the actual load controlled. The switches shall be capable of operating in the manner of a conventional SPST or SPDT wall switch and also be capable of turning off automatically when their source voltage is interrupted for a period of 5 seconds or more.
2. When swept OFF by power interruption or turned OFF manually, the toggle of the switch shall drop to the conventional OFF position and illuminate to facilitate manual override if required. The switches shall be capable of maintaining the lighting load through a 1.5 second power interruption.
3. The switch shall be capable of controlling all types of loads including fluorescent, quartz, incandescent, metal halide, high pressure sodium, mercury vapor, and low pressure sodium. The switch shall conduct power to the lighting load via a standard metal to metal contact closure and shall not induce any harmonic distortion or notching on the power line. The switch shall have dimensions suitable for mounting in multi-ganged wall boxes and shall utilize standard dimension switch plate hardware.

D. Low Voltage Switchbank:

1. Provide one low voltage switchbank in the ECC and one low voltage switchbank in the SCC.
2. LCD control station for one touch control of system presets. System preset scenes include specific relays activated as a group to control operationally functional lighting systems.
3. Provide an individual low voltage pilot switch for each of the following preset scenes:

    a. Building façade lighting.
    b. Landscape and pedestrian lighting.
    c. Parking lot lighting.
    d. Public corridor lighting.
    e. Main lobby lighting.
    f. Garage lighting.
    g. General interior lighting for each floor of the building (one switch per floor).

PART 3 - EXECUTION

3.1 GENERAL

A. Connect each lighting relay cabinet to the normal power supply.

B. Provide a dedicated isolated ground receptacle outlet connected to the emergency power supply for connection of the PC interface equipment.

C. Provide an exterior photocell in suitable location on roof facing north sky.

3.2 INITIAL PROGRAMMING

A. Provide initial programming of system including assignment of relays to low voltage switching devices and assignment of relays to automatic schedules prior to system start up and training. Time of day schedules shall be established by the Owner.

B. Provide initial programming of reporting and monitoring software including project specific maintenance, recording, and monitoring applications.

C. Provide initial programming of 12 graphic screens and interactive application functions. Graphic screens shall be established by the Owner.

3.3 SYSTEM START UP

A. Provide qualified technicians to confirm proper installation and operation of system components after initial programming and prior to training.

3.4 TRAINING

A. Provide a minimum of three days of on site training and instruction to the building's operating personnel by qualified application engineers. Include the instructor's cost of travel and subsistence.

3.5 OPERATION ASSISTANCE

A. Factory telephone support shall be available at no cost to the owner for the duration of the warranty period. Factory assistance shall consist of solving programming or application questions concerning the control equipment. The manufacturer shall be capable of trouble shooting the software aspects of the system from a factory location via modem.

END OF SECTION

SECTION 26 0943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Section specifies the requirements necessary to furnish and install an expansion of the existing space lighting control system in room 330A and 350A

B. This Section specifies the requirements necessary to furnish and install a new replacement lighting control system in rooms 330B.

1. Control equipment and enclosures.
2. Switches.

1.2 RELATED REQUIREMENTS

A. Use this Section in conjunction with the following other Section and related Contract Documents to establish the total requirements for low-voltage lighting control systems:

1. Section 01 33 00, Submittals
2. Section 26 05 00, Common Work Results for Electrical
3. Section 26 05 16, Low-Voltage Electrical Power Conductors and Cables
4. Section 26 27 26, Wiring Devices
5. Section 26 51 00, Interior Lighting
6. Section 27 10 00, Structured Cabling

1.3 DIGITAL LIGHTING CONTROL SYSTEM DESCRIPTION

A. The new lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.

B. The new system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)

C. All new system devices shall be networked together enabling digital communication and shall be individually addressable.

D. The new system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.

E. The new system shall not require any centrally hardwired switching equipment.

1.4 SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)

B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)

C. Other Diagrams – as needed for special operation or interaction with other system(s)

D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up

E. Hardware and Software Operation Manuals

F. Other operational descriptions as needed

1.5 QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

C. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.6 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.7 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon two main concepts;

1. Intelligent lighting control devices
2. Standalone lighting control zones.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. Intelligent lighting control devices shall communicate digitally, require ~3 mA of current to function (Graphic WallPod excluded), and posses at least two T568B connectors.

D. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a future higher level network backbone.

E. Devices within a lighting control zone shall be connected with CAT-6 low voltage cabling, in a daisy-chain fashion, and in any order.

F. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

G. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

H. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

J. System shall have a primary wall mounted network control “gateway” device that is capable of accessing and controlling connected system devices.

K. System shall use “bridge” devices that route communication and distribute power for up to 8 lighting zones together for purposes of decreasing system wiring requirements.

L. System shall be capable of a future upgrade to a web-based software management program. That future system will enable remote system control, status monitoring, and creation of lighting control profiles.

M. Individual lighting zones shall be capable of being segmented into several channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

N. System shall be capable of operating a lighting control zone according to several sequences of operation. Note operating modes should be utilized only in manners consistent with local energy codes.

1. Auto-On / Auto-Off (via occupancy sensors)
2. Manual-On / Auto-Off
3. Auto-to-Override On
4. Manual-to-Override On
5. Auto On/Predictive Off
6. Multi-Level On (multiple lighting levels per manual button press)

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Networked System Occupancy Sensors

1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
4. Sensors shall be have programmable time delays, multiple lens options which are customized for specific applications.
5. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
6. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-6 cabling.
7. Sensors shall be available in Wall Switch, Surface Ceiling, Fixture Mounted, Recessed Ceiling, & corner mounted versions.

B. Networked System Daylight (Photocell and or Dimming) Sensors

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor’s set-point and deadband shall be automatically calibrated through the sensor’s microprocessor by initiating

an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
5. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an “offset” from the primary zone.

C. Combination Motion Sensor / Photocell units

1. Any of the above motion sensors and/or Photocell units shall be able to combine both motion sensing as well as daylight sensing into a single unit to reduce ceiling clutter.

D. Lighting Control Relays and Dimmers

1. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system.
2. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
3. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads.
4. Relays and Dimmers shall provide UL924 listing and operation where required for the switching of legally required life safety egress lighting.
5. Power Packs shall be available in the following types to match the loads required to be controlled:

    a. Single Pole – 120 through 277 VAC
    b. Two Pole – 208, 240, & 480 VAC
    c. Dry contact – up to 1 amp at less than 42 V DC or AC
    d. 0-10V with Single Pole relay
    e. Phase Control Dimming – for Incancdesent, Magnetic Low Voltage Transformers, Electronic Low Voltage Transformers, 2 Wire Flourescent dimming ballasts, Neon, or Cold Cathode as required
    f. 3 Wire dimming – for Lutron or similar Dimming Ballasts

E. Networked System Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening and shall be gangable with other compatible devices.

2. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
3. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
4. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
5. Devices with mechanical push-buttons shall be made available with custom button labeling
6. Single Pole, Two Pole, and Four Pole switches shall be available.
7. Single and two pole Dimmers shall be available
8. Preset Control shall be available in 2 and four buttons per single gang device.

F. Networked Auxiliary Input / Output (I/O) Devices

1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
2. Devices shall have two RJ-45 ports
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
5. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
6. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
7. Specific I/O devices shall sense state of low voltage outdoor photocells

G. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.

H. Networked System Graphic Wall Station

1. Device shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
3. Device shall surface mount to single-gang switch box.

I. Communication Bridges

1. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.

2. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-6 cabled connection.
3. Device shall report back over network (accessible at gateway or software) the number of devices connected and their activity on each port.

J. Networked LED Luminaires

1. Networked LED luminaire shall have a mechanically integrated control device
2. Networked LED luminaire shall have two RJ-45 ports
3. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
4. Networked LED luminaire shall provide low voltage power to other networked control devices
5. System shall be able to turn on/off LED luminaire without using a relay
6. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate, receive, mount, connect, and place into operation all equipment.

B. Install equipment in accordance with manufacturer's installation instructions.

C. Provide complete installation of system in accordance with Contract Documents.

D. Maintain performance criteria stated by the manufacturer without defects, damage, or failure.

E. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

F. As specified in Article 3.1, Paragraph F, interior sensors work mainly with diffused light and have a much higher lighting gain than exterior sensors. Electric light sources can affect these sensors unless the sensors are shielded from the light given off by electric light sources.

G. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

H. Furnish all conduit, wire, connectors, hardware, and other incidental items necessary for a properly functioning lighting control and relay system as

described herein and shown on the plans. The Electrical Contractor shall maintain performance criteria stated by the manufacturer without defects, damage, or failure.

I. Compliance: Contractor shall comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.

J. Circuit Testing: The contractor shall test that all branch load circuits are operational before connecting loads to system load terminals, and then de-energize all circuits before installation.

K. Application of Power: Power shall not be applied to the relay system during construction and prior to turn-on unless specifically authorized by written instructions from the manufacturer.

L. Terminate and test all network cable assemblies. Each field installed RJ45 connection must be tested prior to system interconnection. A test report must be furnished to factory-certified service engineer prior to scheduling commissioning activity.

3.2 SITE VERIFICATION

A. Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 FIELD MEASUREMENTS

A. The electrical contractor shall be responsible for field measurements and coordinating the physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

3.4 INSPECTION

A. Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.5 SITE PROTECTION

A. Contractor shall protect installed product and finished surfaces from damage during all phases of installation including storage, preparation, testing, and cleanup.

END OF SECTION

SECTION 26 2000 - LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install the materials for the complete secondary service and distribution system as specified herein and shown on the Drawings. Secondary distribution system shall be fully rated. Series rating shall not be acceptable.

B. Provide a transformer pad and ground grid for use by the serving utility. Coordinate pad size, openings, type of construction, conduit arrangement and grounding requirements with the utility prior to construction.

1.2 UTILITY METERING

A. Provide utility metering facilities where indicated on the Drawings, complying with the established serving utility requirements. Provide quantity and style of meter sockets and accessories required by the utility.

B. Include all metering charges or connection costs charged by the serving utility in the original proposal. Refer to Coordination of Work section of these Specifications.

1.3 SUBMITTALS

A. Shop drawings.

B. Product data.

C. Ground Fault Protection System Test Report.

D. Coordination study.

E. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cutler Hammer, General Electric, Square D.

2.2 MAIN DISTRIBUTION PANEL

A. Panel: Sectionalized, floor standing, metal enclosed units containing molded or insulated case circuit breakers. Panel shall be listed by Underwriters' Laboratories and shall bear a UL label as suitable for use as service equipment; NEMA 3R Enclosure.

B. Circuit Breakers: Main breakers and sub distribution feeder breakers shall be AC power type, dead front, with solid state trip devices. Interrupting rating shall be a minimum of 65,000 rms symmetrical amperes. Breakers shall be rated for standard continuous duty. Field adjustable trip functions shall consist of:

1. Long time ampere rating.
2. Long time delay.
3. Instantaneous pickup.
4. Short time pickup.
5. Short time delay.
6. Ground fault pickup.
7. Ground fault delay.

C. Equip breakers with the following additional auxiliary devices:

1. Shunt trip.
2. Undervoltage trip.
3. Normally (open) (closed) alarm switch.
4. Electric operator.
5. Ground fault test button.
6. Ground fault trip indicator.
7. Trip indication with auxiliary contacts.
8. Overcurrent indication with auxiliary contacts.

D. Equip breakers with zone selective interlocking on the (short time)(ground fault)(short time and ground fault) trip for maximum coordination.

E. Bus work: Copper or aluminum, sized as shown on the Drawings, 100% neutral with a maximum hot-spot temperature rise of 65 degrees C. above an ambient of 40 degrees C. under continuous full load current and rated to withstand (42,000 A) (65,000 A) (100,000 A) fault current. Include bussing provisions for future devices in all spaces called for. Provide a copper ground bus in bottom of enclosure, full length of assembly.

F. Digital Metering: Provide potential and current transformers, ammeter, voltmeter, power factor meter, required selector switches and associated accessories for monitoring the properties of the incoming secondary power as provided by the utility. Ammeter and voltmeter selector switches shall have provisions for reading individual phase amperes, individual phase to neutral volts, phase to phase volts and include a meter “off” position. Metering equipment shall be switchboard grade with nominal 2% accuracy.

G. Finish: Primed and finished with not less than two coats of light gray enamel.

2.3 SUB-DISTRIBUTION PANELS

A. Panels: Similar in manufacture as the main distribution equipment, free standing, front operated circuit breaker type, fully enclosed with bussing provisions for future extension. Assemblies rated over 1000 amperes shall be of free standing construction. Overcurrent protection ratings shall be as noted on the Drawings. All devices shall be capable of interrupting the fault current available.

B. Bus Work: Copper or aluminum, sized as shown on the Drawings, 100% neutral with a maximum hot-spot temperature rise of 65 degrees C above an ambient of 40 degrees C under continuous full load current and rated to withstand 65,000 A fault currents. Include bussing provisions for mounting future devices in all spaces called for. Where panel configuration provides additional spaces within a section, these spaces shall be bussed to receive future devices. Make provisions for future extension of bussing. Provide a copper ground bus in bottom of enclosure.

C. Circuit Breakers: Molded case, bolt-in thermal magnetic type. Breakers shall have short circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system. Minimum short circuit rating for any circuit breaker shall be 10,000 A.I.C. for 120V and 208V breakers, 14,000 A.I.C. for 277V and 480V breakers.

D. Digital Sub-Metering: Provide metering provisions in separate sections of the distribution equipment to measure line amps and energy consumption of various selected loads indicated on the Drawings. Metering shall include the necessary potential and current transformers, ammeter with phase selector switch, watthour meter with demand register and associated accessories for recording the department usage on a regular basis. Metering equipment shall be switchboard grade with nominal 2% accuracy with provisions for flush mounting in the appropriate distribution panel section. Kilowatt hour meters shall be two stator polyphase complete with 15 minute interval sweep type demand register.

E. Finish: Primed and finished with not less than two coats of light gray enamel.

2.4 BRANCH PANELBOARDS

A. Branch Circuit Panels: Bolt-in circuit breaker type with aluminum or copper bussing. Panels shall be fitted with flush lift latches and locks keyed alike, same as existing. Deliver all panel keys to the Owner at completion of the project.

B. Main Circuit Breakers: Equip panels indicated with main circuit breakers sized as scheduled and mounted behind door at top of panel. Back feeding of branch circuit breakers is not acceptable.

C. Branch Circuit Breakers: Molded case, thermal magnetic type. Breakers shall have short Circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system. Breakers mounted in branch panelboards shall be of the bolt-in type. Circuit breakers used for switching duty shall be UL listed for that purpose and marked “SWD”. Minimum short circuit rating for any circuit breaker: 10,000 A.I.C. for 120V and 208V breakers, 14,000 A.I.C. for 277V and 480V breakers.

D. Wiring Gutters: A minimum of 4 inches wide except where feeder conductors enter where a minimum of 6 inches clear shall be provided. Feeder conductors to enter directly in line with lug terminals wherever practicable. Provide separate feeder studs for each feeder conductor compression lug.

E. Cabinets: Flush doors with concealed hinges and mounting clamps equal to Square D Mono Flat, or ITE Decor trim. Surface panels shall have metal face trims with no sharp edges or corners. Finish surface panel tubs to match face trim. Equip with a sheet metal skirt to floor, finished to match panel to prevent dirt accumulation where conduits penetrate floor. Access panel on skirt may be screw type for access to interior.

F. Ground Bus: Provide a grounding bus with termination capacity for the grounding conductor sized for the branch circuit equipment grounding conductors in isolated ground 208Y/120V panels identified by suffix IG. Grounding bus shall be (insulated from) (bonded to) the panel cabinet.

2.5 DRY TYPE TRANSFORMERS

A. Enclosed and ventilated, air cooled type, Class H insulation, designed for 115 degrees C temperature rise above 40 degrees C ambient temperature at full load continuous operation. Equip with two 2-1/2% FCAN taps and four 2-1/2% FCBN taps. Maximum sound level shall be N.E.M.A. standard with vibration isolators between the core and coil assembly and case.

B. Case to be totally enclosed with louvers to prevent entry of foreign objects into the interior, manufactured in accordance with all NEMA & U.L. approval standards.

C. Provide an isolation shield between the primary and secondary windings in transformers where noted or shown on the Drawings to attenuate line electrical disturbances. Insulate shield from the transformer windings and core and ground to transformer enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the secondary distribution system assemblies and equipment as shown on the Drawings, parallel and square with the building lines.

B. Neatly lace and secure the conductors of the feeder circuits individually at maximum 2 foot intervals. The cable lugs shall not support the weight of the cables.

C. Mount a spare fuse cabinet adjacent to each fusible distribution panel. Equip cabinet with one complete set of spare fuses of each size and type installed in the panel with appropriate fuse pullers.

3.2 BRANCH PANELBOARDS

A. Install panelboards plumb and level, located as shown on the Drawings up 6'-0" to top unless noted otherwise.

B. Equip selected breakers with mechanical locking devices such that they may be locked in the “on” position. Selected breakers shall include those serving alarm systems, fire suppression systems, communications systems and other critical loads directed.

C. Install a spare 3/4-inch conduit from flush panels for each three single pole breakers or spaces provided. Terminate conduits above accessible ceiling or as directed.

D. Utilize circuit breakers in existing panels which are to remain. Where faulty or inadequate breakers are found in these panels, replace with suitable breakers from panels removed during demolition.

E. Equip all circuit breakers associated with multi-wire branch circuit breakers with handle ties per NEC 210-4. Provide grouping of multi-wire branch circuits per NEC 210-4(D).

3.3 TRANSFORMERS

A. Install the indoor low voltage transformer with flexible conduit connections to housing. Make all cable and ground wire connections.

B. In general, transformers will be floor mounted. When necessary to wall or trapeze mount, securely anchor to structure using a safety factory of 4.

3.4 CONCRETE PADS

A. Provide nominally 3 1/2-inch deep concrete housekeeping pads under all free-standing pieces of switchgear and floor mounted transformers. Pads shall extend nominally 2 inches beyond the edges of the equipment.

3.5 COORDINATION AND ARC FLASH STUDY

A. Provide arc flash study per NEC, IEEE 1584, and NFPA 70E.

B. Coordination study shall be prepared for the electrical overcurrent devices to assure proper equipment and personnel protection.

C. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source. The study shall reflect the operation of each device during normal and abnormal current conditions.

D. The coordination study shall be prepared by qualified engineers of the switchgear manufacturer, Electro-Test, Electrical Systems Analysis, Inc. or approved. The contractor is responsible for providing all pertinent information required by the preparers to complete the study.

E. The complete study shall include a system one-line diagram and protective coordination curves.

F. Coordination curves shall be prepared to determine the required settings of protective devices to assure selective coordination. The curves shall graphically illustrate on log-log paper that adequate time separation exists between each protection device shall be plotted in such a manner that all upstream devices will be clearly depicted on one sheet. The following specified information shall also be shown on the coordination curves:

1. Device identification.
2. Voltage and current ratio for curves.
3. 3-phase and 1-phase ANSI damage points for each transformer.
4. No-damage, melting, and clearing curves for fuses.
5. Cable damage curve.
6. Transformer in rush points.
7. Maximum short circuit cut-off pint.

G. A table shall be developed to summarize the settings selected for the protective devices. Included in the table shall be the following:

1. Device identification.
2. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
3. Fuse rating and type.
4. Ground fault pickup and time delay.

END OF SECTION

SECTION 26 2413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide switchboards in accordance with the Contract Documents.

B. Switchboards include both main switchboards and distribution switchboards.

1.2 QUALITY ASSURANCE

A. Utility company approval of service busway, incoming section, and metering provisions.

1.3 STANDARDS

A. Switchboards:

1. NEMA PB-2
2. UL 891
3. UL service entrance label

B. Overcurrent Protection Devices :

1. Circuit breakers: NEMA AB-1, Federal Specification W-C-375 B/GEN, UL 489
2. Switch and fuse: UL 977

C. Testing:

1. NETA

D. Utility company requirements.

1.4 SUBMITTALS

A. Manufacturer’s product data sheets for overcurrent protection devices.

B. Dimensioned layout and elevation drawings showing switchboards, housekeeping pads, and support locations and types.

C. One line diagram showing electrical ratings, overcurrent protection device ratings, cable lugs, utility company metering, metering displays, identification nameplate, and fuse clip sizes.

D. Utility company approval for components subject to their specifications.

E. Wiring diagrams.

F. Installation instructions.

G. Short circuit and coordination study.

H. Certified test reports

I. Seismic restraint calculations. .

1.5 FIELD TESTING

A. Field inspection and testing shall occur after installation is complete, feeders are terminated, and the room is secure. Testing shall be conducted not more than 4 weeks before equipment is energized.

B. Testing Scope:

1. Visual and physical inspection of equipment.
2. Check control wiring and metering.
3. Meter calibration
4. Ground fault protection. .
5. Adjust circuit breaker settings based on recommendations in the short circuit and coordination study.
6. Primary current injection testing of circuit breakers.
7. System grounding.

C. Certified Test Reports:

1. Field testing shall be performed by a NETA certified, independent third party testing agency: Apparatus Unlimited, Electro-Test, Power Systems Testing, or approved equal.
2. Verify that the installation is in accordance with the manufacturer's instructions.
3. Verify that the equipment has been fully tested and is operational.
4. Perform testing and compile detailed test reports for each switchboard and overcurrent protection device.

1.6 IDENTIFICATION

A. Provide an identification nameplate for each switchboard, each main, and each feeder overcurrent protection device.

1.7 SHORT CIRCUIT AND COORDINATION STUDY

A. Prepare a short circuit and coordination study based on the actual overcurrent protection devices proposed for use and the actual conductor sizes and lengths.

The study shall be prepared by an Electrical Engineer licensed in the State of the Project.

B. The study shall be submitted with the distribution equipment submittal and shall indicate where device substitutions are being made in order to achieve adequate interrupting capacity ratings for each piece of equipment.

C. The study shall include recommended settings of adjustable overcurrent and ground fault settings.

D. Provide overcurrent protective devices of suitable type and rating to meet or exceed the available short circuit currents indicated in the short circuit study. Circuit breakers protecting elevators, including all upstream feeder circuit breakers, shall be of the appropriate frame size to ensure 100% selectivity in the instantaneous region of the trip curves at the calculated fault current.

E. Interrupting capacities shall be based on a fully rated protection system where all overcurrent protection devices are rated for the full prospective short circuit current (as indicated in the final short circuit submittal). Series rated panelboards are not permitted .

F. Interrupting capacities may be based on a series rated protection system where the short circuit interrupting rating (as indicated in the final short circuit submittal) for a combination of two or more overcurrent protection devices which are connected in series and in which the rating of the downstream device(s) in the combination is less than the series rating. Submit evidence of UL series ratings of overcurrent protection devices.

G. Obtain from the utility company (and confirm in writing) the short circuit current available at the utility company's transformer secondary.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cutler Hammer, General Electric, Siemens, or Square D.

2.2 RATINGS

A. Switchboards shall be of the ratings and configurations shown on the Drawings.

B. Switchboards and overcurrent protection devices shall have a minimum short circuit rating as specified herein or greater where indicated on the Drawings.

C. Main Switchboards:

1. Main switchboards are identified with the designation MS as shown on the Drawings.

2. Maximum allowable physical dimensions: 48 inches wide by 60 inches deep per section.
3. Main switchboards – circuit breaker type: 100,000 RMS symmetrical amperes minimum interrupting capacity.
4. Main switchboards – switch and fuse type: 200,000 RMS symmetrical amperes minimum interrupting capacity.

D. Distribution Switchboards :

1. Distribution switchboards are identified with the designation DSL (120/208V or 208V) or DSH (277/480V or 480V) as shown on the Drawings.
2. Maximum allowable physical dimensions: 36 inches wide by 24 inches deep per section.
3. Distribution switchboards (DSL): 42,000 RMS symmetrical amperes minimum interrupting capacity.
4. Distribution switchboards – circuit breaker type (DSH): 100,000 RMS symmetrical amperes minimum interrupting capacity.
5. Distribution switchboards – switch and fuse type (DSH): 200,000 RMS symmetrical amperes minimum interrupting capacity.

2.3 CONSTRUCTION

A. Main switchboards shall be free standing, front and rear accessible, with individually mounted, compartmentalized, rear connected main and feeder overcurrent protection devices of the number, rating, and arrangement as shown on the Drawings. Vertical sections shall be aligned front and rear .

B. Main switchboards shall be front accessible, with group mounted main and feeder overcurrent protection devices of the number, rating, and arrangement as shown on the Drawings. Vertical sections shall be rear aligned.

C. Distribution switchboards shall be front accessible, with group mounted main and feeder overcurrent protection devices of the number, rating, and arrangement as shown on the Drawings.

D. Switchboards shall be completely self supporting structures of the required number of vertical sections bolted together to form a single metal enclosed switchboard. Sides, top and rear covers shall be code gauge steel, bolted to the switchboard structure. The frame structure members shall be die-formed, 12 gauge steel bolted together and reinforced at corners with rugged gussets internal and external to the switchboard members.

E. Switchboards shall be provided with adequate lifting means, and be capable of being rolled or moved into position and bolted directly to the floor without the use of floor sills.

F. Steel surfaces shall be chemically cleaned and treated, providing a bond between paint and metal surfaces to prevent the entrance of moisture and formation of rust under the paint finish. Finish shall be ANSI-61 grey enamel paint.

G. Space for future devices shall include all necessary bus, overcurrent protection device supports and mounting, and connections.

H. Switchboards enclosures shall be NEMA Type 1 where installed indoors. Switchboards enclosures shall be NEMA Type 3R where installed outdoors. Switchboard sections shall be aligned on top, 90 inches high, unless lower height is required due to space limitations.

I. Where required for conduit terminations, provide pull box on top of switchboard of same type of construction and finish as the switchboard.

J. Where draw out type overcurrent protection devices are provided, provide a traveling type lifter, rail mounted on top of the switchboard.

2.4 BUS SYSTEM

A. Bus bars shall be arranged throughout A-B-C left to right, top to bottom, and front to rear. Bus bars shall be permanently labeled by phase. Bus joints shall be bolted with high tensile zinc plated steel bolts with spring loaded Bellville type washers.

B. Bus bars shall be plated copper or aluminum based on ANSI standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure). In addition to full UL air clearances, bus shall be insulated with a minimum of 5 mil thickness of epoxy resin coating. Provide removable non-PVC boots for access to the cross bus joints for inspection and maintenance .

C. Bus bars shall be of the ampere rating (continuous) shown on the Drawings. Neutral bus shall be full size. Provide a 33% minimum copper ground bus, extending along the full length of the switchboard.

D. Horizontal bus shall be full size, tapered bus is not permitted. Provide bolt holes drilled and tapped for future extension at the end of bus bars including neutral and ground bus so that the addition of a future section would require only the installation of standard bolted splice plates .

E. Busway terminating at switchboard shall be bus connected. Cable connections are unacceptable.

2.5 OVERCURRENT PROTECTION DEVICES

A. General:

1. Feeder overcurrent protection devices shall be bus connected on the line side.
2. All circuit breakers rated 1200A or higher shall be equipped with an Arc Energy Reduction mechanism as outlined in NEC 240.87.
3. Overcurrent protection devices shall have an external operating handle located on the front door.
4. Stationary or draw out type construction as shown on the Drawings .

B. Overcurrent protection device types:

1. Main switchboards: High pressure contact switches .
2. Main switchboards: Insulated case circuit breakers.
3. Distribution Switchboards (DSL): Molded case circuit breakers .
4. Distribution Switchboards (DSH): Fusible switch units or molded case circuit breakers as shown on the Drawings.

C. High Pressure Contact Switches :

1. Stored energy, quick make/quick break operation. Extra heavy duty, low torque, rotary operated handle closing mechanism. Fingertip OPEN button shall instantly open the main contacts.
2. High interrupting capacity disconnect with electric trip for remote tripping or ground fault protection .
3. Fuse compartment interlocked to prevent access when switch is closed.
4. Handle shall be capable of being padlocked in the OFF position.
5. Positive ON/OFF indicators, green for OFF, red for ON.
6. UL Class L fuses.
7. UL listed for continuous operation at 100% rated load.
8. Blown fuse protection shall trip switch when switch is closed with a blown fuse or no fuse is installed.
9. Auxiliary switch for remote indication of switch ON/OFF position .
10. Provide ground fault protection for main and feeder devices as follows:

    a. Current Monitor: The current monitor shall consist of a zero-sequence current transformer which shall enclose all current carrying conductors, including the neutral conductor if used, of the circuit being protected.
    b. Ground Fault Sensor: The ground fault sensor shall continuously sense the output of the current monitor. Should the sensor detect a ground current in excess of the pick-up setting for a duration exceeding the time delay, the sensor shall shunt-trip the appropriate device.
    c. Test Panels: Each ground fault sensor shall be provided with a test panel which shall completely test the ground fault system. The test panel shall indicate that a ground fault was sensed or test the system with or without tripping the switch. The test panel shall be installed in the front of the switchboard adjacent to the device being protected.

d. Shunt-Trip: Automatically open the device when signaled by the sensor.
e. Provide fuse protected control power transformer from the switchboard line side for the ground fault system. Ground fault and shunt-trip device shall be capable of operation at 55% of rated voltage.
f. Set each ground fault sensor pick up setting at 25 percent of the rating of overcurrent protection device with a 6-cycle time delay or as specifically indicated in the final short circuit and coordination study submittal.

D. Insulated Case Circuit Breakers:

1. Stored energy charging mechanism and independent close and trip functions.
2. High interrupting capacity disconnect with electric trip for remote tripping or ground fault protection .
3. Breaker compartment interlocked to prevent access when breaker is closed.
4. Handle shall be capable of being padlocked in the OFF position.
5. Positive ON/OFF indicators, green for OFF, red for ON.
6. Provide integral residual sensing ground fault protection for main and feeder devices. Set each ground fault sensor pick up setting at 25 percent of the rating of overcurrent protection device with a 6-cycle time delay or as specifically indicated in the final short circuit and coordination study submittal .
7. UL listed for continuous operation at 100% rated load.
8. Auxiliary switches for remote indication of breaker ON/OFF status.
9. Microelectronic digital processor based true RMS trip unit with interchangeable ratings plugs to change the continuous current rating. Provide a hand held, portable plug in test kit for testing and verifying programmer settings. Provide the following functions:

    a. Current setting adjustment (long delay pick-up)
    b. Long-time delay adjustment
    c. Short-time pick-up adjustment
    d. Short-time delay adjustment
    e. Instantaneous pick-up adjustment
    f. I2t-In-Out-adjustment
    g. Ground-fault pick-up adjustment
    h. Ground-fault delay adjustment

E. Fusible Switch Units:

1. Quick-make, quick-break, dead-front type. Each switch shall be a self-contained unit, externally operated from the front.
2. Fuse and switch compartment with defeatable interlock to prevent access with switch in the ‘ON’ position.

3. Switches shall be equipped with rejection type clips suitable for UL Class R fuses up to 600A, suitable for UL Class L fuses above 600A.
4. Handle shall be capable of being padlocked in the OFF position.

F. Molded case circuit breakers:

1. Completely sealed enclosure. Toggle type operating handle. Trip ampere rating and ON/OFF indication clearly visible.
2. Thermal-magnetic trip-free, trip-indicating, quick-make, quick-break, with inverse time characteristic. Single-handle and common tripping on multipole breakers. External handle shall be suitable for locking in the OFF position.
3. Silver alloy contacts with auxiliary arc-quenching devices.
4. Provide main breakers in switchboards served from transformers.
5. Shunt trip breakers shall be supplied with 120V AC coils.

2.6 GROUND FAULT PROTECTION

A. Ground fault protection shall be provided where specified and on service disconnect switches rated 1000 amperes or more as required by the NEC.

B. Settings: Set each ground fault sensor pick up setting at 25 percent of the rating of overcurrent device with a 6-cycle time delay unless specifically indicated otherwise in the final short circuit and coordination study submittal.

2.7 UTILITY METERING

A. Provide utility metering cubicle(s) in accordance with the requirements of the serving utility company.

2.8 METERING DISPLAY

A. Provide an electronic digital true RMS sensing metering display for each main switchboard main and each feeder serving a busway. The display shall indicate voltage (each phase to each phase and each phase to neutral, amps (each phase), watts, vars, power factor, frequency, watt demand, and watt hours. Display shall be positioned not lower than 48 inches or higher than 72 inches above the finished floor.

PART 3 - EXECUTION

3.1 GENERAL

A. Install switchboards when the area is free and clear of dust and debris. Protect switchboards from dust and moisture. Do not utilize switchboard for temporary lighting and power services.

B. Install switchboards on 4 inch high concrete housekeeping pads which shall follow the contour of switchboards with 1 inch of overlap on all sides.

C. Provide channel iron sills below each switchboard where the switchboard frame is not suitable for use as a floor sill.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Description

1. This Work includes circuit breaker panelboards furnishing and installing as shown on the drawings and as specified herein.

B. Related Sections

1. Division 01, Submittals
2. Division 02, Quality Control Requirements
3. Section 26 00 00, Electrical
4. Section 26 05 29, Hangers and Supports for Electrical Systems
5. Section 26 05 33, Raceways, Boxes, and Conduits for Electrical Systems
6. Section 26 05 75, Electrical Testing

C. Measurement

1. No separate measurement will be made for Work described in this Section.

D. Payment

1. No separate payment will be made for Work described in this Section. The cost of meeting these requirements shall be included in the Contract price.

1.2 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA PB 1 - Panelboards

C. UL 50 - Cabinets and Boxes

D. UL 67 - Panelboards

1.3 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Division 01 and 26 00 00, except as modified herein.

B. Submit Product Data on the following items:

1. Panelboard, including ratings, circuit breakers, bus, neutral, enclosure, dimensions, and nameplates.

C. Submit Shop Drawings and Sketches on the following items:

1. Panelboards, showing their layout, circuit breaker arrangement and rating, neutral location, and lugs or main.

1.4 QUALITY ASSURANCE/QUALITY CONTROL

A. Comply with the requirements of Division 01 and Section 26 00 00, Electrical, except as modified herein.

B. Comply with the provisions of NEMA and UL, as applicable.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D

B. Siemens

C. Cutler Hammer

2.2 BUSING ASSEMBLY AND TEMPERATURE RISE

A. Panelboards shall be rated 120/240 volts 3-wire as indicated on the Drawings.

B. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the Drawings. Ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C. rise above ambient. Factory heat rise tests shall be conducted in accordance with UL Standard 67.

C. Panelboard bus shall be copper sized at 1000 or less amperes per square inch.

D. Provide 100% current rated, insulated neutral bus.

E. Provide separate, full rated, ground bus bonded to panelboard cabinet.

F. Provide multiple lugs where conductors are shown in parallel.

G. Provide bolted to bus, circuit breaker construction panels with door in door, panel trim construction. All panels provided for this project are surface mounted. Trims shall not overlap enclosure. Load center construction is not approved for new, project provided, panels.

H. Meet the requirements of NEMA PB 1.

2.3 CIRCUIT BREAKERS

A. Circuit breakers shall conform to NEMA AB 1. Circuit breakers shall be thermal magnetic trip equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle

taking a position between ON and OFF. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.

B. Circuit Breakers shall be bolted securely to the new panelboard bus. "Push on" or "plug in" breakers are not acceptable in new panels.

C. New circuit breakers installed in existing load centers shall be manufacturer listed and labeled for installation in the existing load center. New Load center circuit breakers are required to be new, with current UL listing and label attached.

D. Where circuit breakers are intended for switching fluorescent or HID lighting loads they shall be rated for switching duty and labeled "SWD".

E. Where circuit breakers are intended for supplying HID or fluorescent loads, they shall be rated and labeled for use on HID loads.

F. Provide GFI breakers where shown on the Drawings.

2.4 INTEGRATED EQUIPMENT SHORT-CIRCUIT RATING

A. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the Drawings or as specified. Method of factory testing shall be per UL Standard 67. Panelboards shall be marked with their maximum short-circuit current rating at the supply voltage and shall be UL listed.

B. Provide panelboards rated for connection to a single-phase 120/240 volt system with 22,000 amperes RMS short-circuit current available, minimum. Other ratings shall be as shown on the Drawings.

2.5 CABINETS AND FRONTS

A. Panelboard assembly shall be enclosed in a steel cabinet. the rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67 for panelboards.

B. Fronts shall include doors and have flush, stainless steel, cylinder tumbler-type locks with latches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Keying shall match existing building panelboard lock keying. Fronts shall have adjustable indicating trim clamps, which shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as shown on the Drawings. Panel fronts shall be of the door-in-door type such that breaker handles can be accessed by opening the inner door and panel wiring can be accessed by opening the outer door. Provide two keys for each panel. Provide flush trims in finished areas, and surface type trims in unfinished areas.

C. A circuit directory frame and card with a transparent protective plastic covering shall be provided on the inside of the door. The directory card shall provide a writing space at least 1/4" high x 3" long for each circuit.

D. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish, ANSI 61 gray color.

E. NEMA Enclosure Types

1. Interior mounted cabinets shall be rated NEMA Type 1.

2.6 BARRIERS

A. The panelboard interior assembly shall be dead-front with panelboard front removed. Main lugs and main breaker shall be barriered on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall be barriered.

2.7 CIRCUIT NUMBERING AND BUS ARRANGEMENT

A. Circuits and phasing shall be as shown on the Drawings.

2.8 NAMEPLATE

A. Provide nameplates with the following information attached with screws to each panelboard front:

1. Panel Name: 1/4" high characters
2. Voltage, Phase, Wire: 1/8 inch high characters
3. Short-circuit withstand capability rating: 1/8 inch high characters
4. Feeder Source: 1/8 inch high characters
5. Example:

P-1

208Y/120 VOLTS, 3 PHASE, 4 WIRE

RATED 22,000 AMPS S.C. CURRENT
MAXIMUM

Fed from Panelboard PD-1

B. Nameplate color shall be black letters on white background.

C. Nameplates shall be labeled as indicated on the Drawings.

D. Provide an Arc-Flash calculation of the existing power system as it contributes to the new panelboards installed in this project. As a result of that calculation, provide permanent labeling attached to the panel front giving the Arc-Flash hazard within the panel.

2.9 FEED-THROUGH AND DOUBLE LUGS

A. Provide feed-through or double lugs, where shown on the Drawings, with current rating equal to the incoming feeder current rating unless otherwise shown.

PART 3 - EXECUTION

3.1 MOUNTING

A. Secure in place, plumb and square with walls, with top of cabinet at 6'-0", unless otherwise noted on the Drawings. Top of cabinet and trim shall be level. Firmly anchor cabinets directly or with concealed bracing to building or cabinet structure in a manner that meets the requirements of Section 26 05 29, Hangers and Supports for Electrical Systems. When panels are not located in or directly on a wall, provide a support frame of formed steel channel, in accordance with Section 26 05 29, Hangers and Supports for Electrical Systems, 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. Install under the transparent protective cover in the metal frame inside the cabinet door. The listing shall match circuit breaker arrangements typically with odd numbers on the left and even numbers on the right. Room numbers or names used shall be the final room numbers or names used in the building as identified on the Design Drawings.

3.3 CABINET PAINTING

A. Clean and touch-up blemished surfaces with paint to match factory finish.

3.4 BOLTED CONNECTIONS

A. Inspect all bolted connections after installation and re-tighten all connections not securely tightened. Torque per manufacturer’s specifications.

3.5 CLEAN-UP

A. After construction and testing are complete, remove all debris, dust and foreign material from all panel interiors and exteriors by vacuum cleaning.

3.6 TESTS

A. Tests shall be performed by Contractor’s QA staff to verify correct circuiting, wiring, and the circuit index.

B. Each panelboard shall also be tested and pass the following tests and inspections.

1. Each panelboard shall be inspected for the correct size, rating, and the number and type of circuit breakers.
2. All connections shall be tightened to the equipment manufacturer's recommended torque.
3. The neutral bar shall be grounded or ungrounded in accordance with the Design Drawings.
4. Each circuit breaker shall be operated and tested for proper on-off operation.

C. Contractor shall correct any deficiencies as identified from above at no additional cost to Tri-Met.

D. Test in accordance with Section 26 05 75, Electrical Testing.

END OF SECTION

SECTION 26 2713 - ELECTRICITY METERING

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 equipment for [electricity metering by utility company] [and] [electricity metering by Owner].

1.3 DEFINITIONS

A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.

B. PC: Personal computer.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.
2. Software licenses.
3. Software service agreement.
4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify [Architect] [Construction Manager] [Owner] no fewer than [two] <Insert number> days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without [Architect's] [Construction Manager's] [Owner's] written permission.

1.10 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for [two] <Insert number> years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within [two] <Insert number> years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide [30] <Insert number> days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade his computer equipment if necessary.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

Retain one or both of first two paragraphs below. Retain both if Owner's meter is not in a modular meter center.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Modular Meter Center: Factory-coordinated assembly of a main service [terminal box with lugs only] [disconnect device], wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Siemens Energy & Automation, Inc.
    d. Square D; a brand of Schneider Electric.
    e. <Insert manufacturer's name>.

3. Comply with requirements of utility company for meter center.
4. Housing: NEMA 250, [Type 1] [Type 3R] enclosure.
5. Minimum Short-Circuit Rating: [22,000] [42,000] [65,000] [100,000] <Insert number> A symmetrical at rated voltage.
6. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
7. Main Disconnect Device: Fusible switch, series-combination rated by circuit-breaker manufacturer to protect downstream feeder and branch circuit breakers.
8. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.

    a. Identification: Complying with requirements in Section 26 05 53, Identification for Electrical Systems with legend identifying tenant's address.
    b. Physical Protection: Tamper resistant, with hasp for padlock.

9. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.
10. Surge Protection: For main disconnect device, comply with requirements in Section 26 43 13, Surge Protection for Low-Voltage Electrical Power Circuits.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. E-Mon; a division of Hunt Power.
2. National Meter Industries.
3. Osaki Meter Sales, Inc.
4. Square D; a brand of Schneider Electric.
5. <Insert manufacturer's name>.

C. General Requirements for Owner's Meters:

1. Comply with UL 1244.
2. Meters used for billing shall have an accuracy of [0.2] [0.5] [1.0] percent of reading, complying with requirements in ANSI C12.20.
3. Meters shall be certified by [California Type Evaluation Program] <Insert agency> as complying with [Title 4, California Code of Regulations, Article 2.2] <Insert regulatory requirements>.
4. Enclosure: NEMA 250, [Type 1] [Type 3R] minimum, with hasp for padlocking or sealing.
5. Identification: Comply with requirements in Section 26 05 53, Identification for Electrical Systems.
6. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
7. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.

    a. Type: [Split] [and] [solid] core.

8. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
9. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to [BAS] <Insert signal destination> input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.

D. Kilowatt-hour Meter: Electronic [single] [three] [single- and three]-phase meters, measuring electricity used.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.
3. Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.

E. Kilowatt-hour/Demand Meter: Electronic [single] [three] [single- and three]-phase meters, measuring electricity use and demand. Demand shall be integrated over a [15-minute] <Insert value> interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, [current time and date,] current demand, [and] historic peak demand,] and time and date of historic peak demand]. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.

F. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway. Comply with Section 260523 "Control-Voltage Electrical Power Cables."

G. Software: PC based, a product of meter manufacturer, suitable for calculation of utility cost allocation [and billing].

1. Utility Cost Allocation: Automatically import energy-usage records to allocate energy costs for the following:

   a. At least [15] <Insert number> departments.
   b. At least [30] <Insert number> tenants.
   c. At least [five] <Insert number> processes.
   d. At least [five] <Insert number> buildings.
   e. <Insert entity>.

2. Tenant or Activity Billing Software: Automatically import energy-usage records to automatically compute and prepare [tenant bills] [activity demand and energy-use statements] based on metering of energy use [and peak demand]. Maintain separate directory for each tenant's historical billing information. Prepare summary reports in user-defined formats and time intervals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53, Identification for Electrical Systems.

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for [printed, weather-resistant card] [typewritten card] with occupant's name.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, [1.5] <Insert number> kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 3323 - CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Provide a battery-operated emergency power system to operate all egress lighting, exit lights, stair lights, selected area lights and other equipment as indicated on the Drawings. Under normal operation, the system will act as a 24-hour security and night lighting system. Upon normal power failure, switching equipment will automatically connect the power source to the emergency system. Upon resumption of normal power, the load will be automatically switched back to the normal source.

1.2 WARRANTY:

A. Include with the power supply submittal drawings a warranty of 3 years on the power supply and a separate 10-year warranty on life and performance on the battery supplied by the battery manufacturer. The warranties shall be written on the manufacturer's letterhead and signed by a corporate officer.

B. The warranty shall include the following:

1. All equipment shall be in compliance with the latest adopted National Electrical Code.
2. The complete assembly will provide its full rated output under normal operation for 90 minutes at anytime throughout the 10-year warranty period.
3. Indicate the battery manufacturer and warrant each individual battery for 10 years under normal operation. A battery will be considered to have failed when it does not provide 80% of its initial ampere-hour capacity.
4. Each power supply shall be factory tested under full load operating conditions.

1.3 SUBMITTALS:

A. Shop drawings.

B. Product data.

C. Operating and maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Dual-Lite D Series or prior approved equal.

B. Other Manufacturers: Submit Substitution Request in accordance with Section 01 25 00, Substitution Procedures.

2.2 EMERGENCY POWER SUPPLY:

A. The power supply EPS shall be rated as shown on the drawings at 120V or 277V AC, 2 wire, 60Hz. The power supply shall consist of output power modules, battery pack, battery charger, transfer module, required sensing devices, and control panel. All components shall be mounted in one or more free standing metal cabinets of sufficient strength to handle the weight of the components. Cabinets shall have a durable finish, factory applied.

B. Output power modules shall consist of solid state inverters and power transformer. The power module shall be equipped with surge protection and be current limiting to 110% of full load continuing to deliver power to the emergency system until removed from the line. The output shall be an alternating 60 Hz waveform with 5% frequency stability. Output voltage shall not vary more than 10% from no load to full load for battery voltages from 100% to low voltage cut-off.

C. Transfer module shall be of solid-state design and automatically transfer the emergency system loads to the output power modules within 500 milliseconds of normal power failure. Upon restoration of normal power, a delay of return to normal power shall be provided to assure an in-phase transfer. In the event of a prolonged outage, the power modules will be removed from the line when the batteries discharge to nominally 87% of full charge voltage.

D. Batteries shall be lead-calcium, series and parallel connected, with a warranted life of 10 years and expected life of 20 years. Battery cases shall be impact resistant with vapor-tite removable caps and lead connectors integrally molded into the cover. Batteries shall be equipped with an electrolyte level sensing device to alarm upon low liquid level.

E. Battery charger module shall be solid state, capable of fully recharging the batteries within listed UL requirements. The charger shall constantly monitor the batteries, providing automatic discharge and charge only when needed. Charger shall be internally protected against short circuits and automatically recover to charge batteries when the fault is removed.

F. All instruments, controls and indicating lights shall be factory mounted on the front of the cabinet for easy monitoring and operation without requiring access to the interior. Control panel shall contain AC line switch, charging indicating light, test switch, AC output voltmeter, DC voltmeter, DC ammeter, electrolyte level alarm. When fuses or breakers are used to protect components, visual alarms shall be provided on the control panel to indicate tripped conditions.

G. The entire unit shall be UL listed and labeled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the emergency power supplies as per manufacturer's recommendations and as shown on the Drawings.

3.2 OUTPUT BREAKERS

A. A.Provide a minimum of eight 20 ampere, one pole breakers on the output to provide separate output circuits as shown or scheduled on the Drawings.

END OF SECTION

SECTION 26 4313 - SURGE PROTECTION FOR LOW VOLTAGE ELECTRIC POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

B. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

C. Most manufacturers offer five-year extended warranties on their equipment. Verify available warranties and warranty periods.

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

PART 2 - PRODUCTS

A. See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 01 60 00, Product Requirements.

2.2 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.3 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1.

1. SPDs with the following features and accessories:

a. Retain first subparagraph below when specifying Type 1 SPD to be installed ahead of the service disconnect, when this disconnect is installed to facilitate maintenance.
b. Integral disconnect switch.
c. Retain first subparagraph below to disconnect the SPD when low-current, high-impedance faults occur.
d. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
e. Indicator light display for protection status.

B. See Editing Instruction No. 2 in the Evaluations for guidance before retaining option in "Peak Surge Current Rating" Paragraph below. Generally available surge current ratings are 300, 250, 200, 150, and 100 kA.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Retain one of first two paragraphs below. Verify compatibility of peak surge current rating and VPR.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V and 1000 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Line to Line: 1000 V.

G. See "UL 1449 Requirements" Article in the Evaluations for discussion on SCCR selection in "SCCR" Paragraph below.

H. SCCR: Equal or exceed 100 kA.

I. See "UL 1449 Requirements" Article in the Evaluations for discussion on Inominal selection in "Inominal Rating" Paragraph below.

J. Nominal Rating: 20 kA.

2.4 PANEL SUPPRESSORS

A. Retain this article for SPDs other than those installed at the service entrance. SPD described in this article is required by NFPA 70 to be installed with OCPD. The type and size of OCPD depends on the UL listing requirements. See "SPD Types" Article in the Evaluations.

B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.

C. Retain subparagraph below to disconnect the SPD when low-current, high-impedance faults occur.

1. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

D. See Editing Instruction No. 2 in the Evaluations for guidance before retaining option in "Peak Surge Current Rating" Paragraph below. Generally available surge current ratings are 300, 250, 200, 150, and 100 kA.

E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

F. Retain one of first two paragraphs below. Verify compatibility of peak surge current rating and clamping voltage. Reference to UL 1449 is to its third edition.

G. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 200 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V and 1000 V for 208Y/120 V.

H. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

I. See "UL 1449 Requirements" Article in the Evaluations for discussion on SCCR selection in "SCCR" Paragraph below.

J. SCCR: Equal or exceed 100 kA.

K. See "UL 1449 Requirements" Article in the Evaluations for discussion on Inominal selection in "Inominal Rating" Paragraph below.

L. Nominal Rating: 20 kA.

2.5 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

A. Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

C. See Section 01 40 00, Quality Requirements for retesting and reinspection requirements and Section 01 73 00, Execution for requirements for correcting the Work.

D. An SPD will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

D. Lamps.

E. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 36 00, Air Terminal Units

B. Section 26 05 33, Raceways, Boxes, and Conduits for Electrical Systems

C. Section 26 05 53, Identification for Electrical Systems

D. Section 26 27 26, Wiring Devices

E. Section 26 09 36, Modular Dimming Controls

F. Section 26 56 00, Exterior Lighting

1.3 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

E. IES LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources; Illuminating Engineering Society; 2008.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2011.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code; National Fire Protection Association; 2012.

M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

O. UL 1598 - Luminaires; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 01 33 00, Submittal Procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:

1. Provide one sample(s) of each luminaire proposed for substitution.

F. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

G. Field Quality Control Reports.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00, Product Requirements, for additional provisions.

K. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. The lighting design for this project was based on luminaire types and manufacturers as specified.

C. Other “Or Equal” Manufacturers and Products: Submit Substitution Request, complying with requirements of Section 01 60 00, Product Requirements.

D. Equality shall be determined by the following luminaire characteristics. Lack of data on any characteristic shall constitute justification for rejection of the submittal.

1. Performance

a. Distribution.
b. Utilization.
c. Average brightness/maximum brightness.
d. Spacing to mounting height ratio.
e. Visual comfort probability.

2. Construction

a. Engineering.
b. Workmanship.
c. Rigidity.
d. Permanence of materials and finishes.

3. Installation Ease

a. Captive parts and captive hardware.
b. Provision for leveling.
c. Through-wiring ease.

4. Maintenance

a. Relamping ease.
b. Replacement of ballast and lamp sockets.

5. Appearance

a. Light tightness.
b. Neat, trim styling.
c. Conformance with design intent

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01 77 00, Closeout Procedures, for additional warranty requirements.

B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00, Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

    a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
    b. Luminaires for Heat Removal: Provide heat removal dampers where indicated.

H. Fluorescent Luminaires:

1. Provide ballast disconnecting means complying with NFPA 70 where required.
2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.

    a. Luminaires with Two Lamps: Each ballast controls one lamp.
    b. Luminaires with Three Lamps: One ballast controls two outer lamps and one ballast controls inner lamp.
    c. Luminaires with Four Lamps: One ballast controls two outer lamps and one ballast controls two inner lamps.

I. LED Luminaire Components: UL 8750 recognized or listed as applicable.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

2.4 BALLASTS AND DRIVERS

A. All Ballasts:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Fluorescent Ballasts:

1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.

    a. Inrush Current: Not exceeding peak currents specified in NEMA 410.
    b. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
    c. Total Harmonic Distortion: Not greater than 20 percent.
    d. Power Factor: Not less than 0.95.
    e. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
    f. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
    g. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
    h. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
    i. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.

        1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.

    j. Lamp Current Crest Factor: Not greater than 1.7.
    k. Lamp Wiring Method:

        1) Rapid Start Ballasts: Series wired.
        2) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.

    l. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
    m. Provide end of lamp life automatic shutdown circuitry for T5 and smaller diameter lamp ballasts.
    n. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
    o. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
    p. Ballast Marking: Include wiring diagrams with lamp connections.

2. Non-Dimming Fluorescent Ballasts:

    a. Lamp Starting Method:

        1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
        2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.

3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.

b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

3. Bi-Level Stepped Dimming Linear Fluorescent Ballasts:

a. Bi-Level Operation: Capable of being switched between full light output on all lamps, 50 percent of full light output on all lamps, and all lamps off.
b. Control Compatibility: Capable of being controlled by standard manual light switches or occupancy sensors unless otherwise indicated.
c. Lamp Starting Method: Programmed start unless otherwise indicated.

C. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

a. Programmable Lighting Controls: See Section 26 09 36, Modular Dimming Controls.

2.5 LAMPS

A. Lamps - General Requirements:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

B. Lamps - Sustainable Design Requirements:

1. Maximum Mercury Content:

a. T8 Linear Fluorescent, 96 Inch: 10 mg.
b. T8 Linear Fluorescent, 48 Inch: 3.5 mg.
c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 3.5 mg.

d. T8 Linear Fluorescent, U-Bent: 6 mg.
e. T5 Linear Fluorescent: 2.5 mg.
f. T5 Circular Fluorescent: 9 mg.
g. Compact Fluorescent, Nonintegral Ballast: 3.5 mg.
h. Compact Fluorescent, Integral Ballast: 3.5 mg (ENERGY STAR qualified).
i. High Pressure Sodium, Up to 400 W: 10 mg.
j. High Pressure Sodium, Greater Than 400 W: 32 mg.

2. Minimum Rated Lamp Life:

a. T8 Linear Fluorescent, 96 Inch: 24,000 hours for standard output lamps on instant start ballasts; 18,000 hours for high output lamps on instant start or programmed start ballasts; based on three hours per start.
b. T8 Linear Fluorescent, 48 Inch: 30,000 hours for standard and high output lamps on instant start ballasts; 36,000 hours on programmed start ballasts; based on three hours per start.
c. T8 Linear Fluorescent, 36 Inch and 24 Inch: 24,000 hours on instant start or programmed start ballasts; based on three hours per start.
d. T8 Linear Fluorescent, U-Bent: 18,000 hours on instant start ballasts; 24,000 hours on programmed start ballasts; based on three hours per start.
e. T5 Linear Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
f. T5 Circular Fluorescent: 25,000 hours for standard and high output lamps on programmed start ballasts.
g. Compact Fluorescent, Nonintegral Ballast: 12,000 hours.
h. Compact Fluorescent, Integral Ballast: 10,000 hours for bare bulbs; 8,000 hours for covered models such as globes, reflectors, and A-19 lamps.
i. High Pressure Sodium: Use only non-cycling type lamps.

C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.

D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
2. T8 Linear Fluorescent Lamps:

a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
b. Color Rendering Index (CRI): Not less than 80.

3. T5 Linear Fluorescent Lamps:

    a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    b. Color Rendering Index (CRI): Not less than 80.

2.6 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33, Raceway, Boxes, and Conduits for Electrical Systems as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 23 36 00, Air Terminal Units.

L. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

O. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00, Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Architect.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01 77 00, Closeout Procedures

B. See Section 01 79 00, Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 0500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Common requirements for electrical systems.

1.2 RELATED SECTIONS

A. Section 01 3100 Project Management and Coordination
B. Section 01 3300 Submittal Procedures
C. Section 01 7000 Execution and Closeout Requirements
D. Division 23 Heating, Ventilation and Air Conditioning (HVAC)
E. Division 31 Earthwork
F. Division 33 Utilities

1.3 REFERENCE STANDARDS

A. The latest adopted revisions of the following publications form a part of this specification and the other specifications in Division 26 to the extent referenced. The publications are referred to in the text by basic designation only:

1. Illuminating Engineers Society (IES).
2. International Building Code (IBC).
3. Institute of Electrical and Electronic Engineers (IEEE).
4. International Electrical Testing Association (IETA).
5. International Electrotechnical Commission (IEC).
6. International Fire Code (IFC).
7. Intertek Electrical Testing Laboratories Listed (ETL).
8. National Electrical Contractors Association (NECA).
9. National Fire Protection Association:

    a. NFPA 70: National Electrical Code (NEC)
    b. NFPA 70E: Standard for Electrical Safety in the Workplace

10. Oregon Energy Efficiency Specialty Code
11. Oregon Fire Code (OFC).
12. Oregon Structural Specialty Code.

1.4 COORDINATION

A. Coordinate with all other trades involved in installation of equipment that requires electrical connections or that shares the same space as the electrical equipment, electrical wiring or appurtenances.

1. Examine the Drawings to coordinate with and avoid conflicts with other equipment, structural members, cabinets, counters, etc.

a. Verify the physical dimensions of each item of electrical equipment to fit the available space.
b. Determine all equipment proposed to fit into available space, and the access routes through construction.

2. Confirm rough-in and wiring requirements with equipment supplier and installer for all equipment provided under other divisions of Work that require electrical connections.

a. Make installation and connections in accordance with rough-in and wiring diagrams provided by equipment supplier and installers.

B. Arrange raceways, wiring, and equipment to permit ready access to switches, motors, and control components. Keep space in front of doors and access panels clear.

C. Coordinate all aspects of electrical service connections with the service provider.

1. No additional compensation will be allowed for additional work or equipment not covered in the Drawings or Specifications but required by the serving utility.

D. Coordinate underground Work with the work of others working on the site.

1. Coordinate electrical Work with storm sewer, sanitary sewer, gas, water and irrigation lines to avoid conflicts.
2. Common trenches may be used with other trades, providing clearances required by codes, ordinances and service provider are maintained, and with prior approval from Owner.

1.5 SUBMITTALS

A. Provide submittals according to Section 01 3300 Submittal Procedures requirements and the following:

1. Submit product, material and equipment data and shop drawings in 3-1/2” expanding pocket file folders.

a. Provide one folder for each Division 26 Section requiring submittals, with all required data of that Section grouped together.
b. Include at the front of each folder a complete index for all Sections and materials requiring submittals.

B. Shop Drawings: Submit for review and approval prior to beginning installation:

1. Show all outlets, devices, terminal cabinets, conduits, clearances, wiring, and connections required for a complete system.

2. Prepare detailed drawings to scale of panel layouts in electric cabinets, rooms or closets, utilizing dimensioned shop drawing data of equipment to be furnished.
3. Provide additional wiring details at switchboards, motor control centers, and other areas where work is of sufficient complexity to warrant additional detailing for coordination.
4. Prepare plan view drawing to scale showing underground installations, including conduits, cabinet pads and junction boxes with proposed common trenches with other utilities.

D. Closeout Submittals:

1. Copies of certification of code authority acceptance.

2. Operating and Maintenance Manuals:

a. Provide a separate chapter for each class of system as follows:

1) Secondary distribution system.
2) Low voltage distribution system.
3) Standby power system.
5) Lighting systems, including lamps and egress lighting.
6) Lighting control system, interior and exterior.
7) Wiring devices, i.e., GFI receptacles and cable reels.

b. Content of each chapter to include, but not limited to, the following:

1) Description of system.
2) Test data.
3) Operating Sequence and Procedures:

aa. Step-by-step procedure for system start-up, including a pre-start checklist. Refer to controls and indicators by nomenclature consistent with that used on panels and in control diagrams.
bb. Detailed instruction in proper sequence, for each mode of operation (i.e., day-night, staging of equipment).
cc. Emergency Operation: If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under those conditions. Include here only those alternate methods of operations (from normal) which the operator can follow when there is a partial failure or malfunctioning of components or other unusual condition.
dd. Shutdown Procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

4). Preventive Maintenance:

aa. Provide a schedule for preventive maintenance. State the recommended frequency of performance of each preventive maintenance task such as cleaning, inspection, and scheduled overhauls.

bb. Cleaning: Provide instructions and schedules for all routine cleaning and inspection with recommended lubricants.

cc. Inspection: If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria.

dd. Provide instructions for lubrication and adjustments required for preventive maintenance routines. Identify test points and given values for each.

5) Manufacturers' Brochures: Include manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views, and renewal parts lists. Edit manufacturers' standard brochures so that information applying to equipment actually installed is clearly defined.

3. Guarantees and warranties.
4. Record documentation.

E. Maintenance material submittals.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Installers *[Note to editor: supply qualifications here, or alternatively in each of the individual Div. 26 sections under the QA article in Part 1. Choose which and then delete this note.]*

B. Materials: Provide new materials of the best quality, American-made.

1. Provide materials manufactured in accordance with applicable standards.

C. Electrical Products: Provide products listed and labeled by the UL or by a recognized independent testing laboratory approved in writing by the local inspection authority.

1.7 WARRANTY

A. Warrant all electrical apparatus to be:

1. Appropriate for the application for which it was installed.
2. Built and installed to deliver the full rated capacity at the efficiency for which each individual apparatus was designed.
3. Operable at full capacity without objectionable noise or vibration.

B. Warrant systems against failure or damage caused by any system component.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

A. Provide like products from only one manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Drawings are diagrammatic with symbols representing electrical equipment, outlets, luminaires, and wiring.

B. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of electrical wiring, footings, poles and equipment with conditions of construction.

3.2 INSTALLATION

A. Install a complete, properly operating system for each item of equipment specified.

1. Install equipment in accordance with manufacturer's instructions, the best industry practices, and as indicated.
2. Where a conflict in instruction for installation occurs, request a clarification before work is roughed in.

a. Remove and correct conflicting Work installed without clarification at no cost to the Owner.

B. Install equipment in a neat, finished, and safe manner according to the latest published NECA Standard of Installation under competent supervision.

C. Where electrical equipment is installed in sleeves or block-outs penetrating rated fire barriers, install intumescent material around ducts, conduits, etc., to prevent spread of smoke or fire.

1. Use a penetration sealing system capable of passing a 3 hour test in according to ASTM E- 814 (UL 1479), consisting of material capable of expanding nominally 8 times when exposed to temperatures of 250-350°

degrees F. An alternate method utilizing intumescent materials in caulk and/or putty form may be used.

D. Do not install electrical equipment in obvious passages, doorways, scuttles, crawl spaces or in other places that would impede or block the passageway's intended use.

3.3 EXCAVATION AND BACKFILL

A. Perform excavation and backfill for installation of electrical work in compliance with applicable requirements of Divisions 31 and 33, and as described in this Article.

B. Steel or Non-Metallic Conduit: Place a minimum 3 inch cover of sand or clean earth fill around the cable or conduit on a leveled trench bottom.

1. Place conduit on a smooth, level trench bottom, so that contact is made for its entire length.
2. Remove water from trench while electrical conduit is being placed.

C. Place backfill in layers not exceeding 8 inches deep and compact to 95 percent of maximum density at optimum moisture.

1. Interior: Bank sand or pea gravel.
2. Exterior: Excavated material with final 8 inches of clean soil.

D. After backfilling, grade trenches level with surrounding soil. Dispose of excess soil off site.

E. Above high voltage cable or conduit runs, provide 6 inch wide vinyl tape marked "ELECTRICAL" in backfill, 12 inches below finished grade.

F. Patch asphalt or concrete surfaces disturbed by electrical work.

3.4 NOISE CONTROL

A. Minimize transmission of noise between occupied spaces.

1. Do not place outlet boxes back to back or use straight through boxes, except where specifically permitted in the Drawings.
2. Keep products and equipment clean before, during and after installation.

B. Minimize penetrations through sound rated walls.

1. Route conduit along corridors or other space that is not sound rated.
2. Grout penetrations through sound-rated partitions solid and airtight.
3. Do not rigidly connect (i.e. bridge) conduit and its associated attachment device to independent wall structures. Use flexible connections and attachments.

C. Do not place contactors, transformers, starters, and similar noise producing devices on walls which are common to occupied spaces, unless specifically shown in the Drawings.

1. Where such devices must be mounted on walls common to occupied spaces, they must be shock mounted or isolated in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.

3.5 EQUIPMENT CONNECTIONS

A. Provide complete electrical connections, including incidental wiring, materials, devices, and labor necessary for a finished working installation.

B. Verify the location and method for connecting to each item of equipment prior to roughing-in. Check the voltage and phase of each item of equipment before connecting.

C. Make motor connections for the proper direction of rotation.

1. Use minimum 1/2 inch size flexible conduit for mechanical equipment, except at small control devices where 3/8 inch flex may be used.
2. For exposed wiring, provide jacketed metallic flexible conduit with a minimum 6 inch slack loop.
3. Do not test run pump motors until liquid is in the system.

D. Control devices and wiring for HVAC systems will be provided as Work of Division 23, except for provisions or items specifically noted in the electrical Drawings or specified to provide as Work of Division 26.

3.6 EQUIPMENT SUPPORT

A. Provide supports and fastening devices for electrical equipment, luminaires, panels, outlets, and cabinets capable of supporting not less than 4 times the ultimate weight of the object or objects fastened to or suspended from the building structure.

B. Properly install and adequately support luminaires from the building structure.

1. Provide supports that properly align and level luminaires.
2. Where flexible connections are permitted for exposed luminaires, provide connections that are neat and straight, without excess slack, attached to the support device.

C. Support all junction boxes, pull boxes, or other conduit terminating housings located above the suspended ceiling from the floor above, roof, or penthouse floor structure to prevent sagging or swaying.

D. Conduits:

1. Support suspended conduits 1 inch and larger from the overhead structural system with metal ring or trapeze hangers and threaded steel rod having a structural safety factor of 4.

   a. Conduits smaller than 1 inch, installed in ceiling cavities, may be supported on the mechanical system supports when available space and support capacity has been coordinated.

2. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.

E. Powder actuated or similar shot-in fastening devices will not be permitted for any electrical work except by special written permission by Owner.

3.7 ALIGNMENT

A. Install panels, cabinets, and equipment level and plumb, parallel with structural building lines.

1. Fit switchgear panels and electrical enclosures neatly without gaps, openings, or distortion.
2. Properly and neatly close all unused openings with approved devices.

B. Fit surface panels, devices, and outlets with neat, appropriate trims, plates, or covers without overhanging edges, protruding corners, gaps or raw edges to leave a finished appearance.

3.8 CUTTING AND PATCHING

A. Include cutting, patching and restoration of finishes where necessary.

1. Perform cutting and patching according to the requirements of Section 01 3100 Project Management and Coordination.
2. Neatly patch and finish surfaces damaged by electrical work, and spaces around conduits passing through floors and walls, to match the adjacent construction, including painting .
3. Clean up and remove all dirt and debris .

B. Locate and size access panels as indicated or with prior approval of Owner.

3.9 PROTECTION OF WORK

A. Keep switchgear, transformers, panels, luminaires, and electrical equipment covered or closed to exclude dust, dirt, and splashes of plaster, cement, and paint, and all other contamination.

3.10 MAINTENANCE OF SERVICE

A. Where a portion of a building is occupied during construction, maintain service to all functioning portions of the building during normal working hours of the building, except as otherwise indicated.

B. Minimize electrical power outages to occupied areas. Pre-arrange necessary outages with the Owner.

1. Be liable for any damages resulting from unscheduled outages, or for outages not confined to pre-arranged times.

C. Keep signal, communication systems, and equipment in operation wherever they serve occupied or functional portions of the building. Pre-arrange necessary outages with the Owner.

1. Be liable for any damages resulting from unscheduled outages, or for outages not confined to pre-arranged times.

D. Coordinate disruption of telephone services with the Owner in advance and in a manner that service required by the building occupants can be maintained.

E. Provide temporary facilities and necessary provisions to maintain electrical, signal and communications services. Remove temporary wiring and facilities before final acceptance.

3.11 COMPLETION AND TESTING

A. Test systems prior to Substantial Completion to show that installed equipment operates as designed and specified, free of faults and unintentional grounds.

1. Test as many systems at one time as possible to work into construction phasing.
2. Perform tests in the presence of the Owner or his representative. Provide 48 hours advance notice for scheduled tests.

B. Have a journeyman electrician with required tools available to conduct all tests, regardless of whether the equipment factory representative is present or not.

C. Testing includes, but is not be limited to, the following systems:

1. Fire alarm.
2. Lighting control systems.
3. Emergency egress lighting.
4. GFI receptacles testing.
5. Exterior lighting.
6. Exterior receptacles.
7. Any exterior improvement having electrical power.

D. Compile a written record of tests performed, with dates performed and witnessed. Submit with operating and maintenance data to the Owner prior to final acceptance.

END OF SECTION

SECTION 26 0519 – LOW VOLTAGE ELECTICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Low Voltage (600W and Below) Power Conductors and Connections:

1. Cables and wires.
2. Connectors.
3. Lugs.

B. Related Requirements:

1. Section 01 7000 Execution and Closeout.
2. Section 26 0500 Common Work Results for Electrical.

1.2 REFERENCES

A. ICEA: Insulated Cable Engineers Association.

B. Underwriters Laboratory (UL):

1. UL 62: Flexible Cords and Cables.
2. UL 83: Thermoplastic-Insulated Wires and Cables.
3. UL 1581: Reference Standard for Electrical Wires, Cables and Flexible Cords.

1.34 ABBREVIATIONS

A. AWG: American Wire Gauge.

B. DMX: Digital Multiplex.

C. GFI: Ground Fault Interrupter.

D. MC: Metal clad.

E. THW: Thermoplastic insulation, heat resistant, wet rated.

F. THWN-2: Thermoplastic insulation, heat resistant, wet rated with nylon jacket.

G. XHHW: Cross-linked polyethylene (XLPE) insulation, high heat resistant, wet rated.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for specified products, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Documentation of dynamometer readings from cable pulls.

C. Conductor insulation test reports.

1.5 QUALITY ASSURANCE

A. Electrical Products:

1. Provide products in conformance with requirements of NFPA 70.
2. Provide all products of each type from the same manufacturer.
3. Provide products conforming to requirements of UL 62, UL 83 and UL 1581.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver conductors to job site in cartons, protective covers, or on reels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Conductors: General Cable, Okonite, Southwire Company, Cerro.

B. Connectors:

1. Branch circuit conductor splices:

a. Live spring: Scotchlok, Ideal Wire Nut or 3M.
b. Self-stripping: Buchanan B-Cap or 3M Series 560.
c. Cable splices: Anderson, Burndy, Ilsco or Kearney.

2. Splices in handholes, manholes, underground vaults or wet locations: 3M DBR-6, 3M 82-A, or 3M “Scotchcast” 85 Series.
3. Terminator Lugs: Burndy or Anderson.

2.2 CONDUCTORS

A. Copper Cable:

1. No. 12 AWG minimum unless noted otherwise, solid or stranded.
2. No. 8 and larger, Class B concentric or compressed stranded.
3. Copper Insulation:

    a. Interior: THW, THWN-2 unless noted or specified otherwise.
    b. Exterior: XHHW unless noted or specified otherwise.

4. Rate through wiring for 90 degree C minimum.
5. Do not use aluminum conductors.

B. Armored Cable:

1. Type MC, 14 through 6 AWG: Copper conductor, 600-Volt THWN-2 insulation, rated 90 degrees C, lightweight steel interlocked armor.

C. Power Limited Wiring:

1. Copper, stranded or solid as recommended by the system manufacturer.
2. Use insulation appropriate for the system and location used.

2.3 CONNECTORS

A. Use commercial-grade splicing materials.

B. Branch Circuit Conductor Splices:

1. Live spring type.
2. Self-stripping type.
3. Cable Splices: Compression tool applied sleeves with 600V heat shrink insulation:

    a. Provide watertight cable splices in underground vaults, weather exposed locations or wet locations.
    b. Make splices in handholes and manholes watertight with epoxy resin type splicing kits.

C. Terminator Lugs for Stranded Wire:

1. No. 10 Wire and Smaller: Spade flared, tool applied.
2. No. 8 Wire and Larger: Compression tool applied.

    a. Set screw type terminator lugs supplied as an integral part of switches and circuit breakers will be acceptable.

PART 3 - EXECUTION

3.1 CONDUCTORS

A. Complete electrical raceway installation before starting installation of conductors and cables.

1. Do not pull in wire until all bushings are installed and raceways terminations are completed.
2. Do not pull wire into conduit embedded in concrete until after the concrete is poured and forms are stripped.

B. Install conductors without damaging insulation.

C. Pulling compounds may be used for pulling all power and PVC jacketed communications cables.

1. Clean residue from the conductors and raceway entrances after the pull is made. Do not use pulling compounds for installation of conductors connected to GFI circuit breakers or GFI receptacles.

D. Use pulleys or blocks for alignment of conductors when pulling.

1. Pull in accordance with manufacturer's specifications regarding pulling tensions, bending radii of the cable, and compounds.
2. Use a dynamometer on cable pulls to insure that the maximum allowed cable tension is not exceeded.
3. Notify the Owner prior to cable pulls.
4. Record the maximum strain of each pull.

E. Provide one dedicated neutral conductor for each circuit conductor on a single phase circuit.

F. Conductors inside cabinets, boxes, equipment and panelboards:

1. Hold conductors away from sharp metal edges.
2. Cable and tree all wires for power and control. Use plastic ties in panels and cabinets.
3. Neatly train and lace wiring. Maintain proximity of current pairs or triplexes.
4. Tie and bundle feeder conductors in wireways of panelboards.

G. Make up and insulate wiring promptly after installation of conductors.

H. Splice cables only with written permission.

1. Show splice locations on Record Drawings.

I. Make conductor lengths for parallel circuits equal.

J. Where connection of cables installed under this section is made by others, provide pigtails minimum 12 inches long for neat, trained and bundled connections.

3.2 CONNECTORS

A. Terminate control and special systems wires with a tool applied spade flared lug when terminating at a screw connection.

B. Make screw and bolt type connectors tight and re-tighten after an eight hour period and prior to Substantial Completion.

C. Install tool applied compression connectors according to manufacturer's recommendations; physically check for tightness.

D. Make splices in accessible junction boxes.

E. Terminate copper conductors on tin-plated aluminum-bodied compression connectors in accordance with manufacturer's instructions. Fill with antioxidant compound prior to installation of conductor.

F. Use suitable reducing connectors or mechanical connector adapters for connecting copper conductors to aluminum lugs or bussing.

G. Use solderless pressure connectors with insulating covers for copper wire splices and taps 8 AWG and smaller.

1. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps on lighting and receptacle circuits.

H. Terminate control circuit conductors at terminal block only.

3.3 COLOR CODING

A. Color code wiring in accordance with NEC and appropriate NFPA Standards.

B. Color code secondary service, feeders, and branch circuit conductors.

1. Use consistent coding scheme at all feeder terminations: A-B-C left-to-right, A-B-C top-to-bottom, or A-B-C front-to-back.
2. Color code as follows:

Phase	208Y/120V	120V/240V	480V/277
A	Black	Black	Brown
B	Red	Red	Orange
C	Blue	Blue	Yellow
Neutral	White	White	Gray

Ground*	Green	Green	Green

* Grounds for isolated ground receptacles: Green with yellow tracer.

C. Use solid color compound or solid color coating for No. 12 and No. 10 branch circuit conductors and neutral sizes.

D. Phase conductors No. 8 and larger color code using one of the following:

1. Solid color compound or solid color coating.
2. Stripes, bands, or hash marks of color specified above.
3. Colored as specified using 3/4-inch wide tape.

    a. Apply tape in half overlapping turns for a minimum of three inches for terminal points and in junction boxes, pull boxes, troughs, manholes, and handholes.
    b. Apply the last two laps of tape with no tension to prevent possible unwinding.
    c. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

E. Color code switch legs and travelers to be consistent with the phases to which connected or a color distinctive from that listed.

F. Color code flexible wiring system conductors and connectors according to manufacturer's standard.

G. Color code in conformance with the existing wiring system for modifications and additions.

3.4 FIELD QUALITY CONTROL

A. Tests

1. Test conductor insulation on feeders of 60 amp and greater for conformity with 1000 volt megohmmeter. Use ICEA testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. If insulation resistance is less than 1 megohm, notify Owner's Representative.
2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual included in project closeout documentation.

END OF SECTION

SECTION 26 0526 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Complete grounding for electrical systems:

   a. Conduit system.
   b. Transformer housing.
   c. Electrical equipment and neutral bus.
   d. Motors.
   e. Miscellaneous grounds as required.

2. Main bonding jumper.

B. Related Sections:

1. Section 26 0500 Common Work Results for Electrical
2. Section 26 2000 Secondary Distribution System.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers Standards Association (IEEE 81-2012): IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. National Fire Protection Association 70 National Electrical Code Article 250 (NEC 250): Grounding and Bonding.

C. Underwriters Laboratory UL 467: Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Product Data for each product or device specified. Include manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Shop Drawings indicating proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

1.4 QUALITY ASSURANCE

A. Electrical Products: Provide products in conformance with requirements of NFPA 70, IEEE 81-2012 and UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Burndy, O-Z/Gedney, Thomas & Betts

2.2 GROUND CONDUCTORS

A. Interior Bonding Systems: Bare or green insulated copper.

B. Underground or Exterior Systems: Bare copper.

C. Circuit Ground Conductors Installed in Raceways or MC Cable: 600 Volt insulation to match phase and neutral conductor insulation rating.

2.3 CONNECTORS

A. Cast, set screw or bolted type.

B. Form poured, exothermic welds.

C. Grounding lugs, where required by code, as standard manufacturer's items.

2.4 GROUND PADS

A. 1000 Ampere rated copper bus nominally 1/4 inch by 3 inches by 12 inches long.

2.5 GROUND RODS

A. Ground Rods: 5/8 inch by 10'-0" long copper clad steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide insulated 600 Volt main bonding jumper as directed by service utility.

B. Ground Conductors: Size in accordance with NEC 250, Tables 250-122 and 250-66.

C. Ground Conductor Connectors: Make up tight to ensure low impedance.

D. Ground the electrical system, the cold water service, structural steel, and transformers, to the building ground grid.

E. Provide a ground pad at each location indicated. Mount ground pads with stand-off devices to provide a minimum of 1-1/2 inches free space behind pad for access to lug nuts and washers.

F. Plug-in Receptacles: Bond to the boxes, raceways, and ground conductor.

G. Provide equipment ground conductor in branch circuits.

H. Provide ground bonding to above ground portion of metal gas piping in accordance with NEC 250.104(B).

I. Solidly ground all separately derived systems to the nearest water piping.

J. Provide ground rod at all lightpole handholes. Provide ground conductor between ground rod and conduit stub-out ground bushings via bare #2 copper wire.

3.2 CONCRETE-ENCASED GROUNDING ELECTRODE

A. Concrete-Encased Grounding Electrode:

1. Fabricate according to NEC 250.50, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

2. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation.
3. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts.
4. Extend grounding conductor below grade and connect to grounding grid or to a grounding electrode external to concrete.

B. Provide a concrete encased building grounding (Ufer) electrode where indicated.

1. Grounding Electrode: Three No. 4/0 bare copper conductors a minimum of 20 feet each, cast into the bottom 6 inches of an exterior concrete foundation or footing.

3.3 EQUIPMENT

A. Provide separate green insulated equipment ground conductor in all electrical raceways.

1. Effectively ground all luminaires, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures.
2. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose.

B. Provide grounding bushings on all feeder conduit entrances to panels and equipment enclosures and bond bushings to enclosures with minimum No. 10 AWG conductor.

1. Connect the equipment ground to the building system ground.
2. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG.

END OF SECTION

SECTION 26 0533 – CONDUITS, RACEWAY BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways.
2. Conduit fittings, hangers and appurtenances.
3. Receptacles.
4. Weatherproof receptacles.
5. Junction and pull boxes.

B. Related Sections:

1. Section 26 0500 Common Work Results for Electrical
2. Section 26 0519 Low Voltage Electrical Power Conductors
3. Section 26 0526 Grounding and Bonding for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Fire Protection Association 70 National Electrical Code (NEC):

1. NEC 330: Article 330 Metal-Clad Cable, Type MC.
2. NEC 342: Article 342 Intermediate Metal Conduit, Type IMC.
3. NEC 344: Article 344 Rigid Metal Conduit, Type RMC.
4. NEC 348: Article 348 Flexible Metal Conduit, Type FMC.
5. NEC 350: Article 351 Liquidtight Flexible Metal Conduit, Type LFMC.
6. NEC 358: Article 358 Electrical Metallic Tubing, Type EMT.

B. American Society for Testing and Materials (ASTM) F512, Standard Specification for Smooth-Wall Polyvinyl Chloride (PVC) Conduit and Fittings for Underground Installation: ASTM F512.

C. National Electrical Manufacturers Association, Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installations: NEMA TC-6.

D. Underwriters Laboratory Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings: UL 651.

1.3 SUBMITTALS

A. Product Data for each type of electrical device specified. Include manufacturer's standard catalog pages and data sheets for conduits, fittings, and raceways and boxes.

B. Shop Drawings, including the following:

1. Proposed arrangement for conduits installed within structural concrete slabs.
2. Proposed locations of roof penetrations and methods for sealing.

1.3 QUALITY ASSURANCE

A. Electrical Products: Provide products in conformance with requirements of NFPA 70.

B. *[Anything else?]*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Raceways: Allied Steel, Certainteed, Jones & Laughlin, Carlon or Kraloy.

B. Conduit Fittings: 0-Z Gedney, Thomas & Betts or Crouse & Hinds.

C. Outlet Boxes: Bowers, Hubbell or Raco.

D. Weatherproof Outlet Boxes: Bell, Red Dot or Carlon.

E. Secure Weatherproof Receptacle Enclosure: Fouch Electric.

F. Weatherproof-In-Use Covers: Thomas & Betts – Red Dot.

G. Junction and Pull Boxes: Circle AW or Hoffman.

H. Box Extension Adapter: Bell, Red Dot or Carlon.

I. Conduit Fittings: O-Z Gedney or Thomas & Betts.

2.2 METALLIC CONDUITS

A. Galvanized Rigid Conduit (GRC): Smooth surfaced heavy wall mild steel tube of uniform thickness and temper, reamed and threaded at each end and protected inside and out with galvanizing, sherardizing, or equivalent process. Comply with requirements of NEC 344.

B. Intermediate Metallic Conduit (IMC): Smooth surface, intermediate wall mild steel tube of uniform thickness and temper, reamed and threaded at each end, and protected inside and out with galvanizing, sherardizing, or equivalent process. Comply with requirements of NEC 342.

C. Electrical Metallic Tubing (EMT): Smooth surface, thin wall mild steel tube of uniform thickness and temper, galvanized or sherardized on the outside, and enameled on the interior. Comply with requirements of NEC 358.

D. Flexible Conduits (Flex):

1. Flexible Metallic Conduit: Interlocking single strip steel construction, galvanized inside and out after fabrication. Comply with requirements of NEC 348.
2. Liquid Tight: Similar to flexible metallic conduit, except encased in a liquid tight polyvinylchloride or equivalent outer jacket over the flexible steel core. Comply with requirements of NEC 350.

2.3 NON-METALLIC CONDUITS

A. Underground Ducts:

1. PVC, Encased Burial: Type EB for concrete encasement, meeting or exceeding the current requirements of EB-20, ASTM F512, NEMA TC-6 and UL 65l. Suitable for use with 90 degree C rated wire.
2. PVC, Direct Burial: Type DB suitable for direct burial, meeting or exceeding the current requirements of DB-20, ASTM F512 and NEMA TC-6. Suitable for use with 90 degree C rated wire.

B. Rigid Non-Metallic Conduit: Type II PVC Schedule 40, suitable for use with 90 degree C rated wire. Conduit shall conform to UL 65l and carry appropriate UL listing for above and below ground use.

2.4 METAL CLAD CABLE

A. Sheath: Steel of the interlocking metal type, continuous and close fitting.

1. Do not use sheath as a current carrying or grounding conductor.
2. Sheaths constructed using overlapping metal tape method are not acceptable.
3. Comply with requirements of NEC 330.

B. Conductors: As specified in Section 26 0519, “Low Voltage Electrical Power Conductors”.

C. Limit use of metal clad wire to interior or enclosed installation.

2.5 WIREWAYS

A. Troughs: Steel, painted, square in cross section, preformed knock-outs on standard spacing, screw cover.

B. Fittings: Provide tees, elbows, couplings as required for configurations shown in the Drawings.

2.6 FITTINGS

A. GRC and IMC:

1. Threaded Locknuts: Sealing type where used with NEMA Types 2, 3, 3R, 4 and 12 enclosures.
2. Threaded Bushings: 1-1/4 inch and larger, insulated, grounding type as specified in Section 26 0526, “Grounding and Bonding for Electrical Systems”.
3. Threaded Couplings: Standard threaded of the same material and as furnished with conduit supplied. Erickson type couplings may be used where required to complete conduit runs larger than 1 inch.

B. EMT:

1. Connectors: Steel compression ring or steel set screw type for conduit termination, with insulated throat, suitable for conditions used. Use lay-in grounding type bushings where terminating grounding conductors.
2. Couplings: Steel compression ring or steel set screw type, concrete tight.

C. MC Cable: Size and design box connectors for metal clad cable for the specific application as recommended by the cable manufacturer.

D. Threadless: GRC and IMC couplings and box connectors may be steel threadless, compression ring or set screw type for use with conduits 1 inch and smaller where installed in poured concrete locations, or where limited working space makes threaded fittings impractical.

E. Weatherproof Connectors: Threaded.

F. Expansion Couplings: Equal to O.Z. type EX with jumper.

G. Seal-Offs: With filler fiber, compound, and removable cover.

2.6 METALLIC BOXES

A. Flush and Concealed Outlet Boxes: Galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, fixture studs if required

B. Surface Outlet Boxes:

1. Ceilings: Galvanized stamped steel same as for flush and concealed outlet boxes.
2. Walls: Steel or aluminum with threaded hubs or bosses.

C. Junction or Pull Boxes: Painted, welded steel construction with screw cover for boxes exceeding 4-11/16 inches square; Steel gauge as required for physical size.

D. Systems: Boxes for systems devices as recommended by the systems manufacturer, suitable for the equipment installed. Equip with grounding lugs, brackets, device rings, etc., as required.

2.7 FLOOR BOXES

A. Flush-in Floor Junction Boxes, and those serving pedestal fittings:

1. Concrete tight square stamped steel, fully adjustable, with round brass cover assembly, equivalent to Steel City 68 series with appropriate P-60 floor plate or Hubbell B2527 with appropriate service cover plate.
2. Comply with requirements of 514A.
3. Carpet Areas: Equip floor outlets with translucent polycarbonate carpet flanges equivalent to Steel City P-60-LCP, or Hubbell S3079.
4. In wood joist floor systems similar to above, non-adjustable; Hubbell B2588 with appropriate service cover plates.
5. Equip floor boxes with a aluminum pedestal housing as required, equivalent to Steel City (SFH-40) (SFH-50) series or Hubbell SC3099A

B. Combination Service Flush Floor Boxes:

1. Galvanized steel equipped with suitable sectionalizing plates with nominally 4 inch diameter opening and designated devices, equivalent to Steel City 663 series, or Hubbell SystemOne Series.
2. Comply with requirements of U.L. 514A.
3. Equip boxes in hard floors with Steel City P-60 series or Hubbell S1TFC covers, and in carpeted areas with P-62-CP or Hubbell S1CFC carpet plate and cover.

C. Combination Service Floor Boxes:

1. Galvanized steel equipped with suitable concrete-tight stamped steel sleeve, two device compartments for up to eight single going devices.
2. Provide die-cast aluminum trim ring with aluminum trim ring with aluminum-coated finish and blank access door.
3. Provide Wiremold RFB9 series floor box with RFB119BTCAL recessed activation kit or Hubbell CFB7G with CFB7TALU cover.

D. Concealed Service Floor Boxes:

1. Galvanized steel equipped with suitable sectionalizing plates, designated devices, hinged rectangular polymide access plate and carpet flange, equivalent to Steel City 664 series or Hubbell 3SFBSS series.
2. Comply with requirements of 514A.
3. Finish color and carpet as selected by Owner.

E. Flush Floor Boxes:

1. Cast iron, fully adjustable, brushed aluminum ring equipped with suitable metallic sectionalizing plates.
2. Comply with requirements of U.L. 514A.
3. Provide brushed aluminum duplex flaps for both power and Telecom.
4. Provide brushed aluminum carpet flange.
5. Single gang: Hubbell BA2436/SA3825/SA3083, Steel City, Wiremold, or approved.
6. Double gang: Hubbell BA4233/SA3825/SA3084, Steel City, Wiremold, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conceal conduits in finished spaces.

1. Run concealed conduits in a direct line with long sweep bends and offsets.
2. Embed GRC and IMC in concrete below grade or in damp locations; make watertight by painting the entire male thread with Rustoleum metal primer or equal before assembly.

B. Route exposed conduit parallel or at right angles to structural building lines, neatly offset into boxes.

1. Closely follow surfaces for conduits attached directly to building.
2. Use conduit fittings to “saddle” under beams.
3. Coordinate with Owner drilling or notching of existing beams, trusses on structural members.

C. Rigidly secure GRC and IMC terminations at boxes, cabinets, and general wiring enclosures with double locknuts and bushings or approved fittings.

1. Where conduit boxes with threaded hubs or bosses are used, screw in conduit, engaging at least 5 threads in hub.
2. Use insulating bushings d for conduits 1-1/4 inches or larger.

D. Keep conduit and raceways closed with suitable plugs or caps during construction to prevent entrance of dirt, moisture, concrete, or foreign objects.

1. Ensure that raceways are clean and dry before installation of wire at the time of acceptance.

E. Pack spaces around conduits with polyethylene backing rods and seal with polyurethane caulking to prevent entrance of moisture where conduits are installed in sleeves or block-outs penetrating moisture barriers.

3.2 CONDUIT

A. GRC may be used in all areas for wiring systems.

1. Install GRC for wiring underground in cast concrete construction, in damp locations, and in hazardous areas for serving fire pump controllers.
2. Install GRC made up tight where subject to mechanical injury with threaded fittings.
3. IMC may be used in locations not in contact with earth or fill.

B. EMT may be used in dry protected locations.

1. Provide green equipment bonding conductor where used for power circuit feeders 2-inch and larger.
2. Whether exposed or concealed, install EMT securely supported and fastened at intervals of nominally every 8 feet and within 24 inches of each outlet, ell, fitting, panel, etc.

C. Use flex for connections to vibration producing equipment, and where installation flexibility is required, with a minimum 12 inches slack connection.

1. Limit flex length to 36 inches for exposed equipment connections and 72 inches in concealed ceiling and wall cavities.
2. Use PVC jacketed flex in wet locations, areas subject to washdown, and exterior locations.

D. PVC Type II Schedule 40 may be used underground and in and under interior slabs, poured concrete walls, and where scheduled or noted in the Drawings.

1. Make connections with waterproof solvent cement.
2. Provide GRC at 60 degree and larger bends and where penetrating slabs.

3.3 RACEWAYS

A. Surface metal wireways may be installed at locations to serve motor starters or other control devices where required by a multitude of wiring interconnections or physical layout.

3.4 FITTINGS

A. Assemble metallic raceways and conduits continuous and secured to boxes, panels, etc., with appropriate fittings to maintain electrical continuity. Cut conduit joints square and reamed smooth with fittings drawn up tight.

B. Do not use crimp-on, tap-on, indenter type, malleable iron or cast set screw fittings.

3.5 BOXES

A. Mount boxes and outlets at nominal center line in accordance with Oregon State adopted ADA requirements.

1. Coordinate locations with Owner and heights shown in the Drawings.
2. Adjust heights in concrete masonry unit walls to prevent devices or finish plates from spanning masonry joints.

B. Provide outlet boxes of code required size to accommodate wires, fittings, and devices.

1. Provide multi-gang boxes as required to accept devices installed with no more than one device per gang.
2. Equip metallic boxes with grounding provisions.

C. Provide flush wall switch and receptacle outlets used with conduit systems 4 inches square, 1-1/2 inches or more deep, and with one or two-gang plaster ring mounted vertically.

1. Where three or more devices are at one location, use one piece multiple gang tile box or gang box with suitable device ring.

D. Provide wall bracket and ceiling surface mounted luminaire outlets with 4 inch octagon 1-1/2 inches deep boxes with 3/8 inch fixture stud.

1. Provide wall bracket outlets with single gang opening where required to accommodate fixture canopy.
2. Provide larger boxes or extension rings where quantity of wires installed requires more cubic capacity.

E. For junction boxes installed in accessible ceiling or wall cavities or exposed in utility areas, provide boxes a minimum of 4 inches square, 1-1/2 inches deep, with appropriately marked blank cover.

F. Provide boxes for the special systems suitable for the equipment installed. Coordinate size and type with the system supplier.

G. Provide pull boxes where shown for installation of cable supports, or where required to limit the number of bends in any conduit to not more than three 90 degree bends. Use galvanized boxes of code required size with removable covers installed so that covers will be accessible after work is completed.

H. Provide recessed boxes flush with finished surfaces, or not more than 1/8 inch back, level and plumb.

1. Do not use long screws with spacers or shims for mounting devices.
2. Do not expose wiring at outlets to combustible material.

I. Extend covers for flush mounted boxes in finished spaces a minimum of 1/4 inch beyond the box edge to provide a finished appearance. Finish edge of cover to match cover face.

J. Equip boxes attached to a stud in gypsum board walls with opposite side box supports equivalent to Caddy #760.

1. Install drywall screw prior to finish taping.
2. Use methods to attach boxes to studs that do not cause projections on the face of the stud, to prevent full length contact of gypsum board to the stud face.

3.6 PULL WIRES

A. Install nylon pull lines in all empty conduits larger than 1 inch where routing includes 25 feet or more in length or includes 180 degrees or more in bends.

B. Where conduits requiring pull lines are stubbed out and capped, coil a minimum of 36 inches of pull line and tape at termination of conduit for easy future access.

1. Label pull lines as to conduit starting or terminations point and intended future use.

END OF SECTION

SECTION 26 0553 – IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Switchgear labels.
2. Branch circuit panelboard labels.
3. Equipment identification labels.
4. Device identification labels.
5. Raceway and Box identification.
6. Systems identification.
7. Underground utility markers.

B. Related Requirements:

1. Section 26 0500: Common Work Results for Electrical
2.

1.2 REFERENCE STANDARDS

A. American Public Works Association (APWA) standards for underground electrical conduit systems.

B. National Electrical Code (NEC).

C.

1.3 COORDINATION

A. Coordinate names, abbreviations and other designations with equipment as specified in this or other Divisions or on Drawings.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.5 QUALITY ASSURANCE

A. Provide products in conformance with requirements of NFPA 70 and the NEC.

B.

PART 2 - PRODUCTS

2.1 LABELS

A. Hand-written labels are not acceptable. For outdoor applications.

B. Pre-Printed Labels: Permanent material pre-printed with black on white, with adhesive backing; Brady or 3M.

C. Laminated Plastic: 3-ply laminated plastic, black with white letters, for 208/120V equipment and red with white letters for 480/277V equipment; Lamicoid.

D. Clear Plastic Tape: Black 12 point Helvetica medium characters machine imprinted on clear tape; Merlin or Kroy.

E. Plastic Tape: Black or red with white letters, adhesive backing, field printed with proper tool; Dymo-tape.

F. Underground Utilities Ribbon: Inert polyethylene plastic ribbon, 6-inch wide by 4 mil thick, legend imprinted over entire length of ribbon in permanent black letters with the legend, "…CAUTION CAUTION CAUTION ELECTRIC LINE BURIED BELOW…"; Panduit HTU6R-E.

G. Wire Markers: White with black numbers, adhesive backed tape on dispenser roll; Brady, 3M, or approved.

PART 3 - EXECUTION

3.1 GENERAL

A. Fasten labels to equipment in secure and permanent manner. Clean all oils, dirt and any foreign materials from substrate prior to label application.

B. Install labels at locations detailed or, where not otherwise indicated, in a location convenient for viewing without interference with operations and maintenance of equipment.

C. Where labels are to be applied to surfaces requiring finishes, install after completion of finish application.

3.2 SWITCHGEAR

A. Label main and feeder protective devices in distribution panels and motor control centers with laminated plastic labels indicating the function or the load served.

B. Provide laminated plastic labels for bussed spaces indicating the maximum ampere rating or size of future breaker, switch or starter that may be installed in the reserved space.

3.2 BRANCH CIRCUIT PANELBOARDS

A. Indicate panel number with laminated plastic labels.

1. Use plastic tape labels on the side of the panel door to indicate voltage phase and feeder source, feeder wire size, and feeder breaker or fuse size with plastic tape labels on the inside of the panel door.

B. Provide typewritten panel directories, with protective, clear transparent covers, accurately accounting for every breaker installed including spares.

1. Near completion of the Work, provide schedules in panel directories that use actual room designations assigned by name or number and not the space designation used in the Drawings.

3.3 EQUIPMENT

A. Label all disconnect switches, motor starters, relays, contactors, and time switches indicating equipment served with plastic tape labels.

B. Where the controlling device is remote mounted from the serving panel, include the serving panel designation and circuit number with additional plastic tape labels.

3.4 DEVICES

A. Label each receptacle plate with preprinted clear plastic press on labels with 3/16" minimum black letters indicating serving panel and circuit number.

1. Provide the same labeling for receptacles connected to a GFCI protected circuit downstream from the protecting device.

3.5 RACEWAYS AND BOXES

A. Label pull boxes and junction boxes for systems with tape, paint, or marker pen on box cover identifying system.

1. If tape is used, place in an area readily visible, at least 3 inches in length across the box, installed in a neat and workman like manner.
2. Where box covers are exposed in finished areas, label inside of cover.
3. Label covers with the following colors:

a. 480Y/277V Wiring: Orange.
b. 208Y/120V Wiring: Black.
c. Fire Alarm: Red.

d. Communications: Green.
e. Security: Blue.

B. Label each end of pull wires left in empty conduits with tags or tape indicating location of other end of wire.

3.6 SYSTEMS

A. Complex control circuits may utilize any combination of colors with each conductor identified throughout, using wraparound numbers or letters.

1. Use the number or letters shown where the Drawings or operation and maintenance data indicate wiring identification.

B. Label the fire alarm and communication equipment zones, controls, indicators, etc., with machine printed labels or indicators appropriate for the equipment installed as supplied or recommended by the equipment manufacturer.

3.7 EXISTING EQUIPMENT

A. Install nylon pull lines in all empty conduits larger than 1 inch where routing includes 25 feet or more in length or includes 180 degrees or more in bends.

3.8 UNDERGROUND UTILITIES

A. Install continuous ribbon 6 inches to 8 inches below finish grade for each exterior underground raceway.

B. Where multiple small raceways are buried in a common trench not exceeding an overall width of 16 inches, install a single ribbon. Where trench width exceeds 16 inches, install multiple ribbons not over 10 inches apart, edge to edge, over entire group of raceways.

C. Color code as recommended by APWA.

1. Safety Red for electric power distribution.
2. Safety Alert Orange for telephone, signal, data and cable TV.

END OF SECTION

SECTION 26 2000 – SECONDARY DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes materials and equipment for a complete secondary service and distribution system.

B. Related Sections:

1. Section 26 0500 Common Work Results for Electrical
2. Section 26 0526 Grounding and Bonding for Electrical Systems.
3. Section 26 0553 Identification for Electrical Systems, for product identification requirements.

1.2 REFERENCES

A. ANSI C12.17 – American National Standard for Requirements for Watthour Meter Sockets; 2014

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

D. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

E. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

F. UL 67 - Panelboards; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.

C. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. Panel Keys: Two of each different key.
2. Maintenance requirements for products specified in this Section.

1.4 QUALITY ASSURANCE

A. Provide secondary distribution system that is fully rated.

B. Qualifications: Minimum 5 years in the industry.

C. Regulatory Requirements:

1. Provide utility metering facilities that comply with the established serving utility requirements.
2. Provide quantity and style of meter sockets and accessories required by the utility.
3. Provide utility metering facilities that comply with ANSI C12.7.

D. Electrical Products: Provide products in conformance with requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. Enclosure: Hoffman Enclosure Weatherpro Outdoor Pad Mount, Type 3R:

1. Pedestal Riser: V.I.T. Products.
2. Finish: Powder coated steel to match Enclosure, minimum 2 coats.
3. Finish: Stainless steel.

B. Enclosure Fan:

1. Hoffman # A4AXFN.

    a.

2. Hoffman Enclosure Fan Kit #_____.

2.2 PANEL

A. Siemens. All other manufacturers: submit substitution request.

B. Front operated circuit breaker type, fully enclosed with bussing provisions for future extension.

1. Provide assemblies rated over 1000 amperes of free standing construction.
2. Provide overcurrent protection ratings as indicated in the Drawings.
3. Provide devices capable of interrupting the fault current available.

B. Bus Work:

1. Copper, sized as indicated.
2. 100 percent neutral with a maximum hot-spot temperature rise of 65 degrees C above an ambient of 40 degrees C under continuous full load current.
3. Rated to withstand 65,000 A fault currents.
4. Include bussing provisions for mounting future devices in all spaces called for.

    a. Where panel configuration provides additional spaces within a section, buss these spaces to receive future devices.
    b. Make provisions for future extension of bussing.

5. Provide a copper ground bus in bottom of enclosure.

C. Ground Bus:

1. Provide a ground bus with termination capacity for the grounding conductor sized for the branch circuit equipment grounding conductors in 240/120V panels.
2. Bond ground bus to the panel cabinet.

2.3 CIRCUIT BREAKERS

A. General:

1. Molded case, bolt-in thermal magnetic type.
2. Provide breakers with short circuit capacity rating to withstand the maximum short circuit duty that can be expected at the breaker location in the electrical system.
3. Minimum short circuit rating for any circuit breaker to be 10,000 A.I.C. for 120V and 208V breakers, and 14,000 A.I.C. for 277V and 480V breakers.

B. Main Circuit Breakers:

1. Equip panels as indicated with main circuit breakers sized as scheduled and mounted behind door at top of panel.
2. Back feeding of branch circuit breakers is not acceptable.

C. Branch Circuit Breakers:

1. Molded case, thermal magnetic type.
2. Provide breakers with short circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system.
3. Provide breakers mounted in branch panelboards of the bolt-in type.
4. Provide circuit breakers used for switching duty to be UL listed for that purpose and marked “SWD.”
5. Minimum short circuit rating for any circuit breaker: 10,000 A.I.C. for 120V and 240V.

D. Branch Circuit Panels:

1. Bolt-in circuit breaker type with copper bussing.
2. Bussing that is not copper is not acceptable.
3. Fit panels with flush lift latches and locks keyed alike.

2.4 ACCESSORIES

A. Lighting Time Clock:

1. Intermatic ET 8215C.
2. Shelter receptacle: non-astronomic control time clock.

B. Accessories for External Mounted Meter: Comply with service utility requirements, including clearance requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the secondary distribution system assemblies and equipment as shown on the Drawings, parallel and square with the building lines.

B. Neatly lace and secure feeder circuit conductors individually at maximum 2 foot intervals. Cable lugs shall not support the weight of the cables.

C. Pole mount service transformer. Coordinate type of construction, conduit arrangement and grounding requirements with *[service provider]* prior to construction.

3.2 BRANCH PANELBOARDS

A. Install panelboards plumb and level, located as shown In the Drawings up 6'-0" to top, unless indicated otherwise.

B. Equip selected breakers with mechanical locking devices that may be locked in the “on” position.

1. Include selected breakers serving alarm systems, fire suppression systems, communications systems and other critical loads directed.

3.3 CONCRETE PADS

A. Provide nominally 3-1/2 inch deep concrete housekeeping pads under all free-standing service pedestals and cabinets. Extend pads nominally 2 inches beyond the edges of the equipment.

B. Anchor cabinet to foundation. Pass anchor bolts through housekeeping pad and anchor within foundation.

3.4 CLOSEOUT ACTIVITIES

1. Deliver panel keys to the Owner at completion of the Project.

END OF SECTION

SECTION 26 2726 – WIRING DEVICES AND PLATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall switches.
2. Receptacles.
3. Device plates.
4. Surface covers.

B. Related Sections:

1. Section 26 0500: Common Work Results for Electrical
2. Section 26 0943: Network Lighting Controls

C. Switched Receptacles:

1. Provide per Washington Energy Code and ASHRAE 90.1.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Include manufacturer's Installation Instructions indicating application conditions and limitations of use required by product testing agency.
2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

B. Field Quality Control Test Reports.

C. Closeout Submittals:

1. Project Record Documents: Record actual installed locations of wiring devices.
2. Operation and Maintenance Data:

a. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
b. Maintenance Materials: Furnish for Owner's use in maintenance of project.

1.3 QUALITY ASSURANCE

A. Provide products in conformance with requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Wiring Devices and Plates: Hubbell, Leviton, Pass & Seymour.

B. Dimmers: Wattstopper, Lutron, Prescolite.

2.2 MATERIALS - GENERAL

A. Wiring Devices: Specification grade, with special devices as specified and required.

1. Furnish a matching cap for all special purpose devices that do not have the common 120 volt NEMA 5-20R configuration.

B. Provide lighting switches and duplex receptacles that have similar appearance characteristics, unless noted otherwise.

2.3 WALL SWITCHES

A. Line Voltage Switches: 20 ampere, 277 volt, quiet type, back and side wired. Verify finish color with Owner; Hubbell 1221 series.

B. Switch with pilot, lighted clear toggle: Hubbell HBL-1221-PL.

C. Momentary Contact Switches: 15A, SPDT, center off. Verify finish color with Owner; Hubbell HBL-1556.

D. Auto-off Switch: 15A, 277V, automatic to “off” position in event of 5 second power interruption, lighted handle in “off” position; Sentry.

E. Low Voltage Switches: As specified in Section 26 0943, “Lighting Control Devices.”

2.4 DIMMERS

A. Low Voltage Dimmers: As specified in Section 26 0943, “Network Lighting Control.”

2.5 OCCUPANCY SENSORS

A. Digital Occupancy Sensors: As specified in Section 26 0943, “Network Lighting Control.”

2.6 RECEPTACLES

A. Normal Power Duplex: 3-wire, 2-pole grounding, steel backstrap, NEMA 5-20R, back and side wired. Verify finish color with Owner.

1. General Application: Hubbell CR-5362 series.

B. Ground Fault Interrupting Duplex: NEMA 5-20R. Verify finish color with Owner; UL 943, Class A. Hubbell GFR-5352A series.

C. Special Purpose Receptacles: As indicated in Drawings with NEMA configurations.

2.7 PLATES

A. Flush Finish Plates: 040 inch thick, type 302 stainless steel, brush finish.

B. Surface Covers: Galvanized or cadmium plated steel, 1/2 inch raised industrial type with openings appropriate for device installed.

C. Weatherproof: Standard duplex GFI receptacle. Hubbell WP26MH cover mounted horizontally with hinges up. Special purpose receptacles: Hubbell WP723D.

D. Identification: Identify receptacle plates with press on labels indicating serving panel and branch circuit number.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and finish plates plumb with building lines.

1. Install wall mounted receptacles vertically at centerline height as indicated in the Drawings.
2. Unless otherwise indicated in the drawings, the centerline is 18 inches above finished floor for receptacles, and 48 inches for light switches in accordance with ADA.
3. For all above counter devices, verify mounting heights with Drawings.

B. Do not install finish plates and devices until final painting is complete. Scratched or splattered finish plates and devices will be rejected.

C. Provide weatherproof device covers on devices at all exterior locations and damp or wet label areas.

D. Locate occupancy sensors according to manufacturer's recommendations and installation requirements for optimal coverage.

3.2 CORD CAPS

A. Deliver special plugs to the Owner in cartons with a letter stating the date and to whom the devices were delivered.

3.3 COORDINATION

A. Coordinate locations for installation of devices with the Drawings.

B. Coordinate with equipment installer the locations and methods of connection to devices mounted in cabinets, counters, work benches, service pedestals and similar equipment.

3.4 TESTING

A. Test receptacles for line to neutral, line to ground, and neutral to ground faults. Correct any defective wiring.

B. Test all GFI receptacles and replace defective units.

END OF SECTION

SECTION 26 2816 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes disconnect switches.

B. Related Sections:

1. Section 26 0526: Grounding and Bonding for Electrical Systems
2. Section 26 0529: Hangers and Supports for Electrical Systems
3. Section 26 0553: Identification for Electrical Systems

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency.
2. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Closeout Submittals:

1. Project Record Documents: Record actual installed locations of enclosed switches.
2. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
3. Maintenance Materials: Furnish for Owner's use in maintenance of project.
4. Additional Requirements: Refer to Section 26 0500, “Common Work Results for Electrical.”

1.3 QUALITY ASSURANCE

A. Provide products in conformance with requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Electric, Siemens, ABB, or approved.

2.2 DISCONNECTS

A. Safety and Disconnect Switches: NEMA type HD (heavy duty), quick-make, quick-break, dual rated with electrical characteristics as required by the system voltage and the load served.

1. Equip switches with a defeatable cover interlock and indicating handle that will accept a minimum of three padlocks.

B. Provide NEMA I enclosures for indoor use, unless otherwise indicated.

C. Provide NEMA 3R where installed exposed to the weather or designated by the subscript "WP."

D. Provide fusible or non-fusible disconnects as indicated in the Drawings.

E. Rejection Fuse Clips: Provide for fusible switches (30 to 600A) to prevent the installation of Class H and Class K non-current-limiting fuses.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCHES

A. Provide all code required disconnect switches as Work of this Section, whether specifically shown or not.

B. Provide all disconnect switches from the same manufacturer.

C. Install disconnect switches as recommended by the manufacturer, square with the building structural lines.

D. Install fuses in all fused switches.

E. Provide identification as specified in Section 26 0553, “Identification for Electrical Systems.”

END OF SECTION

SECTION 26 5600 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior lighting systems:

1. Branch circuit wiring from new service and distribution panel.
2. Luminaires, lampholders, ballasts, lamps, light poles and accessory items.
3. Flush with grade handhole and splice boxes for branch circuit wiring.

B. Related requirements:

1. Section 01 2500 Substitution Procedures
2. Section 01 3100 Project Management and Coordination
3. Section 01 3300 Submittal Procedures
4. Section 01 7000 Execution and Closeout
5. Section 26 0500 Common Work Results for Electrical
6. Section 31 2000 Earth Moving, for trenching and backfill.

1.2 PERFORMANCE REQUIREMENTS

A. Provide specified lighting units with a luminaire of the type designated and appropriate for the location.

1. Where outlet symbols indicated do not designate a type of a luminaire, provide the same as those used in similar or like locations.
2. Where a luminaire type designation has been omitted and cannot be determined by inspection, request an interpretation from the Owner and provide a suitable luminaire type as directed.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only.

B. Illuminating Engineering Society of North America (IESNA):

1. LM-63-02 – IESNA Standard File Format for Electronic Transfer of Photometric Data
2. LM-79-08 – IESNA Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products
3. LM-80-15 – IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources

4. RP-16-10 – ANSI/IES Nomenclature and Definitions for Illuminating Engineering

C. National Fire Protection Association:

1. NFPA 70: National Electrical Code (NEC).
2. NFPA 70E: Standard for Electrical Safety in the Workplace.

1.4 DEFINITIONS

A. Lighting terminology used in this Specification is defined in IESNA RP-16. See referenced documents for additional definitions.

1. Exception: The term “driver” is used to broadly cover both drivers and power supplies, where applicable.
2. Clarification: The term “LED light source(s)” is used in accordance with IES LM-80 to broadly cover LED package(s), module(s), and array(s).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under Work of other Sections, or by others.
2. Coordinate elevation to obtain specified pole height and footing depth.
3. Prior to installation of feeders or branch circuits to equipment requiring electrical connections, examine manufacturer information. Verify that the electrical characteristics indicated are consistent with the electrical characteristics of the actual equipment being installed.
3. Notify Owner of conflicts, deviations or inconsistencies. Obtain an interpretation prior to proceeding with Work.

B. Preinstallation Meetings

1. Pole and cabinet location staking.
2. Trench and conduit locations and sequencing coordination.

1.6 SUBMITTALS

A. Electrical permit. Submit before beginning any Work under this Section.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets and detailed information on:

1. Luminaires: Include electrical ratings, dimensions, weight, mounting requirements, clearances, material, finishes, terminations, wiring and connection diagrams, photometric performance data, service conditions, diffusers, and louvers, and installed accessories.

a. Include model number nomenclature clearly marked with all proposed features.
b. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard file format upon request.
a. Photometry Reports consist of a minimum of: Candlepower Distribution Curves, LM-79 and LM-80 Reports for Solid State Lighting.

3. Lamps: Include rated life and initial and mean lumen output.
4. Lighting Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C. Shop Drawings:

1. Device and electrical cabinet and panel layout plans.
2. Wiring diagrams.
3. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
4. Provide structural calculations for each pole proposed for substitution.

D. Samples:

1. Provide sample of lighting pole color and finish selected.
2. Owner may request standard production model luminaire sample, including LED package, identical to product proposed to be installed for inspection.

E. Field Quality Control Reports:

1. Test report indicating measured illumination levels.

F. Certifications:

1. Documentation that pole assembly products are suitable for the luminaires to be installed and comply with designated structural design criteria.
2. Safety certification and file number as required.
3. Compatibility of lamp and lampholder.
4. Luminaire performance at temperatures below 32 degrees F.

G. Manufacturers' Installation Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency.
2. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Closeout Submittals:

1. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
2. Warranty Documentation.
3. Project Record Documents.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Material Submittals

1. Extra Lamps: 10 percent of total quantity installed for each type, but not less than two of each type.
2. Touch-Up Paint: 2 gallons, to match color of pole finish.

1.7 QUALITY ASSURANCE

A. Regulatory Agency Requirements:

1. Approved City of Portland Electrical Permit.
2. Comply with requirements of the servicing electric utility.
3. Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts and transformers and luminaires.
4. Comply with requirements of the NFPA 70E.
5. Comply with applicable NEMA standards pertaining to lighting equipment.

B. Provide products conforming to requirements of NFPA 70.

1.8 DELIVERY, STORAGE AND HANDLING *[Edit as appropriate, then delete this note.]*

A. General: _____

B. Luminaires: _____

C. Lighting Poles: _____

1.9 WARRANTY

A. Provide the following Standard Warranties:

1. Provide a written 5 year on-site replacement material, fixture finish, and workmanship.

a. On-site replacement includes transportation, removal, and installation of new products.

b. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

2. Provide a written 5 year replacement material warranty for defective or non-starting LED source assemblies.
3. Provide a written 5 year replacement material warranty on all power supply units (PSU).
4. Provide a written 5 year replacement warranty for luminaires producing inadequately maintained illuminance levels at end of warranty period, as prorated from levels expected at end of useful life.

B. Optional Extended Warranty:

1. Owner may request an optional 10 year replacement warranty for inadequately maintained illuminance levels, finish of luminaire, PSU, or defective LED source assemblies.
2. The terms of the extended warranty will be negotiated by the Owner and the luminaire manufacturer for an additional cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Lighting Design:

1. Lighting Poles: Ameron; embedded SEQ type with TG style 2 3/8" diameter Tenon.
2. Light Fixtures: Lithonia; Wall Packs and Path Fixtures.

   a. Path Fixture Catalog # MRP-LED.

3. Handhole or Splice Box: Synertech #SYN1118, Lid marked "Lighting."

B. Luminaire Substitution Limitations:

1. Submit substitution proposals according to requirements of Section 01 2500 Substitution Procedures.
2. Acceptance of luminaire substitutions will be determined by the following characteristics. Lack of data on any characteristic is justification for rejection of the submittal:

   a. Performance:

      1) Distribution.
      2) Utilization.
      3) Average brightness/maximum brightness.

4) Spacing to mounting height ratio.
5) Color temperature.
6) Efficient performance at temperatures below 32ºF.
7) Luminaire must be UL-listed and labeled as appropriate for the exterior location.
8) Wiring cavity must be field accessible for service or repair needs.
9) Lamp life.

b. Construction:

1) Engineering.
2) Workmanship.
3) Rigidity.
4) Permanence of materials and finishes.

c. Installation Requirements:

1) Installation Instructions.
2) Captive parts and captive hardware.
3) Provision for leveling.

d. Maintenance:

1) Relamping ease.
2) Replacement of ballast and lamp sockets.
3) Manufacturer services.

e. Appearance:

1) Light tightness.
2) Neat, trim styling.
3) Conformance with design intent.

f. Warranty Documentation

1) Terms.
2) Manufacturer Services.
2) Conditions.
3) Exclusions.

2.2 LUMINAIRES - GENERAL

A. Provide luminaires with trims which fit neatly and tightly to the surfaces in which they are installed without leaks or gaps.

1. Where necessary, install heat resistant non-rubber gasket to prevent light leak or moisture from entering between luminaire trim and mounting surface.

B. For luminaires indicated for open, damp or wet locations:

1. Provide luminaires listed and labeled by UL as suitable for exposed, damp or wet locations.
2. Provide luminaires that will perform efficiently at temperatures below 32 degrees F.

C. Provide luminaires with a NEMA distribution pattern as indicated in the luminaire schedule.

D. Include special features, finishes, accessories and other requirements as indicated regardless of the item's listed catalog number.

E. Provide luminaires fully assembled and electrically tested before shipment from factory.

2.6 LAMPS

A. Lamp each luminaire with the suitable lamp cataloged for the specific luminaire type, and as indicated by manufacturer.

2.7 LIGHTING POLES

A. Provide poles as indicated in the luminaire schedule.

B. Provide premium graffiti-resistant protectant coating over the entire length of each pole.

C. Provide poles rated for a minimum of 100 miles per hour, unless otherwise noted, wind EPA loading for quantity and type of luminaire the pole supports with a gust factor of 1.30.

B. Provide a handhole in the pole and removable handhole coverplate that matches the material and finish of the pole. Install cover with vandal resistant bolts. Locate handhole approximately 18 inches above the pole base.

D. Provide poles with an internal ground lug easily accessible from the handhole.

I. Provide external surfaces of the pole, base cover, support arms, and luminaires finished in the same material and color.

1. Provide poles chemically cleaned, rinsed, phosphatized, sealed and dried.
2. Apply an electrostatic application of polyester-power paint to all external surfaces.

3. Oven-bake complete unit to form a homogeneous, non-porous surface. Provide completed finish with no sags, drips, oxidation or runs.

K. Wrap poles in a protective material for shipment to the Project site.

2.8 MISCELLANEOUS

A. Ground Rod: _____

2.9 MANUFACTURER SERVICES

A. Manufacturers to provide installation and troubleshooting support via telephone.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Stake out the locations of trenches, lighting poles, conduits, and cabinet pad for review and acceptance by the Owner prior to excavation, trenching or conduit rough-in.

B. Install trenches according to requirements in Section 31 2000 “Earth Moving”.

C. Install products where shown and at indicated heights, according to manufacturers’ written instructions.

D. Install poles square, straight, plumb and to the indicated height.

1.

E. Provide a minimum 10 foot copper-clad steel ground rod at each pole base. Connect from ground rod to the ground lug in the pole with minimum AWG No. 8 copper conductor.

F. Install pole mounted luminaires plumb and level, and with reflector distribution in the direction indicated in the Drawings.

1. Grout around the pole base at the foundation to close all openings.
2. Install pole base cover over all exposed installation hardware.

G. Install luminaires such that manufacturer's labels or monograms are not visible after the luminaire is installed.

H. Leave luminaires clean at the time of acceptance of the work with every lamp in operation. If luminaires are deemed dirty by the Owner at completion of the work, clean them at no additional cost to the Owner.

3.2 WIRING

A. Field install wiring within pole mounted units of the same size and type as the circuit supply conductors, unless a fuse is specified or shown in the Drawings.

3.3 FIELD QUALITY CONTROL

A. Test that system provides design photometry and operating hours.

B. Guidance for pre- and post-installation field measurements (measurement and verification plan) can be found at:

http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/lighting_measurement_evaluation_protocol.pdf

3.4 ADJUSTING

A. Align luminaires that are not straight and plumb to finish grade. Recompact soil around direct bury poles.

3.5 CLEANING

A. Clean paint, splatters, dirt, dust, fingerprints and debris from luminaires.

B. Where finish of luminaires and poles has been damaged, touch up finish as directed by manufacturer's instructions.

3.6 CLOSEOUT ACTIVITIES

A.

3.7 MAINTENANCE

A.

END OF SECTION

SECTION 26 5610 – EXTERIOR LED LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior LED lighting systems.

B. Related Sections:

1. Section 26 0500: Common Work Results for Electrical
2. Section 26 2726: Wiring Devices and Plates

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only.

B. American National Standards Institute (ANSI)

1. C82.SSL1 – SSL Drivers (in ANSI development
2. C136.2-2004 - American National Standard for Roadway and Area Lighting Equipment – Luminaire Voltage Classification
3. C136.3-2005 – American National Standard for Roadway and Area Lighting Equipment – Luminaire Attachments
4. C136.10-2010 – American National Standard for Roadway Lighting Equipment – Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing
5. C136.15-2011 – American National Standard for Roadway and Area Lighting Equipment – Luminaire Field Identification
6. C136.22-2004 (R2009) – American National Standard for Roadway and Area Lighting Equipment – Internal Labeling of Luminaires
7. C136.25-2009 – American National Standard for Roadway and Area Lighting Equipment – Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures
8. C136.31-2010 – American National Standard for Roadway Lighting Equipment – Luminaire Vibration.
9. C136.37-2011 – American National Standard for Roadway and Area Lighting Equipment – Solid-State Light Sources Used in Roadway and Area LightiNG.

C. American Society for Testing and Materials International (ASTM)

1. B117-09 – Standard Practice for Operating Salt Spray (Fog) Apparatus
2. D1654-08 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
3. D523-08 (or latest) – Standard Test Method for Specular Gloss

4. G53 – 06 – Standard Practice for Operating Light and Water Exposure Apparatus (Fluorescent UV – Condensation Type) for Exposure of Nonmetallic Materials
5. G154 – 06 (or latest) – Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

D. Council of the European Union (EC)

1. RoHS Directive 2002/95/EC, on the restriction of the use of certain hazardous substances in electrical and electronic equipment

E. Federal Trade Commission (FTC)

1. Green Guides, 16 CFR Part 260, Guides for the Use of Environmental Marketing Claims

F. Illuminating Engineering Society of North America (IESNA)

1. DG-13-98 – Guide for the Selection of Photocontrols for Outdoor Lighting Applications
2. G-1-03 – Guidelines for Security Lighting
3. HB-10-11 – IES Lighting Handbook, 10thEdition
4. LM-79-08 – IESNA Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products
5. LM-80-08 – IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
6. RP-16-10 – ANSI/IES Nomenclature and Definitions for Illuminating Engineering
7. RP-33-99 – Recommended Practice for Lighting for Exterior Environments
8. TM-15-11 – Luminaire Classification System for Outdoor Luminaires
9. TM-21-11 – Projecting Long Term Lumen Maintenance of LED Light Sources

G. International Electrotechnical Commission (IEC)

1. IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code)

H. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C62.41.1-2002 – IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits
2. IEEE C62.41.2-2002 – IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000W and less) AC Power Circuits

I. National Electrical Manufacturers Association (NEMA)

1. ANSI/NEMA/ANSLG C78.377-2008 – American National Standard for the Chromaticity of Solid-State Lighting Products

2. National Fire Protection Association (NFPA)

    a. 70 – National Electrical Code (NEC)

J. Next Generation Lighting Industry Alliance/Department of Energy.

1. LED Luminaire Lifetime: Recommendations for Testing and Reporting – 1stEdition

K. Underwriters Laboratories (UL)

1. 1449 – Surge Protective Devices
2. 1449 – Luminaires
3. 1449 – Light-Emitting Diode (LED) Equipment for Use in Lighting Products

L. U.S. Department of Defense

1. MIL-HDBK 217F (Change 2) – Reliability Prediction of Electronic Equipment.

1.3 DEFINITIONS

A. Lighting terminology used in this Specification is defined in IES RP-16. See referenced documents for additional definitions.

1. Exception: The term “driver” is used to broadly cover both drivers and power supplies, where applicable.
2. Clarification: The term “LED light source(s)” is used in accordance with IES LM-80 to broadly cover LED package(s), module(s), and array(s).

1.4 PERFORMANCE REQUIREMENTS – LUMINAIRES

A. General Requirements:

1. Luminaire Type: Provide fixtures of the same type by one manufacturer.

    a. Provide luminaire type with light source, wattage and voltage as indicated in the Drawings and as specified.
    b. Specific manufacturer and model number references are indicated as a standard of performance and quality.
    c. Other manufacturers’ models may be supplied provided the product meets or exceeds the specifications.
    d. Alternate fixtures must achieve the same photometric levels and uniformity ratios.

2.

3. Housing Finish:Baked-on enamel, anodized, or powder-coated, unless otherwise indicated.
4. Luminaire Labels:

    a. External Label: ANSI C136.15.
    b Internal Label: ANSI C136.22.

6. The luminaire must be subjected to 100,000 cycles of 2 Gs at the resonant frequency of the luminaire (between 5 and 30 Hz) applied at the center of gravity of the luminaire on three primary axes per ANSI C136.31 without damage to the luminaire. The luminaire must be fully functional upon completing the test.
7. Luminaire must be UL-listed for wet locations and wiring cavity must be field accessible for service or repair needs.
8. Optical cavity must be a minimum IEC 60529/IP65.
9. Provide luminaires fully assembled and electrically tested before shipment from factory.
10. The coating must be capable of surviving ASTM B117 Salt Fog environment for 500 hr minimum without blistering or peeling. The coating must demonstrate gloss retention of greater than or equal to 90% for 500 hr exposure QUV test per ASTM G53 UVB313, 4 hr UV-B 60℃/4 hr condensation 50℃.
11. Luminaires must be rated for -20℃ to +40℃ operation.
12. Luminaires must have locality-appropriate governing mark and certification.
13. Provide luminaire color as selected by the Owner.
14. If a lens not integral to the LED is used, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant polycarbonate, acrylic, or glass.
15. 80% of the luminaire material by weight should be recyclable at end of life. Design luminaire for ease of component replacement and end-of-life disassembly.

B. Drivers must meet the following requirements:

1. Must have a minimum efficiency of 95%.
2. Rated case temperature suitable for operation in the luminaire operating in the ambient temperatures.
3. Input Voltage: Capable of 120 to 277 (±10%) volt, single phase as required by the Owner.
4. Power supplies can be UL Class I or II output.
5. Operating frequency must be 50/60 Hz.
6. Drivers must have a power factor of = 0.90.
7. Drivers must be Reduction of Hazardous Substances (RoHS) compliant (see http://www.rohs.eu/english/index.html).
8. Minimum time between failures (MTBF = total hours of testing / number of failures) shall be greater than 300,000 hours at full load and 25℃ ambient, in accordance with MIL-HDBK-217.

9. Lifetime = 50,000 hours at full load and 25°C ambient.

C. Electromagnetic Interference:

1. Shall have a maximum total harmonic distortion (THD) of: = 20% at full input power and across specified voltage range.
2. Shall comply with FCC 47 CFR part 15 non-consumer radio frequency interference/electromagnetic interference standards.

D. Electrical Safety Testing:

1. Luminaire shall be listed for wet locations by an OSHA NRTL.
2. Luminaires shall have locality-appropriate governing mark and certification.

E. Electrical System Requirements:

1. Primary fuse protection: Provide double fusing with fuse holder appropriately sized to the current.
2. Under voltage protection via shutoff and short circuit protection via current limitation.
3. Internal luminaire design must incorporate modular electrical connections.
4. All luminaires shall meet the “Basic” requirements in Appendix D. Site can choose “elevated” requirements.

F. Other Tests:

1. At time of order, Owner can request additional tests for extreme environmental condition (e.g., sea salt near water, extreme cold weather operation) if site is located in adverse locations.

1.5 PERFORMANCE REQUIREMENTS – CONTROLS

A. Daylighting Controls:

1. Control all luminaires with a photocell, time switch, or intelligent control system that allows automatic on and off based on daylighting plus timed off after expected activity ends.

   a. Photosensor is used to energize all luminaires at dusk, and to switch off any security lighting left on overnight by time switch.

2. Furnish switches or relays in NEMA I general-purpose enclosure unless indicated otherwise.

   a. Switches located on the exterior or in “wet” locations must have NEMA 3R, 4, or 4X enclosures as indicated, or required.

3. The photocell system must have the following characteristics:

a. 15 to 30 second built-in time delay to prevent response to momentary lightning flashes, car headlights or cloud movements.
b. Settings to energize the lighting system when the north sky light decreases to approximately XX footcandles, and maintains the system energized until the north sky light increases to approximately XX footcandles. Note: XX values to be supplied by Site Owner. Actual value will depend on the lighting zone/required illuminance as specified in section 1.6. A TURN-ON/TURN-OFF ratio = 5:1 (the lights either turn on or off when the photocell measures 5x the required illuminance) should be used.
c. Mounted in an unobscured location for measuring the available north sky daylight with a separate control/calibration module mounted separately and in an accessible location and shield the sensor from direct sunlight.
d. Use relays that are UL 773 or UL 773A listed and designed to fail in the on position.

4. The time switch(s) must control specific circuit “off” functions during dark hours and be:

   a. Digital microprocessor-based with battery backup capable of retaining programmed settings for at least 10 hours.
   b. 7-day, 24-hour astronomic capable.

5. Intelligent control systems must have the following characteristics:

   a. Power-line carrier (PLC) systems or wireless.
   b. Allow for two-way communication with the luminaire.
   c. Allow for scheduling for both time of day and astronomical events.
   d. Be remotely accessible.

B. Optional Controls:

1. Optional controls installed in addition to the primary control system may include but are not limited to:

   a. After hours dimming control – dims light levels to X% [Site Owner must specify between 10% – 50% of full lumen output] after expected parking lot activity ends (a.k.a. “curfew” control).
   b. After hours switching control – turns off or reduces light levels after expected parking lot activity ends (a.k.a. “curfew” control).

      1) Specific areas turned off after expected parking lot activity ends.
      2) Overall reduction of light level after expected parking lot activity ends.

c. Lumen maintenance – Luminaires are initially dimmed to 70% of full output, with input power then gradually (and automatically) increased over time to compensate for LLD.

d. Occupancy Sensor Controls:

1) Install and aim sensors in locations to achieve coverage of areas indicated. Coverage patterns shall be derated as recommended by manufacturer based on mounting height of sensor and tree locations. Do not simply use gross rated coverage in manufacturer's product literature.
2) Occupancy/vacancy sensors shall comply with NEMA Standard WD 7-2000, which provides for testing requirements on the issues of performance sensitivity.
3) Infrared: Integral to the luminaire. Detect occupancy by changed in infrared energy within a coverage area and must be capable of operating between -20℃ to +40℃ and be wet-location rated.
4) Sensors shall be located or shielded or controlled by software to adjust sensitivity based on ambient temperature or air temperature variations.
5) Sensor must incorporate a failsafe feature such that lamps fail "on" in the event of sensor failure.
6) If sensors are to be installed integral to the luminaire, installation must be performed by luminaire manufacturer.

e. End-of-Life:

1) Provide end-of-life mechanism into the luminaire. When the LED die output has reached end of useful life, the luminaire should enter a visible "failure mode" (e.g., intermittent flashing or flickering).

1.6 SUBMITTALS

A. Shop Drawings.

B. Performance Reports: Submit the following for approval when required by the Site Owner.

1. Computer-generated photometric analysis of proposed DAY 1 (defined as the initial illuminance values) of the lighting installation. Submittal should include the following requirements:

a. Provide vertical illuminance calculations.
b. Computer calculation must use the following applicable light-loss factor (LLF) values: 1.0 lamp lumen depreciation (LLD), and 1.0 luminaire dirt depreciation (LDD).
c. Mesopic multipliers as listed in this Article.

2. Computer-generated photometric analysis of end-of-useful-life date of the lighting installation. Submittal should include the following requirements:

    a. Provide vertical illuminance calculations.
    b. Computer calculation must use the LLF values specified in section 1.07.A.3.
    c. Mesopic multipliers as listed in this Article.

3. Light Loss Factors:

    a. LLD: 0.85. An alternate value may be used based on the use of the site defined performance method if allowed by Site Owner. See luminaire performance requirements for calculation.
    b. LDD: Use http://www.epa.gov/airtrends/pm.html#pmloc to determine the particulate matter (PM) for the site and determine the applicable LLD for the site based on the PM according to RP-20.

4. Use of HB-10 mesopic multipliers:

    a. Use a scotopic/photopic (S/P) ratio of 1.00 for all luminaire. If owner allows, use nominal S/P ratio and bilinear interpolation. Mesopic multiplier(s) used shall be clearly indicated in the calculations.

C. Luminaire photometric reports according to IES LM-79-08, including laboratory name, report number, date, luminaire catalog number, and luminaire/light source specifications. Report must contain luminous intensity, zonal lumen summary, and an iso-footcandle diagram according to LM-31 as well as documentation that specified standards and test methods were followed.

D. Provide documentation of the expected useful life as defined in luminaire performance requirements, including the testing and calculation of useful life and verification of site lighting performance at that life.

    1. If the site-defined performance method is used, document the use of LM-80 test data, the specific extrapolation procedure used, the interpolation between the three sets of LM-80 data, and all calculations applied in deriving the proposed LLD and useful life.

E. Summary of Joint Electron Devices Engineering Council (JEDEC) or Japan Electronics and Information Technology Industries (JEITA) reliability testing performed for LED packages.

F. Summary of reliability testing performed for LED drivers.

G. Written product warranty..

H. Provide safety certification and file number as required for the luminaire family that must be listed, labeled, or identified per the National Electric Code (NEC). Applicable testing bodies are determined by the U.S. Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratory).

I. Closeout Submittals:

1. Operations and Maintenance Data.

1.7 QUALITY ASSURANCE

A. Sample Luminaires for Verification:

1. Site Owner may request standard production model luminaire samples, including LED package, identical to product proposed to be installed for inspection.
2. Owner may request independent testing of sample luminaires to verify luminaire performance and compliance with the specifications.

a. Conduct testing in accordance with the applicable IES and ANSI-approved methods for products using solid-state lighting (SSL) sources.
b. Test laboratories must be either National Voluntary Laboratory Accreditation Program accredited for SSL testing as part of the Energy-Efficient Lighting Products Laboratory Accreditation Program or one of the qualified labs listed on the DOE SSL website.

B. Field Measurements for Verification:

1. If luminaires are believed to be underperforming in early life, the Owner may choose to take field measurements between 2,000 and 3,000 operating hours of the completion of installation to confirm that lighting levels are in accordance with the site-specific photometric requirements specified.
2. If uniformity is more than 15 percent worse or average light levels are more than 15 percent below the DAY 1 submittal, and the luminaire locations in the field are as designed, the luminaire manufacturer must provide additional luminaires to achieve the specified light levels and uniformity.
3. Variance from specified tolerances may be allowed by prior Owner approval.

C. Guidance for pre- and post-installation field measurements (measurement and verification plan) can be found at:

http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/lighting_measurement_evaluation_protocol.pdf.

1.8 PROJECT REQUIRMENTS

A. Provide specified lighting units with a luminaire of the type designated and appropriate for the location.

1. Where outlet symbols in the Drawings do not designate a type of a luminaire, provide the same as those used in similar or like locations.
2. Where a luminaire type designation has been omitted and cannot be determined by inspection, request a clarification from the Owner and provide a suitable luminaire type as directed.

B. Coordinate installation of luminaires with other trades to provide a total system that is neat and orderly in apperarance.

C. Install all remote drivers in enclosures as required by luminaire specified.

1. Locate remote mounted drivers within the distance limitations specified by the driver manufacturer.

1.9 WARRANTY

A. Provide the following Standard Warranties:

1. Provide a written 5 year on-site replacement material, fixture finish, and workmanship.

a. On-site replacement includes transportation, removal, and installation of new products.
b. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

2. Provide a written 5 year replacement material warranty for defective or non-starting LED source assemblies.
3. Provide a written 5 year replacement material warranty on all power supply units (PSU)
4. Provide a written 5 year replacement warranty for luminaires producing inadequately maintained illuminance levels at end of warranty period, as prorated from levels expected at end of useful life.

B. Optional Extended Warranty:

1. Owner may request an optional 10 year replacement warranty for inadequately maintained illuminance levels, finish of luminaire, PSU, or defective LED source assemblies.

2. The terms of the extended warranty will be negotiated by the Owner and the luminaire manufacturer for an additional cost.

C. Warranty periods will begin on date of possession.

PART 2 - PRODUCTS

2.1 PRODUCT MANUFACTURERS

A. Subject to compliance with product performance and operation requirements, any manufacturer may offer products that may be incorporated into the Work of this Section, with approval.

1. Other mutually exclusive product options offered by qualified manufacturers such as housing color or lamp type are to be determined by the Owner prior to selection and installation of the product.

B. Product Approval: Manufacturers may submit products for approval as specified in PART 1 Article for “Submittals.”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Disconnect all power sources prior to installation.

B. Comply with manufacturers’ recommended installation procedures.

3.2 TESTING AND COMMISSIONING

A. Set appropriate time delay.

B. Adjust sensitivity setting as necessary.

3.3 MANUFACTURER SERVICES

A. Manufacturers to provide installation and troubleshooting support via telephone.

END OF SECTION

SECTION 27 0500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install complete raceway system and backboards for telephone/data equipment and devices as noted on the Drawings.

B. Comply with TIA/EIA Standards 568-B, 569 and 607, latest edition.

1.2 REFERENCES

A. ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Wiring Standard.

B. ANSI/TIA/EIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

C. ANSI/TIA/EIA-606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings.

D. ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.

E. BICSI, Telecommunications Distribution Methods Manual, latest edition.

1.3 SUBMITTAL

A. Product Data.

B. Shop Drawings.

C. Installation and record drawings.

PART 2 - PRODUCTS

2.1 COMPONENTS AND MATERIALS

A. Wall Outlet Boxes: 4-inch square, 2 5/8-inch deep, minimum, with single-gang mud ring unless otherwise noted on the Drawings.

B. Conduits: 1-inch minimum size with larger sizes indicated on the Drawings. Provide PVC Schedule 40 with steel sweep ells for direct-buried conduit runs.

C. Backboards: 3/4-inch 8-foot high, fire rated fir plywood, width as shown on the Drawing.

D. Grounding busbar: 2-inch by 10-inch by 1/4-inch solid copper. Wall mount with insulated standoffs per TIA/EIA-607.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conduit bends shall be large radius field bends or factory ells. Cast type fittings or sharp bends shall not be installed unless specifically approved by the systems installer. No section of conduit shall be longer than 100 feet or contain more than 180 degrees of bend between pull points or pull boxes.

B. Where conduits are shown stubbed into a terminal area, stub 6 inches above floor or 12 inches down from ceiling at the appropriate terminal board location, terminating in insulating bushings.

C. Provide a pull wire in all conduits longer than 15 feet or with more than 90 degrees of bend.

D. Paint front and ends of all terminal boards with two coats of enamel to match interior color specified by the Architect.

E. Coordinate with system supplier for phasing and work scheduling.

F. The inside radius of a bend in conduit shall be at least 6 times the internal diameter. When the conduit size is greater than 2 inches, the inside radius shall be at least 10 times the internal diameter of the conduit.

G. Provide all low voltage conduit stub-outs with insulated bushings.

H. Unless otherwise noted on the drawings, provide #6CU ground minimum per telephone utility requirements.

END OF SECTION

SECTION 27 0513 - COMMUNICATION SERVICES

PART 1 - GENERAL REQUIREMENT

1.1 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 SECTION INCLUDES

A. Basic Communication Requirements

B. Contract Documents

C. Quality Assurance

D. Manufacturer's Warranty

E. Reference Standards

F. Laws and Regulations

G. Submittals

1.3 RELATED SECTIONS

A. Section 01 33 00, Submittals

B. Section 27 05 00, Common Work Results for Communications

C. Section 27 05 26, Grounding and Bonding for Communications Systems

D. Section 27 05 28, Pathways for Communication

E. Section 27 05 53, Identification for Communication Systems

F. Section 27 06 00, Commissioning of Communications

G. Section 27 11 16, Communications Cabinets, Racks, Frames and Enclosures

H. Section 27 11 23, Communications Cable Management and Ladder Rack

I. Section 27 13 13, Communications Copper Backbone Cabling

J. Section 27 15 13, Communications Copper Horizontal Cabling

K. Section 27 15 23, Communications Optical Fiber Horizontal Cabling

L. Section 27 15 43, Communications Faceplates and Connectors

1.4 BASIC COMMUNICATION REQUIREMENTS

A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and materials shall carry Underwriters Laboratory certification if required by local, state or national codes.

B. The Contractor shall field-investigate this facility to ascertain the exact physical and electrical conditions in the main Equipment Room (MDF, room 216) and Telecommunications Rooms (IDF, rooms 353 and 331 in particular) to become familiar with the physical environment of the building.

C. The Contractor shall provide, install, and test the entire cable infrastructure as described under this contract. The Contractor shall call attention to the Owner's Representative any error, conflict, or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until a resolution or clarification has been made. Supplemental Plans and Specifications may be supplied as required and shall become part of the Contract Documents.

D. The Contractor shall coordinate installation with other crafts employed on this project.

E. Attend weekly construction coordination meetings as required by the Owner or General Contractor.

1.5 CONTRACT DOCUMENTS

A. The contract documents, such as drawings, schedules and specifications are used to describe the required work.

B. The work to be performed under the contract documents includes furnishing all labor, materials, equipment and services necessary, whether listed in the specifications or not, to construct and install the complete communications infrastructure as shown on contract drawings and specifications.

C. The drawings and schedules depict, in general, application-dependent data while the narrative/specifications, in general, define broader requirements, such as overall quality.

D. The General Contractor will provide the low voltage Contractor with a schedule and timeline.

E. The Contractor shall follow all specifications herein. In case of conflict between drawings and specifications, the latter shall prevail unless authorized in writing by the Owner or Owner's Representative.

F. Supplementary Details and Plans may be supplied as required. They shall be issued as addendum and shall become a part of the Contract Documents.

1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner's Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), and Building Industry Consulting Service International (BICSI) recommended installation practices and manufacturer's guidelines when installing communications components.

1.7 MANUFACTURER'S WARRANTY

A. Contractor must be certified as a Panduit installation contractor and must be able to provide a manufacturer's warranty certificate.

B. A minimum of three references demonstrating Contractor's past installation experience in Certified Category 6 systems in similar facilities with a minimum of 500 nodes shall be submitted. The Contractor must be able to supply a warranty certification at completion of the job.

C. As an attachment to Bid, Contractor shall provide a list of all technicians who may be involved in this project. Include the following information:

1. Technicians name
2. Technicians Oregon State Journeyman License number (if apprentice, indicate which term)
3. Date of hire by Contractor

D. At least 50% of the technicians must have successfully completed the manufacturer's warranty certification class. A certified technician must be on site at times to supervise work covered by manufacturer's warranty.

E. All Equipment/Telecommunication Room and Telecommunications Outlet equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of the manufacturer's training course, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.

F. Verification of the above requirements must be submitted in writing with bid.

1.8 REFERENCE STANDARDS

A. This section references the latest revisions of the following documents and all associated addenda. In case of conflict between the requirements of this section and those of the listed documents, the more stringent shall prevail.

Reference	Title
ANSI/IEEE 802.3	CSMA/CD Access Method and Physical Layer Specifications
ANSI/IEEE 802.3i-x	Physical Layer Specifications for 10/100/1000Mbps Transmission over Twisted Pair Cable
ANSI/TIA/EIA-568-B/C	Commercial Building Telecommunications Wiring Standard
ANSI/TIA/EIA-569-B	Commercial Building Standard for Telecommunications Pathways and Spaces
EIA RS-310-C	Racks, Panels, and Associated Equipment
UL 94	Tests for Flammability of Plastic Materials and Parts in Devices and Appliances
ANSI/ICEA S-80-576-1988	Communications Wire and Cable for Wiring of Premises
ANSI-J-STD-607	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
UL1863	Standard for Communication Circuit Accessories (Wire and Jacks)

1.9 LAWS AND REGULATIONS

A. This section references the latest revisions of the following documents. In case of conflict between the requirements of this section and those listed documents, the requirements of the listed documents shall prevail.

Reference	Title
NFPA-70	National Electric Code (NEC)
Oregon State Electrical Code plus local County and City Amendments	
IBC	International Building Code
UL	Underwriters Laboratories Inc.

1.10 SUBMITTALS

A. General

1. Owner or Owner's Representative must approve all submittals before the start of fabrication (or shipment, for stock items) of any equipment requiring submittals.

B. Drawings

1. The Contractor shall submit shop drawings for any modification or new product installation not previously identified in bid documents. This includes any changes in cable pathway or route.
2. The Contractor shall proceed with the installation only after approval from the Owner or Owner's Representative.

C. Materials List

1. The Contractor shall submit a list of all materials.
2. The submittals shall include all factory test information, technical data sheet, and catalog information showing dimension, colors and configuration (if applicable).

D. Test Plans

1. The Contractor shall submit a plan for testing the installed cable infrastructure.
2. The test plan shall include test equipment to be used, procedure and report structure.

E. Certificates

1. Electrical Permit

a. The Contractor shall provide a copy of the Low Voltage Electrical Permit to the General Contractor before commencing work where such is required for the product set being installed.
b. The Contractor shall provide copy of approved Low Voltage Electrical Permit to the General Contractor and the Owner's Representative certifying that the work has been inspected and that the work conforms to the minimum requirements of the applicable Electrical and Fire Codes.

F. PRODUCT WARRANTY

1. Documentation of manufacturer's warranty must be provided to the Owner within 60 days after completion of the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.

B. Quantities are to be determined by Contractor unless specified.

C. Products shall be UL® listed for the purpose they are to be used.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturer's installation instructions and requirements shall be strictly adhered to in the telecommunications equipment installation, fabrication and testing process.

B. Where conflicts arise between the requirements of this Specification and the manufacturer's installation instructions, the Authorized Representative shall be consulted for resolution.

C. All twisted pair wiring systems shall be installed according to manufacturers' installation guidelines and according to related standards for such implementation as may be listed within TIA/EIA-568B.

D. All installed cables shall be kept free from nicking, abrading, or cutting during storage and during the installation process.

E. Cable shall be installed into conduits after conduit installation is complete and appropriate bushings or couplers have been installed. Manufacturers'

recommendations for maximum pulling tensions and minimum bend radii for all cables must not be exceeded.

F. If pulling compound is used use only UL-listed compound, compatible with the cable outer jacket and with the raceway involved. Bushings must be fitted on all conduits prior to cable installation.

G. Care shall be exercised in wiring to avoid damage to wiring and equipment.

H. Connections shall be made with approved mechanical connectors.

I. All wiring and connectors shall be installed in strict adherence to standard communications installation practices and to federal, state or local applicable codes.

J. Equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads.

K. Open areas requiring suspension for cables will employ J-hooks, or similar open devices to accommodate future addition of cable.

L. Cable ties will be used in concealed areas only as mandated by code or TIA/EIA-568B. Cable ties shall bear the same rating as the cable when installed in plenum areas.

M. Cable running in exposed areas will be bundled using Velcro® or similar hook and loop material. Such material will be used exclusively in the telecommunications rooms.

N. The installation must conform to OSHA standards and comply with state and local safety codes.

O. Applicable fire codes will be strictly adhered to plenum ratings for cable and associated cable ties. Fire stopping will be the responsibility of this contract in areas

P. Installation shall be neat, well organized, and professional.

Q. Installation shall be conducted as to maintain consistency between color-coding, labeling and documentation.

R. Splicing of any unshielded twisted pair or fiber optic is not acceptable, unless directed to by specifications, addendum, drawings or other written communication with owner or authorized representative.

S. Any discrepancies, conflicts or issues must be brought to the attention of the Owner or the Owner's Representative before installation or as soon as possible thereafter.

T. The Contractor shall clean up the work area at the end of each day. At the end of the project all material removed or left over, and/or not being used shall be

removed from the project site unless other arrangements have been made. A final clean up shall be made before final payment is made.

U. All wall and floor penetrations shall be fire stopped at or before substantial completion.

3.2 PREPARATION

A. Before installation of cabling and/or equipment in the MDF or an IDF, the Contractor shall field-investigate the facility and ascertain if the physical and electrical conditions within the facility shall permit commencement of the Contractor's work.

B. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of the Owner's Representative.

3.3 DOCUMENTATION

A. General

1. All hard copy documentation must be neat and legible.

B. Test Reports

1. The Contractor shall compile test results into the forms that contain all applicable test data. Hard copy output indicating successful testing of every location is not required; rather a CD with the test results and a Windows based viewer is preferred.

C. As-Builts

1. General

a. Prior to acceptance of system the Contractor shall provide the Owner with reproducible plans and other documentation showing system layout and connections.
b. Complete information concerning the routing of all cable shall also be provided in an electronic "as-built". Electronic copies of the prints shall be provided to the Contractor by the Owner's Representative following award of Contract.
c. The Contractor will then enter the information as a separate layer on the electronic copies.
d. Documentation must be presented in such a manner that the Owner can, without physically auditing units or cable runs, be able to determine the configuration of the telecommunications cabling infrastructure.
e. An electronic copy must be created that can be read using AutoCAD 2010.

2. Telecommunication Outlets

a. All locations shall be annotated with information that duplicates the labeling on the faceplate.

END OF SECTION

SECTION 27 0528 - PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 apply to this Section.

1. Related Contract Specification Sections

a. Section 27 05 43, Underground Ducts and Raceways for Communications Systems

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Ladder cable trays.
9. Wire-basket cable trays.

1.3 DEFINITIONS

A. See Section 27 05 00, Common Work Results for Communications

1.4 SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to the side of cable trays.
4. Vertical elevation of cable trays above the floor or below the bottom of ceiling structure.

B. Comply with submittal requirements in Section 27 05 00, Common Work Results for Communications.

C. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

D. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

E. Samples: For wireways nonmetallic wireways and surface pathways and for each color and texture specified, 12 inches long.

F. Seismic Qualification Certificates: For cable trays, accessories, and components, from the manufacturer.

1. The basis for Certification: Indicate whether withstand certification is based on an actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. A detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Products: Subject to compliance with requirements, provide one of the following

1. AFC Cable Systems, Inc
2. Allied Tube & Conduit; a part of Atkore International
3. Alpha Wire
4. Southwire Company
5. Thomas & Betts Corporation
6. Western Tube and Conduit

B. General Requirements for Metal Conduits and Fittings

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel or die cast.

b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Continuous HDPE: Comply with UL 651B.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvent cement and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Description: Comply with UL 2024; flexible-type pathway, approved for plenum or riser installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. General Requirements for Nonmetallic Wireways and Auxiliary Gutters

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for the complete system.

D. Solvent cement and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Minimum size of 1”

C. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect or prime coated, ready for field painting.

D. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL-5A and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. The product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

2.7 BOXES AND ENCLOSURES

A. General Requirements for Boxes, Enclosures, and Cabinets

1. Comply with TIA-569-B.

2. Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with a gasketed cover.

D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasket cover.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R depending on usage, with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2.8 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from a single manufacturer.

2.9 LADDER CABLE TRAYS

A. USE: Ladder Trays shall be utilized inside telecommunications rooms and other vertical spaces as shown on the contract drawings.

B. Description

1. Configuration: 12-inch wide UL Classified Universal Cable Runway, manufactured from 3/8-inch wide by 1-1/2-inch high tubular steel with 0.065-inch wall thickness.
2. Include Junction Splice Kit, Butt Splice Kit, and additional materials to comply with configuration shown on Drawings.
3. Rung Spacing: 9 inches o.c.
4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
5. No portion of the rungs shall protrude below the bottom plane of side rails.

6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
7. Minimum Usable Load Depth: 4 inches.
8. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
9. Width: 12 inches unless otherwise indicated on Drawings.
10. Fitting Minimum Radius: 24 inches.
11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.10 WIRE-BASKET CABLE TRAYS

A. Description

1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
4. Sizes:

    a. Straight sections shall be furnished in standard 118-inch lengths.
    b. Wire-Basket Depth: 4-inch (100-mm) usable loading depth by 8 inches, 12 inches, 18 inches, or 24 inches, wide.

5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
7. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.

2.11 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated.

1. Exposed Conduit: GRC or RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following

    a. Loading Dock
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical Rooms
    d. Gymnasiums

3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct
4. Damp or Wet Locations: GRC
5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway and EMT.
6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway, and EMT.
7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: Riser-type, optical-fiber-cable pathway Riser-type, communications-cable pathway or EMT .
8. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 1-inch trade size

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings. Seek prior approval from Architect or PSU before installing surface pathways.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. All communications pathways are to be independently supported. Suspending pathways from piping, HVAC ductwork, ceiling grids, etc. is not acceptable.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which they are attached.

I. Pathways Embedded in Slabs

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12-inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Surface Pathways

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings or where prior approval has been obtained from Architect or PSU.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48-inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 degrees F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 degrees F and that has straight-run length that exceeds 100 feet.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes at 18-inches above finished floor, measured to center of box, unless indicated otherwise. Where installed in an existing building, match the height of existing electrical outlets.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with the finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with the finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of the exterior floor and wall assemblies.

B. Sleeve and sleeve seals shall comply with the wall rating of the wall requiring penetration.

3.4 FIRESTOPPING

A. Comply with requirements in Section 27 05 00, Common Work Results for Communications.

B. Install re-enterable firestop sleeves at all fire-rated wall penetrations.

1. STI EZ-Path Series 44+, or approved equivalent.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touch-up coating recommended by the manufacturer.

3.6 CABLE TRAY INSTALLATION

A. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

B. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

C. Remove burrs and sharp edges from cable trays.

D. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

E. Fasten cable tray supports to building structure.

F. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb.

G. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

H. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

I. Do not install more than one cable tray splice between supports.

J. Support wire-basket cable trays with center support hangers, or trapeze hangers.

K. Support center support hangers and trapeze hangers for wire-basket trays with 3/8-inchdiameter rods.

L. Make changes in direction and elevation using manufacturer's recommended fittings.

M. Make cable tray connections using manufacturer's recommended fittings.

N. Install cable trays with enough workspace to permit access for installing cables.

O. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

3.7 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with control conductors shall
be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.8 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on vertical runs to cable trays every 18 inches.

C. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

D. In existing construction, remove inactive or dead cables from cable trays.

3.9 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

C. Bond all systems according to the requirements set forth in Section 27 05 33, Raceway, Boxes, and Conduits for Electrical Systems.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.11 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

SECTION 27 0553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.3 SCOPE

A. This section includes all telecommunications cables

1.4 QUALITY ASSURANCE

A. All cable identification tags shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.1 LABEL TAGS

A. The labels shall be machine generated.

B. The label background shall be white with black ink.

C. Lettering on sleeves shall be 1/8-inch high

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable - All horizontal/station cables will be labeled 4” from the termination at each end. The labels will conform to TIA/EIA -606A standard.

END OF SECTION

SECTION 27 1000 – STRUCTURED CABLING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the requirements for specific Information and Communication Technology (ITC) Standards Structured Cabling projects, all projects require coordination with the authorized Nisqually Indian Tribe Technology Services representatives.

B. The materials, products and installation requirements set forth in this document are the contract requirements to provide the Nisqually Indian Tribe turnkey structured cabling system.

C. Provide system components, including all hardware and software for complete, working data network communications system.

D. Coordinate all specific building construction, pathway, supporting trades in addition to any provided network-connected device installation requirements, software configurations, etc. and other building systems with Technology Services and the Office of Management and Finance representatives. Additional costs incurred from incomplete, insufficient, or incorrect coordination are the responsibility of the Contractor.

1.02 RELATED SECTIONS

A. DIVISION 01

B. Division 25 – Integrated Automation

C. Division 26 - Electrical

D. Division 28 - Electronic Safety and Security

1.03 REFERENCES:

A. Perform work in accordance with applicable requirements of governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Wiring Standard.
2. ANSI/TIA/EIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.
3. ANSI/TIA/EIA-606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings.
4. ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. BICSI, Telecommunications Distribution Methods Manual, latest edition.
6. BICSI / INFOCOMM Design Reference Manual, Latest edition
7. FCC Federal Communications Commission
8. State of Oregon and City of Portland local codes and requirements
9. UL Underwriters Laboratories
10. ASTM American Society for Testing Materials

11. NEMA National Electrical Manufacturers Association
12. ANSI American National Standards Institute
13. ETL Electrical Testing Laboratories
14. SMPTE Society of Motion Picture and Television Engineers
15. EIA Electronic Industries Association
16. ISO International Standards Organization

1.04 CONTRACTOR LICENSING REQUIREMENTS

A. Contractors shall obtain, possess, and maintain at all times all required local, state, and federal licenses, insurances, and permits necessary for the lawful execution of the work. Contractor is responsible for all permit fees, and all permit fees are to be included in the contractor's bid.

B. A BICSI Certified RCDD shall be on-staff throughout the project and manage the installation, testing, and customer training aspects of the work.

1.05 SUBMITTALS

A. Submit at one (1) time after contract award but before work commences, drawings and product data on all proposed equipment and system block diagrams. Check for compliance with Contract Documents and certify compliance with Contractor's "APPROVED" stamp.

B. All material submittals shall be made and submitted electronically.

C. Cover Sheet (including name of supplying contractor, project name, and project manager contact information)

D. Detailed Bill of Materials
   1. Include a detailed list of all products proposed for installation in the project. List shall include item quantities, short description and cost.

E. Detailed List of Materials
   1. Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical, and functional equipment specifications. The catalog sheet must also include an image of the product.

F. Prequalification Warrantee
   1. Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is Authorized to obtain for the owner the Special Warranty for Cabling System and the Special Warranty for System Assurance.

G. Prequalification Certificate
   1. Copy of the project managers and any installation technician(s) RCDD and training certificates.

H. Product Data
   1. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification

and drawing requirements.

2. Equipment Cut Sheets - Include a table of contents at the beginning of the product data submittal that identifies each submitted product to its associated specification Section and Paragraph number reference. Where no specification Section relates to a submitted product, provide drawing detail and sheet number reference and/or explanation as to how the product is to be implemented into the work of the project.
    a. Where multiple products are listed on a single cut-sheet, circle or highlight the product that Contractor proposes to use.

I. Provide a complete and thorough list of all equipment and configurations proposed for installation in the system.

J. Engineering Drawings
1. The Contract Drawings indicate the general layout of the various items of equipment. Coordination with other trades and with field conditions is required.
2. Include each interface distribution cabinet layout drawing, as they are to be installed.
3. Wiring diagrams including Telecommunications Grounding system (as required).

1.06 SYSTEM DESCRIPTION

A. Contractor is required to coordinate with the Bureau of Technology Services representative all the following requirements including, but not limited to:
1. Planned installed Cable Counts / per Telecommunications Room
2. Requirements for PoE (Power over Ethernet)
3. Static IP addressing requirements.
4. Additional Network-based systems integration requirements, for systems including, but not limited to:
    a. Access Control and other Electronic Security requirements
    b. Fire Alarm
    c. Building Management and Direct Digital Control systems
    d. Digital Signage
    e. Audiovisual signal routing.
    f. IP Intercom and Public address

B. This Section includes the requirements for the following system components. Other required components not listed herein must be verified with the projects' Bureau of Technology Standards representative.

1. UTP / STP cabling.
2. Optical fiber cabling.
3. Multi-pair copper cable
4. Coaxial cable (radio frequency video).
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cable management system.
8. Backboards.
9. Telecommunications equipment racks and cabinets.
10. Grounding / Bonding.

11. Horizontal Pathways.
12. Telecommunications mounting elements.
13. Multiuser telecommunications outlet assemblies.
14. Uninterruptable Power Supplies
15. Power Distribution Units

PART 2 - PRODUCTS

2.01 BID REQUIREMENTS

A. Contractor shall provide pricing for the installation of several Owner-Furnished items including:
   1. Wireless Access Points
   2. Network Switches (where applicable)
   3. Audiovisual Displays
   4. Video Surveillance camera

2.02 STRUCTURED CABLING SYSTEM COMPONENTS

A. All components unless otherwise specified herein shall be provided by the Contractor.

B. All components specified shall be provided as a complete system and where specific products are called out the contractor shall provide the specified product or in the case of discontinued models shall provide associated current model.

A. UTP Cabling
   1. Description: 100-ohm, 4-pair UTP, covered with a Blue thermoplastic jacket.
      a. Install cabling as shown on the contract drawings.
      b. Provide 2 cables to each device location shown.
      c. All cabling installed in City of Portland spaces shall be plenum rated, unless otherwise noted.
      d. Provide Category 6 cabling to all Work Area Outlets as shown on the contract drawings.
      e. Provide Category 6A cabling to all Wireless Access Point locations shown.
         a) Acceptable Manufacturers
            1) Commscope Systimax
            2) Panduit Pan-Net
            3) Or approved equal

B. F/UTP / STP Cabling
   1. Description: 100-ohm, 4-pair shielded cable, covered with a White thermoplastic jacket.
      a. Install cabling as directed by the contract drawings.
      b. All cabling installed in City of Portland spaces shall be plenum rated, unless otherwise noted.
      c. Cabling shields must remain continuous throughout the permanent link and bonded at the patch panel and WAO.
      d. Provide shielded connections at both ends.
      e. Provide Shielded Cat 6A for any F/UTP STP application specified.
         a) Acceptable Manufacturers

1) Commscope Gigaspeed X10D
2) Panduit TX6A
3) Or approved equal

C. Optical Fiber Cabling (Premise Backbone)
1. Strand counts must be verified by BTS Authorized representative.
2. All fiber installed must be terminated with LC connectors.
3. All Fiber cabling shall be terminated into rack or wall-mounted FODU, as shown on the con- tract drawings.
   a. Description: Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
   b. Comply with low-bend radius guidelines of between 5mm and 8mm
   c. Shall be Zero-Water peak type.
   d. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
   e. Minimum Modal Bandwidth: 200 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
   f. Jacket Color: Yellow for Single Mode Fiber (SMF)
   i. Acceptable Manufacturers
      a) Corning
      b) Or approved equal

D. Multi-Pair Copper Cabling
1. Pair counts must be verified by BTS Authorized representative.
2. Cable shall be rated for its installed environment.
   a. Description: 22AWG, U/UTP-unshielded, Plenum-CMP, Premise Backbone Cable, 24 AWG solid bare copper conductors, LS-PVC insulation, ripcord, LS-PVC jacket
      a) Acceptable Manufacturers
         1) Superior Essex
         2) General Cable
         3) Approved equal

E. Coaxial Cable
1. Any coaxial cable installed as part of the project must be verified by the projects' BTS Authorized representative.
   a. Description: Radio-Grade 6, 75-ohm quad-shield cable, plenum-rated, tested for a minimum of 6 Ghz transmission.
      a) Acceptable Manufacturers
         1) Belden 1695A
         2) General Cable
         3) Approved equal.

F. Connecting Hardware
1. UTP Data Patch Panels: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   a. All patch panels shall be loaded, flat, 24 or 48 port-type.

b. Patch Panels provided must match the performance criteria and warranty requirements of the connecting cabling system.
   a) Acceptable Manufacturers
      1) Commscope Systimax
      2) Panduit Pan-Net

2. F/UTP / STP System Patch Panels
   a. Specified on a per project basis.
   b. F/UTP Data Patch Panels: Shielded metallic modular panels housing multiple- numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   c. All patch panels shall be loaded, flat, 24 or 48 port-type.
   d. Patch Panels provided must match or exceed the performance criteria and warranty requirements of the connecting cabling system.

3. Work Area Outlets
   a. Faceplates
      a) Faceplates shall match the materials and look of those specified by Division 26.
      b) Faceplates shall be provided with flat surfaces and without labeling window.
      c) Faceplates shall accept WAO jacks as specified below.
      d) Provide 2-port plates for all wall-mounted data outlets.

   b. MPTL (Modular Plug Terminated Link)
      a) Where directed provide MPTL connectors for all Point-to-Point AV, Wireless Access Point and Surveillance Camera installations.
      b) Plugs provided shall fit securely into the device and not impede installation configuration.

   c. Surface Mount Boxes for Wireless Access Points
      a) Provide Surface Mount boxes at all ceiling mounted Wireless Access Point
         1) Provide 2) Category 6A jacks inside each box and provide 1) Category 6A patch cable for connection to installed Access Point.

   d. Work Area Outlet Jacks and Jack Assemblies
      a) Match or exceed the performance requirements of the installed cable system.
      b) Meet cabling system warranty requirements.
      c) Modular, color-coded, eight-position eight conductor modular receptacle units with integral IDC-type terminals.
      d) Comply with TIA/EIA-568-B.2, Category 6.
      e) Color coded as specified by BTS
         1) Acceptable Manufacturers
            (1) Commscope Systimax

(2) Panduit Pan-Net

e. Patch Cords:
   a) Copper: Factory-made, four-pair cable 3',6',10' in length (see locations below); terminated with eight-position modular plug at each end.
   b) Fiber: Factory-made, single-fiber cables in one (1) meter lengths. Provide one
      1) LC to LC duplex cable for each specified optical fiber strand installed as part of the project.
   a) Provide any Optical patch cables to the authorized BTS representative.

   c) Patch cords shall be provided with bend-relief-compliant boots and be marked with specified category performance.
   d) Patch cords shall not have latch guards.
      1) Telecommunications Room locations: Provide one (1) 3-foot, Cat6 patch cord to match cable and Jack Assembly category rating per port on the patch panel.
      2) Floor outlet locations: Provide one (1) 10-foot modular Cat6 patch cord to match cable and Jack assembly rating and types.
      3) Wall Outlet locations: Provide one (1) 6-foot modular Cat6 patch cord to match cable and Jack assembly rating and type.
      4) Wireless Access Points: Provide one (1) 15-foot modular Cat6A patch cord to match cable and Jack assembly rating and type.

G. CABLE MANAGEMENT SYSTEMS

1. Fiber Optic Distribution Units
   a. Provide Fiber Optic Distribution units where specified as part of the project.
   b. Units shall be provided with cassette-type modules for system connections.
   c. Provided with removable, translucent top cover.
   d. Fiber cables shall be installed such that the outer sheath of the cable is carried into the interconnect enclosure or patch panels before breaking out buffer tubes.
   e. Provide blanks for any unused slots within the unit.
      a) Acceptable Manufacturers
         1) Clearfield
         2) Corning
         3) Or approved equal.

2. Cable Management
   a. Ladder Racking/Cable Runway

a) Where specified, provide ladder racking inside telecommunications rooms to support cabling.
b) Rectangular steel tubing, 1-1/2”x3/8”x0.065”.
c) Cross members welded at 12” intervals.
1) Acceptable Manufacturers
(1) Chatsworth
(2) Or approved equal

b. Cable Runway Accessories:
a) As required, provide cable runway with the following accessories:
1) Cable runway radius drop (“waterfalls”)
2) Butt-splice kit
3) Junction splice kit
4) Channel Rack-to-runway mounting plate
5) Triangular support bracket
6) Wall angle support kit
7) End caps
8) Vertical wall bracket kit

c. Vertical Cable Management
a) Provide double-sided cable management as directed.
b) Managers shall match the height of the rack.
c) Provide tool-less installation and finger-guides for cabling.
1) Acceptable Manufacturers
(1) Chatsworth Velocity
(2) Or approved equal.

d. Horizontal Cable Management
a) Provide 1RU cable manager between each network switch and patch panel installed as part of the project.
b) Rigid cable manager with 1U spaced plastic T-shaped cable guides.
c) Rear door with easy-open latches and all black finish
1) Acceptable Manufacturers
(1) Chatsworth Evolution
(2) Or approved equal.

H. BACKBOARDS

1. Where specified, provide 4’ x 8’kiln-dried A/C grade plywood sheets as shown in the drawings.
2. Sheets shall be mounted with the A-side out and painted white or other highly-reflective color.
a. Mount sheets so they do not interfere with electrical or grounding components installed within the room.

I. TELECOMMUNICATIONS EQUIPMENT RACKS AND CABINETS.

1. Two-Post Racks

a. Where specified, provide 45RU, Universal, 19" EIA, floor-mounted racks for the installation of equipment.
b. Racks must be permanently affixed to the floor and bonded to adjacent racks and cable trays.
c. Racks shall be provided with marked and numbered rack-mount spaces.
    a) Approved Models
        1) Chatsworth 66353-703
        2) Or approved equal.

2. Four-Post Racks
    a. Where specified, provide 42RU, Universal, 19" EIA, floor-mounted racks for the installation of equipment.
    b. Racks shall be provided with removable side panels.
    c. Racks shall be provided with marked and numbered rack-mount spaces.
    d. Where shown, 4-post racks must be permanently affixed to the floor and bonded to adjacent racks.
        a) Approved Models
            1) APC AR3100
            2) Or approved equal.

3. Modular Wall Cabinets
    a. Where specified, provide wall mounted telecommunications cabinets where shown on the drawings.
    b. Appropriately sized for the cabling terminations and planned network equipment within, plus 30% growth.
    c. Shall have a minimum depth of 30"
    d. 19" Rack mount
    e. Racks shall be provided with the following hardware:
        a) Locks
        b) Fan and Air Filter Kit
        c) Removable top / bottom panels
        d) Polycarbonate or Tempered glass door
            1) Acceptable Manufacturers
                (1) Chatsworth
                (2) Panduit
                (3) Approved equal.

J. GROUNDING / BONDING.

1. New Construction Projects
    a. The contractor is responsible for providing a complete Telecommunications Grounding/Bonding system.
    b. System must be coordinated with the Electrical design and bonding conductors must be sized according to industry best practices.
    c. System design must be included in the submittal package detailed above.
        a) System design must detail main bonding locations and requirements.

2. Tenant Improvement Projects
   a. It is assumed that an existing Telecommunications Grounding system is present in the telecommunications rooms or spaces. It is the responsibility of the contractor to bond any new equipment to the existing system.

K. HORIZONTAL PATHWAYS.
1. Coordinated Design
   a. The contractor is required to coordinate all horizontal cabling pathways for the project with building construction, other trades, General Contractor and BTS authorized representatives. Failure to coordinate all required pathways which result in additional costs are the responsibility of the contractor.
2. Innerduct
   a. Where specified, provide plenum-gard 1 ¼ inch Orange or White in color with factory installed pull tape.

3. Fire Stop Cable Pass-Thru Sleeves
   a. Where required and specified, provide Fire Rated cable pathways.

      a) Horizontal cable pathway locations with fewer than 20 cables EMT sleeve with UL listed system for firestopping is acceptable.

      b) Caulks and sealants shall be manufactured by STI, 3M, Nelson, or approved equivalent.

      c) Fill ratio for fire stop EMT sleeves is based on a not to exceed 40% fill capacity.

L. UNINTERRUPTABLE POWER SUPPLIES
1. Where specified and coordinated with the authorized BTS representative provide a complete, factory-assembled, wired, and tested, on-line, double conversion UPS system including, but not limited to:
   a. Rectifier
   b. DC bus
   c. Inverter
   d. Battery charger
   e. Batteries
   f. Automatic bypass
   g. Ancillary components as specified in this Section and as indicated on the Drawings.

2. Small Systems
   a. System shall be 2000VA/1800W line interactive pure sine wave 2U rack/tower UPS.
   b. User-selectable low voltage setting of 100V-127V.
      a) Approved Product

1) APC SMX2000LVNC UPS

3. Large / MDF / Core Applications
   a. UPS System Input:
   b. Input Voltage:
      a) Less than or equal to 3 kVA UPS:
      b) 120VAC within 3%, single-phase, 2-wire plus ground (L1, N, G).
   c. Greater than 3 kVA UPS:
      a) 208VAC within 5%, single-phase, 3-wire plus ground (L1, L2, N,
   d. Inverter
      a) Less than or equal to 3kVA UPS:
         (1) Standard: 120VAC.
            (1) User selectable: 100VAC, 110VAC, 120VAC, 25VAC.
            (2) Online
      b) 2) Greater than 3kVA UPS:
            c) Standard: 208VAC.
            d) User selectable: 200VAC, 208VAC, 220VAC, 230VAC, 240VAC.
   e. Output connections:
      a) Receptacles:
         1) Less than or equal to 3kVA UPS:
            (1) Provide a minimum of four NEMA Type 5-15R or Type 5-20R receptacles.
            (2) Provide at least one NEMA Type L5-30R receptacle.
         2) Greater than 3kVA UPS:
            (1) Provide a minimum of four NEMA Type 5-20R receptacles.
            (2) Provide at least one NEMA Type L14-30R receptacle.

M. POWER DISTRIBUTION UNITS

1. Where specified and coordinated with Authorized BTS representative provide Power Distribution Units with the minimum requirements set here.
2. 20A (Projects without UPS)
   a. 8 C13 and 2 C19 200–240V outlets distribute AC power to connected equipment.
   b. Switches from primary to secondary power source in <7 ms for constant operation
   c. Digital ammeter for on-site real-time load monitoring to prevent power overloads.
   d. Includes network card and the latest version of remote management software.

a) Approved Units
   1) Tripp-Lite PDUMNH20HVAT1
   2) approved equal

PART 3 - EXECUTION

3.01 PROJECT COORDINATION

A. COORDINATION WITH THE CITY

1. The Contractor is responsible for the coordination of the items covered within this specification with a City of Portland, Bureau of Technology Standards authorized representative before beginning any work.
2. The contractor shall develop formal Requests for Information for any clarifications and requests and follow Project chain-of-command for communication.

B. PRE-INSTALLATION MEETING

1. All system configuration and components detailed within this specification are Contractor Furnished, Contractor Installed (CFCI). The Contractor is responsible for supply, installation, testing and end-user training of all components for fully configured systems.

3.02 OWNER-FURNISHED, CONTRACTOR-INSTALLED ITEMS

1. Where applicable, the contractor may be tasked with installation of Owner-Furnished items. Coordinate with the Projects' authorized representatives for any required items.
2. Owner Furnished, Contractor Installed items may include but are not limited to:
   a. Wireless Access Points
   b. Network Switches

B. SUBSTITUTIONS AND VALUE ENGINEERING

1. Submit bids based on the specified equipment. Submit proposals for alternates and substitutes with associated equipment costs, separate from the costs of the equipment as specified.
2. Proposals for alternate equipment will receive consideration if the differences between the specified and alternate/substituted equipment do not depart from the overall intent of the design and operation of the system and are in the best interests of the Owner.
3. Include in the proposals for alternate equipment, full technical information and cut sheets for the proposed equipment.
4. If the inclusion of substituted equipment results in a different connection configuration than that in the bid documents, produce drawings that illustrate how the proposed system would be connected.
5. System Enhancements: Submit recommendations which will enhance the performance of the system, or reduce costs without loss of performance, in the bid submission. Suggestions that are of value to the

City will be taken into consideration in the evaluation of the bid returns. Make such proposals as "alternates", with the appropriate cost modifications shown separately and apart from the costs of the system "as specified".

6. Immediately notify the Owner, General Contractor and Consultant in writing of any discrepancies.

C. COORDINATION WITH OTHER TRADES

1. Coordinate with the General Contractor the location of faceplates, conduits and the openings for any needed back boxes or support bracing needed.
2. Schedule: Coordinate with the General Contractor for project schedule and occupancy dates.
3. Before beginning work, verify the location, quantity, size, and access for the following:
   a. Technical ground AC power circuits provided for systems.
   b. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
   c. System support components installed by others.
   d. Overhead support and rigging hardware installed by others.
4. Immediately notify the General Contractor, OMF and BTS in writing of any discrepancies.

D. SYSTEM TERMINATION AND TESTING

1. All cables installed as part of the project must be terminated as specified in the contract documents.
2. An approved UTP network cabling test device cable of performing at a minimum the following:
   a. Wiremap
   b. NEXT
   c. Length
      1) Test results must be provided in electronic format with each cable listed with Pass or Fail result.
3. Optical cabling test results must be performed by an approved OTDR and provide at a minimum the following results:
      1) Cable Length
      2) Overall Attenuation
      3) Events
      4) Pass/Fail result
4. Testing documentation should be provided to the Integrated Security / BTS authorized representative.

E. SYSTEM LABELING

1. Contractor shall coordinate with BTS authorized representative for labeling standards and format.
2. All cabling and connectivity infrastructure shall be labeled with machine printed labels according to City specifications.
3. Mark all cables, regardless of length, with permanent, non-

handwritten number or letter cable markers.
a. There shall be no unmarked cables in the system.

F. PROJECT CLOSE-OUT AND DOCUMENTATION

1. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.
2. Test reports: Submit a minimum of 2 weeks prior to final punch walkthrough. Maintain test equipment on-site during punch for sample proof-of-performance tests.
3. Before the project closeout date, the Contractor shall submit:
   a. Warranty certificate.
   b. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
   c. Project record documents.
   d. As-built drawings with labeling scheme and cabling pathways
   e. Labeling and administration documentation.
   f. Optical system test results (as required)
   g. Copper cabling test results
4. Instruction manuals and software, including all software keys, passwords, and applicable software code and files.
5. Contractor shall submit written notice to the BTS Authorized Representative that:
   a. Contract Documents have been reviewed.
   b. Project has been inspected for compliance with contract.
   c. Work has been completed in accordance with the contract.

3.03 WARRANTY

1. A 20+ year warranty from the manufacturer shall be provided for all structured ca- bling, for an end-to-end channel installation which covers cable, connecting hard- ware, and the labor cost for the repair or replacement thereof.
2. Contractor shall provide a (1) year Warranty on all labor. The warranty shall include a 24-hour communication response time from the contractor for any system issues for a period of (1) year.
3. All manufacturer equipment warranties are to be registered by the contractor.

END OF SECTION

SECTION 27 1100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 27 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications Electrical Protection Equipment
5. Grounding and Bonding

1.3 DESCRIPTION, NISQUALLY INDIAN TRIBE TERMINAL CLOSETS

A. There shall be at least one terminal closet per floor. Additional closets should be provided when the floor area exceeds 10,000 sq. ft. or the horizontal distribution distance to the workstation exceeds 90 meter (300 ft). There are typically two size scenarios for terminal closets: 1) the ideal situation where there is ample space to provide a minimum closet size of 10 ft. by 8 ft. with a single door at least 30 inches wide and 80 inches tall, opening out; and 2) the limited space scenario where the closet size should be a minimum of 7 ft. wide and 30 inches deep, both of which are inside dimensions, provided the closet is accessed via double doors which swing out away from the closet. In either scenario, the closet should be at least 8 feet high. Each closet shall have sufficient power and lighting.

B. Nisqually Indian Tribe minimum power requirements are two dedicated 20-amp duplex power outlet per closet. Power supply (including lights) in the closet shall be on emergency power. Additionally, each closet shall have adequate airflow to ensure that operating temperatures do not drop below 50° F or exceed 80° F.

C. Closets shall be "centrally located" on each floor, or located so that horizontal station wires runs to user work stations and phones do not exceed 200 feet. The preferred standard for station wire is 150 feet. Each closet shall have sufficient sleeves, slots, conduits, or similar floor penetrations necessary to allow for ease of installation of telecommunications cabling and wiring. Such penetrations shall be properly firestopped per the applicable building codes.

D. A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.

1.4 DEFINITIONS

A. Section 27 05 00, Common Work Results for Communications.

1.5 SUBMITTALS

A. Comply with submittal requirements in Section 27 05 00, Common Work Results for Communications.

B. Shop Drawings: Comply with Section 27 05 00, Common Work Results for Communications, and provide specific for communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, a method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.6 QUALITY ASSURANCE

A. Comply with requirements of Quality Assurance in Section 27 05 00, Common Work Results for Communications.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

1. Cover all walls in Communications Equipment Rooms from 6-inches to 8-foot, 6-inches above finished floor.
2. Plywood backboards shall be painted white or other highly reflective color as specified by the architect.

2.2 TELECOMMUNICATIONS ENTRANCE ELECTRICAL PROTECTION EQUIPMENT

A. Contractor is responsible for providing Entrance Facility protection equipment.

B. Protection equipment shall be mounted on entrance facility wall as specified on the contract drawings.

C. System provided shall provide protection for all interbuilding backbone cabling installed, plus 10% growth.

D. System shall be provided with protective cover

E. System shall be provided with 300v protective modules.

F. System shall be connected to building grounding and bonding system as specified by the manufacturer.

1. Approved Manufacturers

a. Circa
b. Or approved equal

2.3 EQUIPMENT FRAMES

A. Subject to compliance with requirements, provide the following:

1. Chatsworth Products, Inc.
2. Or approved equal

B. General Frame Requirements:

1. Distribution Frames: Freestanding, modular units designed for telecommunications equipment mounting.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, high strength aluminum construction.

1. 84-inches in height.
2. UL Listed.
3. Two top angle, and two base angle mounts.
4. Side rails capable of vertical cable management channel attachment.
5. Epoxy-polyester hybrid powder coat finish, black in color.
6. 3-inch deep mounting channels punched in the front and rear flange with EIA-310-D hole pattern, 1-3/4-inch rack mount spaces marked and numbered on the mounting channel.

a. Approved Manufacturers

1) Chatsworth Products Inc., 55053-703.
2) Or Approved Equal

D. Vertical Cable Management Channels:

1. The cable manager shall be sized to match cabling requirements. The initial quantity of cables within the cable manager shall not exceed a whole number value equal to 40% of the interior area of the cable manager.
2. Epoxy-polyester hybrid powder coat finish, black in color.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
5. Double-sided 3.65-inch wide by 84-inches tall.

6. Double-sided 6-inch wide by 84-inches tall..

    a. Approved Manufacturer/Product

        1) Double-Sided 6” - Chatsworth Products Inc., 11729-703
        2) Double-Sided 3.65” - Chatsworth Products Inc., 12096-703

2.4 LADDER RACK, SUPPORTS, AND ACCESSORIES

A. Ladder Rack (Universal Cable Runway).

1. Ladder rack shall be manufactured from 3/8-inch wide by 1-1/2-inches high tubular steel with .065-inch wall thickness.
2. Ladder rack (side stringers) will be 9-feet-11½-inches long. Cross members will be welded in between stringers on 12-inches intervals/centers beginning 5-3/4-inches from one end so that there are 10 cross members per ladder rack. There will be 10-1/2-inches of open space in between each cross member.
3. Ladder rack will be delivered individually boxed, and available in the width(s) specified below.
4. Ladder rack will be UL Classified for suitability as an equipment grounding conductor only (the installer must remove paint or use ground straps at splices and intersections)
5. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.

    a. Approved Manufacturer/Part

        1) Chatsworth Products, Inc. (CPI), Universal Cable Runway: 10250-712,

B. Horizontal 90° Turns (Cable Runway E-Bend).

1. Horizontal 90° turns shall be manufactured from 3/8 wide by 11/2-inches high tubular steel with .065-inches wall thickness.
2. Stringers (sides) will be formed in a 90° arc. Cross members will be welded in between stringers on approximate 23° increments so that there are 5 cross members per turn. The welded assembly will have a 15-inches inside radius and will create a smooth horizontal 90° turn.
3. Horizontal 90° turns will be available in the width(s) specified below.
4. Black finish.

C. Vertical-To-Horizontal 90° Turns (Cable Runway Outside Radius Bend).

1. Vertical-to-horizontal 90° turns shall be manufactured from 3/8-inch wide by 1-1/2-inches high tubular steel with .065-inch wall thickness.
2. Stringers (sides) will be formed in a 90° arc with a 12-1/2-inches outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° vertical-to-horizontal turn.

3. Vertical-to-horizontal 90° turns will be available in width(s) specified below.
4. Black finish

D. Horizontal-To-Vertical 90° Turns (Cable Runway Inside Radius Bend)

1. Horizontal-to-vertical 90° turns shall be manufactured from 3/8-inch wide by 1-1/2-inches high tubular steel with .065-inch wall thickness.
2. Stringers (sides) will be formed in a 90° arc with a 12-1/2-inches outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° horizontal-to-vertical turn.
3. Horizontal-to-vertical 90° turns will be available in the width(s) specified below.

E. Corner Brackets (Cable Runway Corner Bracket).

1. Corner brackets shall be manufactured from 3/8-inch wide by 1-1/2-inches high tubular steel with .065-inch wall thickness.
2. The inside stringers of the corner bracket will be formed at 90° with a small chamfer at the vertex. The outside stringer of the corner bracket will be formed in a 90° arc that is either 15-inches or 24-inches in radius. A single cross member will connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly will create a smooth 90° turn within the L-shaped corner created by two intersecting ladder racks.
3. Corner brackets will be available in the size(s) specified below. Installation hardware will be included with the corner bracket. Corner bracket installation hardware does not include the junction splice kit required to form the L-shaped intersection between two ladder racks.

F. Ladder Rack Splices

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless-steel hardware.
3. An insulator bar kit will provide a means of electrically isolating individual ladder rack sections through an end-to-end splice separated with a non-conductive material. The preferred solution is a 3/8-inch wide by 1-1/2-inches high by 5-1/2-inches long insulator bar made of Delrin® (by DuPont, Delrin is a registered trademark of E.I. du Pont de Nemours and Company).
4. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.

5. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.
6. Manufacturer: Chatsworth Products, Inc. (CPI), Cable Runway Splices:

    a. Part Number 11301-701, Butt-Splice Kit, Black. Compression splice for end-to-end connections.
    b. Part Number 11302-701, Junction-Splice Kit, Black. Compression splice for T- or L-connections.

G. Ladder Rack Supports

1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will work with multiple or all widths of ladder rack.
2. Each support will include a means of mechanically securing ladder rack to the support.
3. Supports will be manufactured from steel or aluminum.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.
5. Manufacturer: Chatsworth Products, Inc. (CPI), Cable Runway Supports:

    a. Part Number 11421-712, Wall Angle Support Kit, For 12-inches Wide Cable Runway (Ladder Rack), Steel, Black. NOTE: Wall support for end of cable runway. Installation requires (2) 5/16-inches lag bolts and (2) flat washers or concrete wall hardware (ordered separately).
    b. Part Number 10595-712, Rack-To-Runway Mounting Plate, For 9-inches to 12-inches Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3-inches Deep Equipment Mounting Channels, Steel, Black. NOTE: Rack-To-Runway Mounting Plate attaches cable runway to the top of 2-post freestanding racks in parallel or perpendicular orientation. Includes J-bolt installation hardware for 1-1/2-inches High cable runway and rack top angles. CPI recommends use with Cable Runway Elevation Kit.

H. Ladder Rack Accessories.

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least 3/4-inch wide, and sized for cable bundles that are 2-inches, 3-inches or 4-inches in diameter.
2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack shall be manufactured from 1-inch by ½-inch tubular steel with .065-inch wall thickness. Cable retaining posts will be 8-inches high and will attach to the side stringer of the ladder rack with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.

3. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8-inch wide by 1-1/2 -inches high side stingers and will be sold in pairs.
4. End closing kits used to cover the end of ladder rack will be manufactured from 3/8-inch wide by 1-1/2- inches high tubular steel with .065-inch wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.
5. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3-inches. Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 11/2-inch high cable spools that attach to the top of the radius drop to guide cables.
6. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8-inch by 1-1/2-inches aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.
7. Cable spools used to separate ladder rack into multiple cable pathways will be made from a black flame retardant ABS. Cable spools will attach to the cross members with a clip that allows the width of the ladder rack to be divided into any proportion. The spools will be 3.94-inches tall, with a 1.94-inches diameter top cap, and a body that tapers from .88-inch diameter at the top to .62-inch diameter at the bottom.
8. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack will be made from 1/8-inch by 1-inch steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack. The bracket will hang below the ladder rack a minimum of 4-inches. The bracket support surface will be 4-inches long. The bracket will be zinc plated with a gold chem. finish.
9. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.
10. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below. Hardware will be zinc plated with a gold chem. finish.
11. Manufacturer: Chatsworth Products, Inc. (CPI), Cable Runway Accessories:

    a. Part Number 10596-706, Cable Retaining Post, 6-inches High, Black.
    b. Part Number 10642-001, Cable Runway Protective End Caps, 1 Pair, Black.

2.5 GROUNDING AND BONDING

A. The contractor is responsible for providing a complete TIA compliant grounding and bonding system as specified on the drawings and according to industry standards.

B. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufactures listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Wall-Mount Busbars

1. Telecommunications Main Grounding Busbar (TMGB)

   a. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25” (6.4 mm) thick solid copper bar. The busbar shall be 4”H x 20”L (100 mm x 510 mm) and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
   b. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 2.5” (63.5 mm) standoff from the wall. The busbar shall be UL Listed as grounding and bonding equipment.

2. Telecommunications Grounding Busbar (TGB)

   a. Telecommunications Grounding Busbar (TGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
   b. The busbar shall be 2”H x 12”L (50 mm x 300 mm) and shall have 9 attachment points (one row) for two-hole grounding lugs.
   c. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607 and shall accept 6 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
   d. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 2.5” (63.5 mm) standoff from the wall.
   e. The busbar shall be UL Listed as grounding and bonding equipment.

D. Bonding Accessories

1. Two Mounting Hole Ground Terminal Block

a. Ground terminal block shall be made of electroplated tin aluminum extrusion.
b. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
c. The conductors shall be held in place by two stainless steel set screws.
d. Ground terminal block shall have two 1/4” (6.4 mm) holes spaced on 5/8” (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
e. Ground terminal block shall be UL Listed as a wire connector.

E. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8” (15.8 mm) or 1” (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for entrance pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with PP&R telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and PP&R to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 FIRESTOPPING

A. Comply with TIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING AND BONDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground. Use table in the J-STD-607-A to calculate conductor size based on distance, with any distance over 66-feet requiring a 3/0 conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Comply with requirements in Section 27 05 00, Common Work Results for Communication.

END OF SECTION

SECTION 27 1116 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all labor, equipment and supplies to properly install the equipment for the voice and data cabling infrastructure.

B. This section and all related sections shall be performed by a qualified contractor as outlined in the specifications.

1.2 SECTION SCOPE

A. This section outlines the minimum requirements for equipment racks and cabinets.

B. This section also outlines labeling requirements for racks and cabinets.

1.3 RELATED SECTIONS

A. Section 01 33 00, Submittals

PART 2 - PRODUCTS

2.1 EQUIPMENT RACK – TWO POST

A. The equipment racks shall be 7' (H) X 19"(W) self-supporting 6061-T6 structural grade aluminum equipment rack with two top angles. Panduit R2P, Hoffman EDR19FM4SU, Chatsworth Products Incorporated (CPI) 55053-703 or approved equal are recommended. Existing equipment racks may be reused/relocated if they meet this specification, otherwise replace with new. Any brand names are noted for recommendation purposes and the approved “or approved equal” materials may be used.

B. Installation of equipment racks and installation of equipment in rack mounting provisions is required to be fully compliant with the both rack and equipment manufacturers installation instructions and written requirements.

C. A minimum of 50 mounting screws per rack shall be supplied.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS -

A. Rack bases shall be affixed to the structural floor deck. Provide grade 5 steel bolts and wedge expansion anchors compliant with seismic restraint/anchorage requirements.

B. Top angles shall be firmly affixed to ladder tray by means of a mounting plate as detailed in Section 27 11 23, Communications Cable Management and Ladder Rack.

C. Racks shall be bonded to adjacent assemblies as detailed in Section 27 10 05.

D. Racks shall be sequentially labeled as per the Drawings beginning with “RACK 1”. Labels are to be permanently affixed to the center of the top cross piece of the rack.

END OF SECTION

SECTION 27 1123 - COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Drawings and general provision of the Contract, including General and other Conditions and other Division 1 – General Requirements sections, apply to the work specified in this section.

B. This section and all related sections shall be performed by a qualified contractor as outlined in the specifications.

1.2 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents

B. Install ladder racks, cable trays, wire cable trays and all support structure in the telecommunication equipment room as outlined on drawings and specifications.

1.3 SECTION INCLUDES

A. Equipment, including: ladder trays, cable trays, wire cable trays, vertical cable management, brackets and support pieces, and all related materials required to provide cable management and transition pathways within the Equipment and Telecommunications Rooms of this project.

1.4 QUALITY ASSURANCE

A. All equipment shall be installed in a neat and workmanlike manner.

B. All materials shall be installed per standard installation practices and manufacturer’s specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. All cable management to conform to industry standards and comply with a Category 6 system. All active and passive rack mount equipment to be separated by horizontal cable management. Vertical cable management is required in multiple rack design. Ladder rack required to all racks and for cable entrance into all telecommunication rooms. Provide vertical power strips somewhere on the rear side of each rack.

2.2 RUNWAY MOUNTING PLATE

A. A 3” mounting plate to securely attach 12” wide cable tray to equipment rack is required along with necessary bolts, washers, and nuts needed to make the attachments. Hoffman LRRMPBLK or CPI 12730-712 shall be used.

B. Individual manufacturers and part numbers referenced are used to indicate quality of performance required. Approved “or approved equal” manufacturers may be substituted.

2.3 VERTICAL WIRE MANAGEMENT – TWO POST RACKS, MDF AND IDF LOCATONS

A. The vertical wire management system in all locations shall be double-sided.

1. In the positions between the racks, size shall be 7’ (H) x 12” (W). Panduit PRV12
2. On the outside edge positions, size shall be 7’ (H) x 6” (W). Panduit PRV6
3. Front doors shall be provided for the vertical cable managers. PRD12 and PRD6.

B. Rack Radius Drop, Hoffman LRD12BLK or CPI 12394-701, shall be installed on each Vertical Wire Manager. Where multiple racks are installed, part shall be installed on each side of the common wire manager.

2.4 HORIZONTAL WIRE MANAGEMENT

A. Horizontal cabling managers shall be used to organize and contain patch cord runs from patch port to vertical cable wire management.

1. Panduit NMF2 horizontal cable managers, 2RU, front only, are to be supplied at the top of each rack.
2. Panduit NMF4 horizontal cable managers, 4RU, front only, are to be supplied at the midpoint of each rack to serve as a pass through.

2.5 CABLE RUNWAY

A. The cable runway shall be black 12” wide universal cable runway. Hoffman LSS12BLK or CPI 10250-712.

B. Butt splices, as required, will be accomplished using either Hoffman LJBSK or CPI 11299-701.

C. Ninety degree junctions will be accomplished using either Hoffman LJSKB or CPI 11298-701.

D. Wall Angle Support Kit shall be 12” wide for attaching cable tray perpendicular to the wall. Either Hoffman LWASK12BLK or CPI 11421-712 shall be used.

E. Triangular Support Brackets shall be 12” wide support bracket for attaching the cable tray parallel to the wall. Either Hoffman LTSB12BLK or CPI 11312-712

F. Grounding straps shall be CPI 40164-001 (available in lots of 25 each as CPI 40164-025)

G. Exposed ends of the cable tray shall be covered with protective end caps. Either Hoffman LEC or CPI 10642-001

PART 3 - EXECUTION

3.1 GENERAL

3.2 INSTALLATION

A. Equipment Racks

1. Each equipment rack shall be equipped with rack-to-runway mounting plate, suitable for mounting a 12-inch width cable tray from the rack to the backboard.
2. The equipment rack shall be securely attached to the cable tray. See drawings for cable tray and rack placement detail.
3. Vertical wire management shall be installed as per the drawings.
4. A two RMU horizontal wire management panel shall be installed at the top of each rack.
5. Bolts used to attach the rack to the floor shall be Grade 5 or higher. Comply with seismic restraint and anchorage requirements.

B. Cable Runway

1. Cable runway shall be installed as shown in the Drawings.
2. The cable runway shall be installed to support cable runs from equipment racks to wall connections and between equipment racks.
3. Appropriate vertical wall brackets, support brackets, and splice kits are to be used when securing the runway. Any excess length shall be trimmed.
4. Protective end caps shall be installed on any exposed cable tray end.

C. All racks and associated components shall be grounded in accordance with ANSI-J-STD 607-A, National Electric Code, and the Authority Having Jurisdiction.

END OF SECTION

SECTION 27 1300 - COMMUNICATIONS BACKONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 27 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. Singlemode 8.3/125-micrometer, optical fiber cabling
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

1.3 RELATED SECTIONS

A. Section 27 05 00, Common Work Results for Communications

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-C, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Comply with submittal requirements in Section 27 05 00, Common Work Results for Communications.

B. Shop Drawings. comply with Section 27 05 00, Common Work Results for Communications and in addition:

1. Wiring diagrams to show typical wiring schematics including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.

2. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
3. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Maintenance Data: For splices and connectors to include in maintenance manuals.

D. Software and Firmware Operational Documentation per Closeout Submittals in Section 27 05 00, Common Work Results for Communications.

1.7 QUALITY ASSURANCE

A. Comply with requirements of Quality Assurance in Section 27 05 00, Common Work Results for Communications.

B. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

C. Grounding and Bonding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 UTP CABLE

A. Description: 100-ohm, multipair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-C.1 for performance specifications.
3. Comply with TIA/EIA-568-C.2, for Category 3 and Category 5e performance.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
b. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
c. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
d. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.2 UTP CABLE HARDWARE

A. Products: Subject to compliance with requirements, provide the following:

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

E. Number of Terminals per Field: One for each conductor in assigned cables.

F. Multipair Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. General specifications: Construct patch panel of high strength steel with black powder finish and design for wall or 19-inch rack mounting. Panels shall be available in 24-port and 48-port configurations, with height of 1 RU of 44.5 millimeters (1.75 inches) for each group of 24 ports. Patch panel shall be UL listed and ULC certified. Unit shall accommodate vertical and horizontal cord organizers available to facilitate patch cord management.

a. Provide 8-pin RJ-45 modular patch jacks on the front of the panel and 50-pin female patch connections on the back.

b. Optional - Provide 8- RJ-45 pin modular patch jacks on the front of the panel and 50-pin female patch connections on the back, with 2 pairs terminated on each 8-pin patch outlet. Pair 1 is terminated on pins 1 and 2; pair 2 is terminated on pins 3 and 6, which provides one 50-pin connector serving 12 patch outlets.

1) Comply with following standards:

a) ISO/IEC 11801
b) CENELEC EN-50173
c) UL, ULC, and ACMA

2. Application standards: Support application standards specified for related cabling.
3. Jacks: Comply with jack requirements specified for related cable category.
4. BAS applications: Comply with specifications for related cabling.
5. Performance specifications: Comply with specifications for related cabling.

G. Category 3 Multipair Connectors and Cable Assemblies:

1. General specifications: Category 3 multipair connectors and cable assemblies consist of 25-pair category 3 multipair cables connectorized with either one or two category 3 multipair connectors. Category 5 multipair connectors shall be compatible with industry standard 25-pair Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. connectors while providing keyed category 3 connections with equipment using this feature. In addition, the connector design using crosstalk reduction techniques shall provide a 6-decibel margin to assure category 3 performance throughout systems that use multiple connectors.
2. See following component requirements:

a. Category 3 multipair cables: Comply with specifications in Category 3 Multipair Solutions.
b. Category 3 multipair connectors:

1) Comply with specifications above in Category 3 Multipair Solutions.
2) Angled (110 degree) connectors: Units shall connect to electronics equipment requiring a 50-pin Telco-type connector. The 50-pin assembly shall be downward compatible to support 10BaseT, 100BaseT, and 155 megabits per second ATM applications. Right and left versions of the angle- mount connectorized cable assembly shall allow for flexibility in routing of cords as they exit the equipment.
3) In-line (180 degree) connectors: Units shall connect to 100BaseT (50-pin category 5) modular patch panel.

H. Approved Manufacturers

1. Commscope
2. General Cable
3. Superior Essex
4. Or approved equal

2.3 OPTICAL FIBER CABLE

A. Description:

1. Comply with ICEA S-83-596 for mechanical properties.
2. General Singlemode Specifications: Cables shall be designed for point-to-point applications as well as mid-span access, and shall provide a high-level of protection for optical fiber installed in building environment and OSP applications:

    a. Higher optical fiber count cables shall utilize a sub-unitized design with color- coded subunits for easy identification.
    b. Singlemode optical fibers shall be 8.3 micrometers and use standard colored tight- buffered construction.
    c. The singlemode optical fiber shall be dispersion-unshifted optical fiber that meets ITU-T G.652c requirements.
    d. Cable shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers.
    e. Cable shall support new and emerging applications that utilize extended E band, 1360 to 1460 nanometers.
    f. Cable shall also support existing and legacy singlemode applications that traditionally operate in 1310 and 1550 nanometer regions.
    g. Cable shall deliver a cost-effective upgrade path by expanding available wavelengths by 50 percent supporting 16 channels of coarse wave division multiplexing (CWDM) on a single optical fiber and up to 400 channels of dense wave division multiplexing (DWDM) on a single cable.

3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
    e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.

f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.

4. Where specified: Conductive cable shall be steel armored type for OSP loose tube metallic sheath and aluminum armored type for indoor armored type optical fiber cables.
5. Comply with following cable construction specifications by cable type:
6. OSP loose tube dielectric:

   a. Design: Dielectric design with MDPE sheath jacket and no metallic elements to provide environmental protection.
   b. Buffer tubes and optical fibers:

      1) Industry standard buffer tubes stranded around a central strength member and compatible with standard hardware, cable routing, and fan-out kits
      2) Optical fibers shall be industry-standard color coded and separated into 12- fiber color-coded binder groups surrounded by plastic core tubes

   c. Water blocking: Dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications

7. OSP loose tube metallic sheath: (Where Specified)

   a. Design:

      1) Metallic sheath design with MDPE sheath jacket to provide environmental protection
      2) Metallic armor of corrugated polymer coated steel tape to provide added crush protection
      3) Armor shall meet Telcordia requirements for superior armored cable.

8. Indoor/outdoor tight-buffered:

   a. Design: Dielectric design with fluoropolymer thermoplastic outer sheath jacket and no metallic elements to provide petrochemical resistance, flame propagation, and reduced smoke generation properties
   b. Optical fiber identification:

      1) Optical fibers shall be industry-standard color coded

9. Indoor/outdoor loose tube:

   a. Design: Dielectric design with fluoropolymer thermoplastic outer sheath jacket and no metallic elements to provide petrochemical resistance, flame propagation, and reduced smoke generation properties
   b. Buffer tubes and optical fibers:

1) Industry standard buffer tubes stranded around a central strength member for protection against thermal expansion and contraction at operational temperature extremes
2) Compatible with standard hardware, cable routing, and fan-out kits
3) Optical fibers shall be industry-standard color coded and separated into 12- fiber color-coded binder groups surrounded by plastic core tubes.

10. OSP central tube dielectric:

    a. Design: Dielectric design with medium-density polyethylene (MDPE) sheath jacket with longitudinal polyester ripcords and no metallic elements to provide environmental protection.
    b. Buffer tubes and optical fibers:

        1) Central tube of polybutylene terephthalate (PBT) material, containing all optical fibers, with 2 dielectric longitudinal outer strength members extending length of cable and industry-standard color coding.

11. OSP central tube metallic sheath:

    a. Design:

        1) Metallic sheath design with MDPE sheath jacket to provide environmental protection.
        2) Metallic armor of corrugated polymer coated steel tape to provide added crush protection.

    b. Buffer tubes and optical fibers: Central tube of PBT material, containing all optical fibers, with 2 metallic longitudinal outer strength members extending length of cable and industry-standard color coding.
    c. Water blocking: Water-blocking compound shall be suitable for underground conduit, direct burial, and aerial applications.

12. Indoor armored: (where specified)

    a. Interlocking armor spiraling around premises distribution cable, with an overall sheath jacket to provide additional protection and security
    b. Available with Riser or Plenum-rated outer jacket

B. Optical Fiber Jackets:

1. Jacket Color: OSP Black for singlemode 8.3/125 micrometer, listed
2. Jacket Color: Premise Backbone: Singlemode Yellow.
3. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.

4. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

C. Approved Manufacturers / products

1. Outside Plant SingleMode

   a. Commscope TeraSPEED Zero-Water Peak
   b. Or approved equal

2. Premise-based SingleMode

   a. Commscope OptiSPEED
   b. Or approved equal

2.4 OPTICAL FIBER CABLE HARDWARE

A. Cross-Connects and Patch Panels/Internal Sliding Shelf: Modular panels housing multiple- numbered, duplex cable connectors for singlemode optical fiber cable.

1. General specifications: Panel shelves shall be used for combination of splicing and termination of optical fiber building cable or OSP cables. Shelf shall be designed for use as termination shelf only (direct connector termination) or as splice and termination shelf. Fiber splice and termination capacities shall be as specified in this section.
2. Optical fiber connector panel specifications: Provide connector types in simplex or duplex configurations. Panels shall accommodate singlemode optical fiber cabling. Comply with following specifications:

   a. Pre-populated panels with factory-installed adapters:

      1) Duplex: 6 or 12 adapters accommodating LC
      2) Simplex: 6 or 12 adapters accommodating LC

   b. Pre-terminated modules with pigtails: 12 LC adapters for all optical fiber cable types:

      1) LC modules shall contain 12 pigtails with colorized 0.9 millimeters tight- buffered cordages, following color sequence as defined by TIA standard.

3. Optical fiber termination module specifications: Modules shall support LC connectors and accommodate singlemode optical fiber cabling. Modules shall be either unterminated or equipped with pigtails ready for splicing. Provide interchangeable multimedia outlet bezels where specified to accommodate 4 outlets for M-series jacks for multimedia applications. Configurations shall be as follows:

   a. Unterminated modules: 12 LC adapters for all optical fiber cable types

b. Pre-terminated modules with pigtails: 12 LC adapters for all optical fiber cable types.

4. LC modules shall contain 12 pigtails with colorized 0.9 millimeters tight-buffered cordages, following color sequence as defined by TIA standard.

a. SC and ST modules shall contain 6 pigtails with colorized 0.9 millimeters tight- buffered cordages, with following color sequence:

1) Type A: blue, orange, green, brown, slate, and white
2) Type B: red, black, yellow, violet, rose, and aqua

b. Physical specifications:

1) 1U Internal Sliding Shelf, black 1U, 2U and 4U Configurations.

c. Approved Manufacturers

1) Corning EDGE
2) Or approved equal

B. Optical Fiber Patch Cords: Factory-made, duplex-fiber cables.

1. General Specifications: To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below. Patch cord and pigtail plug connectors shall be equipped with boots, and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise. Optical fiber patch cords and pigtails shall be available with the following options as specified or indicated:

a. Termination types: LC.
b. Connector/cable configuration: duplex.
c. Listing rating: Riser, unless traveling through a plenum air space, then Plenum.
d. Patch cord outside diameters: 1.6 millimeters (0.063 inches) and 3.0 millimeters (0.118 inches).
e. Pigtails: Ruggedized and tight-buffered optical fiber-0.9 millimeters (0.035 inches) outside diameter.
f. Lengths: As specified or indicated. Assume 3 meter if not specified otherwise.

C. Cable Connecting Hardware: Optical fiber connector types shall be provided in patch panels, patch cords, and workstation outlets for termination of optical fiber cables. Connectors shall be compatible with singlemode optical fiber cables. Connector colors shall be specified or selected by PSU's Representative from manufacturer's standard colors:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568- C.3.
2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.

2.5 GROUNDING

A. Comply with requirements in Section 27 11 00 Communications Equipment Room Fittings, for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-C.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-C.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with Section 27 05 00, Common Work Results for Communications.

1. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
2. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING AND BONDING

A. See Section 27 11 00, Communications Equipment Room Fittings for additional information.

B. Install grounding and bonding system according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

1. Comply with ANSI-J-STD-607-A.
2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground. Distances over 66-feet required a 3/0 conductor.
3. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Comply with requirements in Section 27 05 00, Common Work Results for Communication.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Tests and Inspections:

a. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.1.
b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
c. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

1) Test instruments shall meet or exceed applicable requirements in TIA/EIA- 568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and

adapters that are qualified by test equipment manufacturer for channel or link test configuration.

d. Optical Fiber Cable Tests:

1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
2) Link End-to-End Attenuation Tests:

a) Horizontal backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-C.1.

e. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

B. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 27 1500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 27 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Multiuser telecommunications outlet assemblies.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Telecommunications outlet/connectors.
5. Cabling system identification products.
6. Cable management system.

1.3 RELATED SECTIONS

A. Section 27 05 00, Common Work Results for Communications

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 SUBMITTALS

A. Comply with submittal requirements in Section 27 05 00, Common Work Results for Communications.

B. Shop Drawings:

1. Wiring diagrams to show typical wiring schematics, including the following:

a. Cross-connects.
b. Patch panels.
c. Patch cords.

2. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

D. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation per Closeout Submittals in Section 27 05 00, Common Work Results for Communications.

1.7 QUALITY ASSURANCE

A. Comply with requirements of Quality Assurance in Section 27 05 00, Common Work Results for Communications.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-C.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

D. Owner Description: Communications outlets for workstations and other end-user jack locations -- shall minimally consist of two gang wall plates equipped with two 8-pin modular (RJ-45) jacks. The preferred standard for communications outlets in new construction is four gang wall plates equipped with four 8-pin modular (RJ-45) jacks. The number of modular jacks per face plate shall be decided by the use of the area and with the approval of Owner OIT.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

A. See Section 27 11 00, Communications Equipment Room Fittings

2.4 UTP CABLE

A. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket, in color readily available from the manufacturer, typically blue or white.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-C.1 for performance specifications.
3. Comply with TIA/EIA-568-C.2, Category 6 and Category 6A cables.
4. All cables provided as part of this project shall be listed for their installed environment.

5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    b. Communications, Riser Rated: Type CMR; or CMP, complying with UL 1666.

6. Approved Manufacturers/Products

    a. Typical Work Area Outlets:

        1) Commscope Uniprise 75 series, Category 6 cable.

    b. Wireless Access Points and Data Intensive applications

        1) Commscope Uniprise 10G4 Category 6A cable.

2.5 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One and one half for each four-pair UTP cable indicated.

C. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Jack color shall be specified or selected by OIT representative from manufacturer's standard colors.

D. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.6 CONSOLIDATION POINTS

A. Where specified on the contract drawings.

B. Description: Consolidation points shall comply with requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field: One for each four-pair UTP cable indicated.
3. Mounting: Recessed in ceiling or flush on wall, desk, or furniture depending on application.
4. NRTL listed as complying with UL 50 and UL 1863.
5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.7 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

A. Where specified on the contract drawings.

B. Description: MUTOAs shall meet the requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:
3. One for each four-pair UTP cable indicated.
4. Mounting: Recessed in ceiling or flush on wall, desk, or furniture depending on application.
5. NRTL listed as complying with UL 50 and UL 1863.
6. Label shall include maximum length of work area cords, based on TIA/EIA-568-C.1.
7. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.8 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.

B. Workstation Outlets: Two and Four-port-connector assemblies mounted in single or multigang faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Owner's Owners Authorized Representative.
2. Metal Faceplate: Stainless steel, complying with specific Owner project requirements and Owners Authorized Representative.
3. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
4. Flush mounting jacks, positioning the cord at a 45-degree angle.
5. Legend: Factory labeled by silk-screening or engraving for stainless steel faceplates.
6. Legend: Machine printed, in the field, using adhesive-tape label.
7. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.9 GROUNDING

A. Comply with Section 27 11 00, Communications Equipment Room Fittings.

B. Comply with J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

A. Comply with Section 27 05 00, Common Work Results for Communications.

B. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.11 CABLE MANAGEMENT SYSTEM

A. Comply with Section, 27 11 00, Communications Equipment Room Fittings.

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-C.

C. Factory test UTP cables according to TIA/EIA-568-C.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-C.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 27 05 28, Pathways for Communications Systems.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.

3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. MUTOA shall not be used as a cross-connect point.
4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-C.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-C.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with Section 27 05 00, Common Work Results for Communications.

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground. Lengths over 66-feet require a 3/0 conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Comply with requirements in Section 27 05 00, Common Work Results for Communication.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications

equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.1.

2. Visually confirm Category 6 and Category 6A, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Perform tests with a tester that complies with current TIA standards.

B. UTP Performance Tests:

1. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-C:

    a. Wire map.
    b. Length (physical vs. electrical, and length requirements).
    c. Insertion loss.
    d. Near-end crosstalk (NEXT) loss.
    e. Power sum near-end crosstalk (PSNEXT) loss.
    f. Equal-level far-end crosstalk (ELFEXT).
    g. Power sum equal-level far-end crosstalk (PSELFEXT).
    h. Return loss.
    i. Propagation delay.
    j. Delay skew.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION

SECTION 27 1543 - COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.3 QUALITY ASSURANCE

A. See Section 27 05 13, Communication Services

B. All cable shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.1 FACEPLATE

A. See Section 27 15 13, Communication Services paragraph 2.02.

B. Labels must be installed in a manner that does not cover the attachment screws.

2.2 JACK

A. See Section 27 15 13, Communication Services paragraph 2.02.

PART 3 - EXECUTION

3.1 INSTALLTION

A. Install faceplates as per manufacturer’s instructions. Care must be taken to provide a plumb and level appearance. Align with adjacent electrical outlet, if available.

B. Do not over tighten screws. Faceplate must not be indented or puckered at the attachment point.

END OF SECTION

SECTION 27 3000 – VOICE COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. The Command Center is to be located at a central control point on the first floor or as determined by local Authority Having Jurisdiction. Rath Command Center Call Boxes are to be located on all floors above and below the first floor, next to an elevator landing on each floor, other than the 1st floor.

B. The Command Center must include visual indicators to allow rescue personnel to know which Call Box needs assistance. The Command Center must allow rescue personnel to speak to each Call Box individually. The Command Center must include both a handset and speakerphone to communicate back to the Call Boxes.

C. The emergency communication hardware shall comply with the Americans with Disabilities Act (ADA). The Call Boxes shall have the ability to be programmed with up to 2 emergency phone numbers (either both off-site or Base Station and one off-site). Upon activation of the emergency push button, a call will be automatically placed to the Command Center. If no one answers at the Command Center, the Call Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications.

1. Owner shall provide a communications pathway that is compatible with the system, and which shall allow the calls to be directed to the security center on campus.

1.2 SUBMITTALS

A. Submit product data sheets. Include operation manuals.

B. Wiring or shop diagrams detailing wiring schematics, cabling.

C. Submit to Architect for approval and stamp, prior to submitting for permit.

1.3 COMMUNICATIONS

A. The Call Boxes shall be an ADA compliant and vandal resistant speakerphone.

B. The Call Boxes shall be hands-free and be a push-button-once to talk system. Once the button has been pushed, the Call Box will call the Base Station. If no answer at the Base Station, it will automatically call a pre-programmed emergency number. The Call Box must be capable of being programmed with up to 2 emergency numbers (either both off-site or Base Station and one off-site).

C. The Call Box shall have location message capability. Call Box must have a minimum 18 second recordable message capability, programmable to play 1 or 2 times. Call Box shall notify called party of the location of the call upon being received at the emergency dispatch center.

D. The Call Box shall be capable of allowing the called party to replay the location message if necessary to ensure an understanding of the caller location.

E. If system is not attended to 24 hours a day, the Call Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications.

F. Once a call has been made (button pushed), the call can only be terminated by the called party.

G. The Call Box must have a red LED that will light up upon push of the button. The light shall be a solid color when the Call Box is activated, and will flash when call has been answered.

H. The Call Box must be capable of being programmed and re-programmed on-site.

I. Standard Call Box features:

1. Two number programming (either both off-site or *Base Station* and one off-site).
2. Operating temperature of between -40˚F to +150˚F (-40˚ to + 65˚ C).
3. On-site programmable.
4. EEPROM memory to protect programming.

1.4 WARRANTY

A. The Command Center and Call Boxes shall be warranted for a period of three years.

PART 2 - PRODUCTS

2.1 COMMAND CENTER AND POWER SUPPLY

A. The Command Center (2500 series) shall include both the Base Station and Distribution Module. The Base Station must have a powder coated steel housing (surface or flush mount) or be desk mounted, include a black handset with coil cord and be powered from the Distribution Module.

1. Provide Rath 2500-16RCF (flush mount).

B. Distribution Module must be a surface mount enclosure, include connections for the Call Boxes and power both the Base Station and 2400 series Call Boxes. The

Distribution Module shall be powered from 120vac power with a battery backup that provides power for a minimum of 4 hours (Rath part # RP7700104 for 12-36 Zone).

C. Monitoring

1. Provide addressable input modules compatible with fire alarm system to monitor all trouble relays provided on 2-way communications system.

D. Command Center must include wording identifying the location of each Call Box and light an LED when a particular Call Box has been activated.

E. Stations

1. The Call Boxes (2400 series) must be in full compliance with ADA requirements. Call Boxes require a hands-free speakerphone with an LED to indicate status of call.
2. The Call Boxes must allow the programming of a specific location message of the unit. This allows rescue personnel to know the location of the activated Call Box.
3. The Call Boxes are to be located no higher than 48” front reach, or 54” side reach to the center of the button above ground level to ensure conformance with the ADA requirements.
4. The Call Boxes must have a Braille face plate to ensure conformance with the ADA requirements.
5. The Command Center must provide an audible and visual indicator that a Call Box has been activated.
6. Provide Rath Model 2400-808NSP.

2.2 PATHWAY SIGNAGE

A. See Notes on associated drawings.

2.3 STATION SIGNAGE/GRAPHICS

A. See Notes on associated drawings.

2.4 CABLING

A. See Notes on associated drawings.

END OF SECTION

NISQUALLY VOCATIONAL CENTER

OLYMPIA, WASHINGTON

PHASES 1 AND 2

SECTION 28 0500 – COMMON WORKS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This document details the requirements for all City of Portland Electronic Safety and Security projects. The Contractor is responsible for the adherence, coordination and submittals required within. Failure to comply with these specifications which result in additional costs will be the responsibility of the Contractor.

B. The materials, products and installation requirements set forth in this document are the contract requirements to provide a turnkey Electronic Security and Safety system. Provide all system components, including all hardware, cabling, and system programming for complete and working systems.

C. Coordinate all specific building construction, pathway, supporting trades in addition to any provided network-connected device installation requirements, software configurations, etc. and other building systems with the authorized City of Portland Integrated Security representatives. Additional costs incurred from incomplete, insufficient, or incorrect coordination are the responsibility of the Contractor.

D. Operator training is required as part of the Security Contractors scope and shall be provided to the City's Authorized Representative(s).

E. Section Includes:
   1. Description of Work for Electronic Security Systems,
   2. Project coordination with related trades
   3. Required City of Portland communication path.
   4. Submittal Requirements
   5. Approved Electronics Security components.
   6. Electronic security installation requirements.

1.02 REFERENCES:

A. Perform work in accordance with applicable requirements of governing codes, rules and regulations including the following minimum standards, whether statutory or not:

   1. City of Portland 27 10 00: Structured Cabling
   2. Most current version of ANSI/BICSI 005: Electronic Safety and Security (ESS) System Design and Implementation Best Practices.
   3. ANSI/TIA/EIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.
   4. ANSI/TIA/EIA-606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings.
   5. FCC Federal Communications Commission
   6. NEC National Electrical Code
   7. State of Oregon and City of Portland local codes and requirements
   8. UL Underwriters Laboratories
      a. UL 294 (1999; Rev thru Oct 2001) Access Control System Units

b. UL 365 Standard for Police Station Connected Burglar Alarm Units and Systems.
c. UL 636 (1996; Rev thru Mar 2001) Holdup Alarm Units and Systems
d. UL 639 (1997; Rev thru Sep 2002) Intrusion Detection Units
e. UL 681 (1999; Rev thru Jan 2001) Installation and Classification of Burglar and Holdup Alarm Systems
f. UL 796 (1999; Rev thru Dec 2003) Printed-Wiring Boards (1982 issue or latest revision).
g. UL 1037 (1999; Rev thru Sep 1999) Antitheft Alarms and Devices
h. UL 1076 (1995; Rev thru Feb 1999) Proprietary Burglar Alarm Units and Systems
i. UL 1610 (1998; Rev Aug 2001) Central-Station Burglar-Alarm Units

9. U.S. National Archives and Records Administration (NARA)
10. ASTM American Society for Testing Materials
11. NEMA National Electrical Manufacturers Association
12. ANSI American National Standards Institute
13. ETL Electrical Testing Laboratories

1.03 SYSTEM DESCRIPTION

A. The electronic security system shall include but not limited to:
1. Electronic access control
2. Intrusion detection
3. Duress alarms and/or personal protection devices
4. Elevator control interfaces
5. Video assessment and surveillance devices
6. Video recording and storage
7. Intercommunication systems
8. Fire alarm interfaces.
9. Equipment cabinetry
10. Photo badge printers
11. Uninterruptible power supplies (UPS) interfaces.

1.04 COORDINATION / COMMUNICATION PATH

A. The contractor must coordinate their work with others on all City of Portland Integrated Security projects. When working under a General Contractor, the contractor is responsible for coordinating with the scope leads for the following scopes:
1. Division 1 – General
2. Division 8 - Openings
3. Division 11 - Equipment
4. Division 26 – Electrical
5. Division 27 – Communications
6. Division 28 – Electronic Safety and Security

B. When under a General Contractor the Contractor must follow the Generals communication plans and submit formal RFI’s for any information not provided in the contract documents.

C. When working solely under the City of Portland, the contractor shall submit formal

RFIs to the authorized Integrated Security representative.

1.05 CONDUIT AND SYSTEM RACEWAYS:

A. Any conduit, raceways, and cable tray shall be provided by a qualified Division 26 electrical contractor for this specification section. The Security contractor shall furnish and install equipment, cabling, wiring and equipment specific back boxes for these systems.

B. Electrical Metallic Tubing (EMT) is required for all systems; the contractor is responsible for coordinating the installation of conduit with other trades or providing conduit installation costs with bid documents.

C. The contractor must follow NEC conduit fill standards as specified in the NEC and 27 10 00 STRUCTURED CABLING.

D. All Conduit and Pathways system must be bonded to the electrical grounding system.

E. Flexible Metallic Conduit is not approved for interior installation at any City of Portland property.

1.06 SUBMITTALS

A. The City's approval must be obtained for all equipment and materials before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

B. Pre-installation Submittals
1. All material submittals shall be made and submitted electronically.
2. Submit at one (1) time after contract award but before work commences, drawings and product data on all proposed equipment and required system block diagrams. Where security systems are provided under a General Contractor, check for compliance with Contract Documents and certify compliance with Contractor's "APPROVED" stamp.

C. Contractor Information:
1. Only pre-authorized Contractor employees will be permitted to access the City's supported file-sharing program for system configuration. Those responsible for system configuration and File Transfer must be provided to Integrated Security with the complete submittal package.
2. Names, contact information of the following project team members:
   a. Project Manager
   b. Technician or Representative who will be responsible for system configuration.

D. Cover Sheet (including name of supplying contractor, contact information, project name, and date submitted.)

E. Detailed Bill of Materials
1. Provide a complete and thorough list of all equipment, licenses, and configurations proposed for installation in the system.
2. The list shall include item quantities, Manufacturers, model numbers and a short description.

F. Product Data - Equipment Cut Sheets

1. Provide descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer for each product and cable proposed for installation.
    a. Where multiple products are listed on a single cut-sheet, clearly identify or highlight the product that Contractor proposes to use.
2. Where no other specification is provided which relates to a submitted product, provide drawing detail and sheet number reference and/or explanation as to how the product is to be implemented into the work of the project.

G. Interconnection Diagrams
1. Contractor shall provide interconnection diagrams for each system sensor, and device component. Interconnection diagram shall identify the following information:
    a. Termination locations
    b. Standard wire details including termination schedule.
    c. Diagrams shall also identify integrated interfaces to other systems such as elevator control, fire alarm systems, security management systems and others.
2. Riser Diagrams – Where the project spans multiple floors or rooms, the Contractor must provide riser diagrams indicating riser architecture and distribution of the system throughout the facility (or areas in scope).
3. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with any subsystems. Block diagrams shall identify security subsystems (e.g., access control, intrusion detection, video surveillance, intercom, etc.) integration, and any data and media conversion methodologies (i.e. PoE Midspan units, Fiber to Copper media converters, etc.).

1.07 CLOSEOUT SUBMITTALS

A. After the contractor has completed the installation, but before City verification tests, the contractor will submit the following information to the Integrated Security representative through the City's File-Sharing system. All closeout submittals are required for project completion and contractor payment.

B. Training Documentation

C. Record Drawings
1. During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing installed location and configuration of the project components. At the end of construction, the contractor will electronically submit the record drawings using the General Contractors' communication path and the City's provided File Transfer system.
2. As-Built Documents
    a. Any installed pathways
    b. Devices installed w/ final labels (or naming)
    c. Patch Panel / Network Ports connected by the contractor

D. Equipment Operation Manuals

E. Any maintenance and software configuration materials

F. All Network cabling test results

G. Network connected device information
   1. MAC Address
   2. Installed IP Addresses

1.08 PRE-INSTALLATION DUTIES

A. EXISITING CITY OF PORTLAND PROPERTY
   1. Contractors have specific duties which are critical to the delivery of a turn-key system which must be adhered to. Failure to follow the requirements below may result in project delays and additional costs, those costs are the responsibility of the Contractor.
   2. Required Pre-Installation Photos
      a. The Contractor is responsible for taking pictures of all project scope locations.
      b. Photos must be submitted in clear resolutions high enough for electronic submittal and concise identification.
      c. Annotate each photo with location description, and proposed item information.
      d. Project scope locations include:
         1) Proposed Camera and Surveillance device locations
         2) Proposed secure doors (safe and secure sides) and windows
         3) Proposed User Interface locations
         4) Intercom locations, stanchions and other mounts
         5) Any project location of significant work.
         6) Telecommunications Rooms
            a) Wall Space proposed for mounted materials.
            b) Patch Panels
            c) Telecommunications Racks
         7) Installed Network Switches
            a) All Network switches installed.
            b) Any open Ethernet ports on applicable network/security switches. (any images of network ports must be clear enough to identify port numbering).

   3. GENERAL CONTRATOR-LED CONSTRUCTION AND NEW LOCATIONS
      a. Where the Project is under the direction of a General Contractor, the Contractor is required to follow the General Contractors' direction for material submittals and seek approval through the Projects' established communication plan.
      b. Submittals which are not received through the General Contractor will be rejected.

   4. FILE TRANSFER
      a. A City of Portland Integrated Security representative will provide log-in information to the contractors designated employee for access to the City's File Transfer system. Contractors shall utilize the File

Transfer system for submittal of all project documents.
a) Drawings (design and as-built record drawings)
b) Engineering calculations
c) Project Intake documents
d) One-line drawings
e) Submittals (provide electronic copies identical to those submitted though General Contractor communication path)

PART 2 - PRODUCTS

2.01 CITY SYSTEM STANDARD

A. All components and licenses provided for an electronic security system with the City of Portland must be supported and provide full integration with Genetec Security Center and applicable modules.

B. All equipment installed shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken into consideration at each facility and site location prior to installation of the equipment.

2.02 CABLING AND SYSTEM COMPONENTS

A. All components including cabling unless otherwise specified herein shall be provided by the Contractor.

B. All components specified shall be provided as a complete system and where specific products are called out the contractor shall provide the specified product or in the case of discontinued models shall provide associated current model.

2.03 SUBSTITUTIONS

A. All requests for substituted equipment shall be confirmed to meet the specified requirements of the Project. Contractor is responsible for submitting substitution requests and ensuring that:
1. The equipment meets the minimum performance, reliability, functionality, flexibility, expandability requirements of any Contract Documents.
2. No conflicts in signal levels, power, types, protocols or other electronic characteristics of the proposed equipment exist.

B. Equipment and materials installed on the project other than those specified or as an approved substituted item shall be subject to rejection by the City of Portland and if rejected shall be promptly removed and replaced with the approved item at no additional cost to the Owner.

2.04 SYSTEM CABLING

A. Any cabling installed for security purposes is governed by the requirements set forth in the City of Portland, SECTION 27 10 00 STRUCTRED CABLING.

B. Provide plenum rated cable for all projects.

C. Access Control Cabling
1. Banana Peel-type
   a. Belden
   b. Or approved equal

D. Network Cabling
   1. UTP Cabling – Category 6, jacket: blue
      a. Commscope Uniprise
      b. Panduit Pan Net
      c. Or approved equal

   2. Fiber Optic Cabling (Singlemode)
      a. Corning
      b. Or approved equal

E. Sensor Cabling
   1. Provide system sensor cabling as required for the device installed
      a. Belden
      b. General
      c. Or approved equal

F. Media Conversion
   1. Where applicable, provide fiber-to-copper type media conversion units for long distance installations.
   2. When installed outdoors, Media Converters must be rated for their installed location and provided with a NEMA rated enclosure with locking hardware.

G. Cable Labeling
   1. See System Labeling in Part 3 and Appendix sections.

2.05 ELECTRONIC ACCESS CONTROL

A. EXISTING SYSTEMS
   1. Where existing systems utilize older encryption technologies which will remain in place, provide confirmation to the Integrated Security representative that all systems are compatible.

B. INTEGRATED SYSTEMS
   1. Where systems are integrated with Life Safety or other Emergency Communications systems, the contractor must coordinate with the Contractors performing that work and verify system locking requirements with Integrated Security.

2.06 ACCESS CONTROL CREDENTIALS / CARDS

A. When requested, provide Access Control credential cards to the project Owner.

B. Cards must be of City of Portland standard, as dictated by Integrated Security.

C. Access Control card shall have the following requirements:
   1. 125KHz, 13.56 MHz Credential
   2. The Contractor shall provide specified quantities SEOS iCLASS Smart Card proximity access control cards to the Owner.
   3. Card shall be equipped with memory, which shall be purchased with the following capacities:
      a. Cards will be pre-ordered with an anti-forgery holographic overlay, coordinated with the Integrated Security representative.
      b. Access control cards shall be a format compatible with the card readers being provided and shall be utilized in conjunction with a

security panel to associate the access level associated with the user of the card.

4. Proximity cards shall be compatible with the badge printer being supplied.
5. Proximity access control cards shall also allow either a horizontal or vertical punch slot. Coordinate the punch slot with the Owner.
6. Each access card shall be uniquely encoded by the card manufacturer and shall transmit a compatible format output to the card readers.

D. CREDENTIAL / CARD READER
1. Provide pivCLASS Card Readers for all new installations.
2. Where installed outdoors, provide weather-resistant model or provide weatherized covers.
3. FIPS 201 compliant
4. Readers shall be contactless type and be Open Supervised Device Protocol (OSDP) confirmed.
5. Where PIN integrated readers are requested, they must provide a 12-digit keypad.
   a. Approved Manufacturers
      1) HID iClass
      2) Approved Equal

E. REQUEST TO EXIT DEVICES
1. Compatible with single or double-doors
2. Wall or ceiling mountable
3. Selectable fail safe and fail secure modes

F. DOOR CONTACTS (POSITION SENSORS)
1. Size: ¾" or 1" depending on door and door frame assembly.
2. Provide recessed in-frame, closed-loop sensors
3. Sensors shall be provided with terminal connections or pigtail leads.

G. LOCKING DEVICES
1. General Contractor-Led Construction: Contractor is responsible for coordinating locking hardware requirements with the Division 8 documents.
2. Provide system materials compatible with any specified hardware.
   a. Doors:
      1) Where cabling must be routed through the leaf of a door, the contractor must coordinate system requirements with the General Contractor, Div. 8 documents and all associated trades.
3. Existing locations: Where the contractor is providing locking hardware:
   a. Any locking hardware provided must be included in the submittal package.
   b. Hardware must be compatible with door frames and any other construction elements.

2.07 INTRUSION DETECTION SYSTEMS

A. CONTROL PANELS
1. Control Panels must be provided with 25% spare capacity on all sensor

inputs, interfaces and outputs.
2. IP connection capable through hard-wired ethernet cabling.
3. Integrate Intrusion systems with any Fire Alarm interfaces as an auxiliary
4. Configure systems as specified by Integrated Security.
    a. Approved Manufacturers
        1) Bosch
        2) Approved Equal

B. CONTROLLING KEYPADS
1. Control keypads shall feature a color graphic touch screen display
2. Built-in presence detector lights the display when user approaches keypad
3. Built-in proximity reader
4. Provide trouble, alarm, location, and status information
    a. Approved Manufacturers
        1) Bosch
        2) Approved Equal

C. ENCLOSURES
1. All enclosures must be provided with the submittal package.
2. Where required, Intrusion Control Panels and Cabling connections must be made within approved locking enclosures.
3. Enclosures must be large enough to house all components and connections with adequate working clearances.

D. SENSOR DEVICES
1. PIR INTRUSION DETECTORS
    a. Where requested, provide wall or ceiling mount PIR-type motion sensors.
    b. Sensors should be appropriate for the installed environment and provide adequate range based on the installed location and sensor requirements.

2. DOOR AND WINDOW SENSORS
    a. Where requested, provide magnetic closed-loop door and window position sensors which integrate with the complete system.
    b. Only provide door contacts on secured or monitored doors where doors are not covered by another system.
    c. Steel and Glass Doors:
        1) Provide the appropriate sensor for the application and integration
        2) Coordinate the mounting requirements with the Architect, General Contractor and/or Integrated Security.
3. GLASS BREAK SENSORS
    a. Where requested, provide automatic environment testing capable glass break sensors.
    b. Provide magnetic test mode.
    c. Provide visible LED for alarm, test or programming confirmation.
    d. Approved Manufacturers
        1) Bosch
        2) Approved Equal

E. BACKUP SYSTEM COMMUNICATION (CELLULAR)
1. Provide a cellular backup communication device with the Intrusion Detection system.
2. Cellular modules must be configured as directed by the Integrated Security representative.

F. BATTERIES
1. Where not connected to the buildings' standby or generator power, provide sealed lead acid batteries for system backup.
2. Batteries must be provided with adequate storage capacity for system operation for a minimum of 2 hours.

2.08 DURESS ALARMS / PERSONAL PROTECTION DEVICES

A. INSTALLED DURESS ALARMS
1. Where requested, provide hardwired duress buttons at specified locations.
2. Buttons provided must be supervised-type.
3. Buttons must feature single button operation and report back to the supervising system.

B. PERSONAL PROTECTION DEVICES – WIRELESS DURESS
1. Where requested, provide wireless-type duress buttons.
2. Any wireless systems must be provided with compatible wireless transceivers which will integrate with the supervising system.
3. Wireless Duress buttons must provide location information to the supervising system.
4. Buttons shall feature LED lighting for activation alert.

2.09 VIDEO ASSESMENT AND SURVIELLANCE DEVICES

A. CAMERAS
1. All cameras installed as part of City of Portland security projects must be compatible with the City-provided Genetec VMS.
2. Cameras shall be IP-based and ONVIF compliant.
3. Contractor is responsible for providing Cameras which meet the adequate MP resolution and low-light performance to meet the requirements of the installed environment and Project requirements.
   a. Approved Manufacturers
      1) Axis
      2) Approved Equal

B. CAMERA MOUNTS
1. Any camera mounts proposed must be submitted with all other proposed components.
2. All projects and system requirements are unique, however, the City has a preference for vandal-resistant mounts and hardware, the Contractor should provide camera mounts which meet this requirement.
   a. Approved Manufacturers
      1) Axis
      2) Approved Equal

C. EXTERIOR HOUSINGS
1. Where cameras will be installed away from buildings and exposed to

natural elements, the Contractor shall submit exterior-rated housings with integrated heaters and blowers for all associated cameras. Approval for the submitted housing will be provided by Integrated Security.

2. Housings must be rated for 24-hour operation and provide integrated surge-suppression.
3. Housings must be compatible with the supplied cameras.

2.10 LOCAL VIDEO RECORDING AND ARCHIVAL

A. LOCAL STORAGE

1. When requested, the Contractor must submit a Genetec configured local storage array for the project.
2. Local storage arrays must be rack-mountable and be configured as specified by the City of Portland Bureau of Technology Services representative assigned to the Project.
3. Storage solutions must be provided with a minimum of 30-days of storage for all project integrated cameras.
4. Any local storage provided must be installed with an approved UPS system. See 27 10 00 Structured Cabling for UPS requirements.

2.11 INTERCOMMUNICATION SYSTEMS

A. REQUIREMENTS

1. When requested, the contractor will provide an IP-based Intercom system which will integrate into the Genetec Security Center platform.
2. Intercom systems must be installed at ADA-compliant side and front reach height.
3. Intercom systems must be SIP and ONVIF compliant.
4. Exterior mounted Intercom stations must be suitable for their installed environment.
    a. Approved Manufacturers
        1) Axis
        2) Approved Equal

B. MASTER STATION SOFTWARE

1. When requested, provide a complete intercom system including software installation and configuration for project intercom devices.
2. Configuration details for the Intercom will be provided within the Owners secure file- transfer program.

C. REMOTE STATIONS

1. Must provide hands-free communication.
2. Where applicable, provide with integrated card reader
3. Configure system to provide integrated camera streams with a minimum of 720p resolution.
    a. Approved Manufacturer
        1) Axis 8207-VE
        2) Or approved equal

2.12 PHOTO BADGE PRINTERS

A. When requested, the contractor must provide a Photo Badge Printer to the Project.

B. Printers must be submitted for approval along with the entirety of the complete system components.

C. Training
   1. The Contractor shall also provide training to the City's authorized representative on how to create badges and modify existing standard templates.
   2. The Contractor shall utilize their own badge printers for initial setup and will not use the badge printer being provided in this project for badge reproduction.

D. Printer resolution shall be no less than 300 dpi; the printer shall produce up to 16.7 million/256 shades per pixel, edge to edge, and print one single sided card within forty (40) seconds.

E. The Contractor shall be responsible to provide one (1) color dye sublimation printer, coordinate location with Owner. The dye sublimation printers shall have the following characteristics:
   1. The printer shall have a card width range of 2.125" a card length range of 3.375" and shall accept cards .03"-.06" in thickness.
   2. Printer shall support Universal Serial Bus (USB).
      a. The printer shall accept PVC cards and support a four-panel ribbon with integrated resin panels.
   3. The printer shall support holographic and clear overlay varnishes.

2.13 CONTRACTOR-PROVIDED NETWORK COMPONENTS

A. Any network connected device must be approved by the Bureau of Technology Services prior to its connection to any Owner network.

B. Network Switches
   1. Where the contractor is requested to provide network switch ports for the support of any security system switches must be included in the submittal package.
      a. Approved Manufacturer
         1) Cisco IE series
         2) Approved equal

C. Midspan Units
   1. Where additional power is required for devices and not provided by City network infrastructure, the contractor must install a Midspan PoE injector. The unit must meet the minimum requirements:
      a. Gigabit rated, auto-negotiating
      b. Provide built-in SNMP management
      c. Event Logging

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS

A. General Work Note:
   a. Upon completion of each workday, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the

premises clean, neat and orderly.

B. Comply with NECA 1.

C. Any cabling service-loops shall not be simply coiled up, but instead be wrapped in an over-under manner to prevent the creation of a coil.

D. Data cables must not be run parallel to (within 12 inches) or in-contact with electrical cabling or conduits.

E. No data cabling shall be installed within 2' of lighting ballasts.

F. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

G. Headroom Maintenance: If mounting heights or other location criteria are not indicated on contract drawings, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

H. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

3.02 SYSTEM CABLING TERMINATION AND TESTING

A. All Network cables installed as part of the project must be terminated as specified in the contract documents.

B. All multi-conductor cables installed as part of the project must be continuous and installed with breaks or splices.

C. An approved UTP network cabling test device cable of performing at a minimum the following:
   1. Wiremap
   2. NEXT
   3. Length
      a. Test results must be provided in electronic format with each cable listed with Pass or Fail result.

3.03 SYSTEM LABELING

A. The Contractor must label all cables, components, and patch-panel connections as specified by the City of Portland Naming Convention standard.

B. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

C. Unless otherwise indicated, provide black text on a white background.

D. Shall be preprinted or computer printed type. Handwritten labels are not acceptable.

E. Security System Labels
   1. When providing network cabling and patch panel connections for security systems, the contractor shall provide generic, high-level naming labels.
      a. Example:
         1) Cameras = "CAM#"

2) Access Control – “ACCESS”
3) Intrusion – “INTR”

3.04 INSTALLATION PROCESS

A. PRE-INSTALLATION WORK / SUBMITTALS AND APPROVALS

a. As detailed above, the contractor is responsible for providing a complete submittal package to the City’s Authorized Representative(s), as each Project dictates.
b. Work may only proceed once written approval of the submittal package and notice-to- proceed authorization is received from the Project’s General Contractor or Integrated Security representative.

B. WORK COMMENCE

a. Conduit and Cabling work must be completed as specified above.
b. As specified above, the Contractor must follow the Project’s communication path for any requests for information or clarifications.
c. For any work governed by the AHJ, the Contractor must coordinate with the General Contractor and/or AHJ for any inspections and clearances required.
d. Install all devices as specified or directed by manufacturer instructions.

C. SYSTEM STARTUP

a. Firmware update and initial setup
   1) Network connected devices must not be connected to City networks before approval is received. Where network-connected devices require firmware updates or other software installed before operation, the contractor must perform initial setup and any software installation at their shop location.
   2) Contractor devices/computers may not be connected to the City of Portland network at any time. Any network connections must be approved by the BTS representative.
b. System Configuration
   1) The contractor must coordinate with the Integrated Security representative for system configuration direction.
   2) System configuration files and directions will be provided via the City’s File Transfer system.
c. Dynamic Host Control Protocol (DHCP)
   1) As the contractor is configuring network-connected devices, devices should be set for automatic address assignment by the network. Do not configure any device with a static address unless directed so by the BTS representative.
d. City-Provided Network Switch Installation and Connections
   1) When directed to by the BTS authorized representative the contractor shall provide pricing for the installation of Owner-Furnished active network components. This includes but is not limited to:

a) Network Switches and/or Gateways
b) UPS
c) Patch Cable installation.

2) When directed, the BTS representative will provide direction on where and how to install select components.
3) Network Patch Cable Connections
   a) Network connections for Contractor or Owner-furnished equipment must be made only to the approved switch ports as directed by the BTS representatives.
   b) Do not disconnect any existing connections.
   c) Do not connect any devices which have not been already approved by the BTS representatives.

D. PRETESTING (CONTRACTOR QC)

a. Upon completing the systems' physical installation, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
b. Pre-testing Procedures:
   1) During the system pretest the Contractor shall verify (utilizing approved test equipment) that the system is fully operational and meets all the system performance requirements of the Project.
   2) The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum:
      a) Field Control Panels.
      b) All Networked locations.
      c) System trouble reporting.
      d) System electrical supervision.
      e) Quality of video and audio
      f) System response time for alarm events
      g) Interface features to subsystems and other systems specified under other sections
      h) The Contractor shall provide written certification that the system is ready for the formal acceptance test and camera aiming support.

c. 2 weeks prior to substantial completion, the contractor must notify the Projects' General Contractor and/or Integrated Security representative of the installation progress and request a formal acceptance test.
d. Integrated Security will schedule the inspection with the Bureau of Technology Services (BTS) for workmanship and system functionality.

E. INSPECTION, COMMISSIONING AND ACCEPTANCE (CITY OF PORTLAND QC)

a. Results Expected:
   1) Electronic Security Systems shall be complete and ready for use.
   2) Testing, start-up and cleaning work shall be complete.
   3) Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Integrated Security/BTS representative.

b. Installation Inspection
   1) Once all electronic security systems cabling has been installed and properly supported and any suspended light fixtures hung, but prior to the installation of ceiling tiles/material, contractor shall request of the Integrated Security representative, in writing, for the official above-ceiling and final camera placement inspection. The Integrated Security representative will then schedule a time to be on-site to conduct this inspection.
   2) Inspection Points: Integrated Security/BTS will be onsite to confirm the following:
      a) That any items from the previous inspections by Others have been corrected.
      b) That the camera locations can provide the required field of view.
      c) That electronic security systems cabling is routed correctly and adequately supported.
      d) That electronic security systems cabling is not painted or over-sprayed.
      e) That the installed electronic security systems cabling matches what was specified/submitted.
      f) That there are no kinks, splices, or other damage to the installed electronic security systems cabling.
      g) That all field devices are properly supported, oriented and labeled.
      h) That all penetrations through fire-rated walls are properly fire-stopped, including fire blocking materials installed in the annular spaces; and that the firestops are properly labeled.
      i) System demonstrations: Performance of all systems installed as part of the project must be demonstrated and verified as functional by the Integrated Security representative.

F. FINAL COMPLETION
   a. Where system deficiencies are found during Acceptance Testing, the contractor will correct any punch list items and alert the Integrated Security representative and schedule a final acceptance test.
   b. Once the Integrated Security representative has received confirmation of passing acceptance testing, the contractor may submit final payment invoices.

3.05 TRAINING

A. The contractor shall provide full system training to all customer-designated employees. Training shall include no less than (2) 2-hour sessions.

3.06 WARRANTY

A. Contractor shall provide a (1) year Warranty on all labor.

B. Warranty shall include a 24-hour communication response time from contractor for any system issues for a period of (1) year.

C. The contractor is responsible for providing labor for troubleshooting and resolving all post- installation issues for all installed components for a period of (1) year.

D. All manufacturer equipment warranties are to be registered by the contractor.
   1. Installation Warranted to be free from defects in materials, workmanship, and performance for a minimum of 1 year from date of installation.
      a. At Closeout, provide to Owner an executed copy of manufacturer's standard limited warranty against manufacturing defects, outlining terms, conditions, and exclusions from coverage.

END OF SECTION

SECTION 28 1000 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Access control devices as shown on the Drawings.

B. Access control panels and power supplies.

C. Security system software to monitor and control devices.

1.2 RELATED REQUIREMENTS

A. Division 08, Door Hardware

B. Section 26 05 19, Conductors and Connectors for Electrical Systems

C. Section 27 10 00, Structured Cabling

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ANSI/TIA/EIA Structured Cabling Standards 568, 569, 606 and 607, latest edition.

1.4 SYSTEM OPERATION

A. Magnetic Card Readers will allow access to the facility when a valid Card Key or Fob is presented to the reader.

B. Card Readers will be controlled from a security control panel.

C. Electric door strikes and exit hardware will be provided by the door hardware supplier at access-controlled doors, as shown on Drawings.

D. Emergency push button shall be provided at the receptionist area to initiate lock down of all access doors when required.

E. Request-to-exit sensors will be provided at indicated access-controlled doors to allow unalarmed egress.

F. Magnetic door contacts will be provided at exterior doors to detect unauthorized entry and to provide an intrusion alarm.

1.5 SUBMITTALS

A. Section 0 133 00, Submittals

B. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required.

C. Product Data: Provide product cutsheets of all system products proposed for installation as part of this project.

D. Test Reports: Indicate satisfactory completion of required tests and inspections.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of access authorization equipment.

G. Warranty of materials and workmanship.

H. Operation Data: Operating instructions.

I. Maintenance Data: Maintenance and repair procedures.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience and with service facilities within 50 miles of Project.

C. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years documented experience.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and matching existing system.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Electronic Access Control system and software:

1. S2
2. Bosch
3. Or Approved Equal

B. Power Supplies: provide 20% spare capacity

1. Altronix
2. Honeywell
3. Or Approved Equal.

C. Door Position Switch/Contact: (see Door Hardware scheduled for additional information)

1. GE
2. Honeywell
3. Sentrol
4. or approved equivalent.

D. Input Devices:

1. HID
2. or approved non-proprietary equivalent

2.2 ACCESS CONTROL SYSTEM

A. Access Control System: Control access to building using existing or newly issued proximity cards or fobs and PIN codes, as directed on the contract documents.

1. Exterior Doors: Control access into building via selected doors as shown on Drawings.

2.3 SECURITY MANAGEMENT SYSTEM (SMS)

A. Provide and install the following:

1. An SMS that is capable of controlling and monitoring the access control system and intrusion alarm system and that has an interconnection with the video surveillance system.
2. An SMS that is designed to control and/or interface with standard OEM equipment.
3. An SMS that uses modular architecture to allow easy integration of the following:

a. Access Control.
b. Intrusion detection.
c. Elevator control.
d. Time and attendance.
e. CCTV system integration.
f. Alarm receiver interface.
g. Badging capabilities.
h. Employee and visitor database.

4. Provide one server license and four client licenses.

2.4 MAIN CONTROL PANEL

A. Provide and install the following:

1. A main panel that has the overall system intelligence, any required additional input/output boards and the communication controllers required for remote monitoring and control.
2. A main panel that is modular and can have optional systems and functionality added per project requirements.

2.5 DOOR CONTROL PANEL

A. Local door controller to consist of a scalable architecture, allowing monitoring and control of single or multiple doors per controller.

B. Door controller to utilize on-board microprocessors and database storage for off-network door control capabilities.

C. Door controller to be connected and managed through Ethernet, RS-232, RS-485 or wireless communications. Ethernet wiring to be Cat6 as specified in Section 27 10 00, Structured Cabling, RS-232 and RS-485 to be West Penn or approved equivalent.

D. Door controller to match the brand manufacturer of the main control panel and operate in conjunction with that system.

2.6 COMPONENTS

A. Provide specified components that are UL listed for this application and ADA compliant.

B. Provide minimum 4-hour battery backup for all powered components.

2.7 PROXIMITY MAGNETIC CARD READER/PIN PAD

A. Provide ADA compliant reader/pin pad with a bi-color LED which is illuminated red or green to indicate operational status.

B. Proximity reader shall be able to read 26 bit Wiegand codes.

C. Reader may be located up to 500-feet away from main controller.

2.8 ACCESS CONTROL FOBS

A. HID fobs able to work with 26 bit Wiegand reader

2.9 REQUEST TO EXIT SENSOR

A. Provide passive infrared motion detector to allow unalarmed egress from secured areas, as indicated on Drawings.

B. Provide detector with adjustable sensitivity and field of view.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Make conduit and wiring connections to door hardware devices furnished and installed under Section 08 71 00.

C. Connect security control panels to the Owner data network via Category 6 cables terminated on the appropriate patch panel in the nearest IDF room.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Manufacturer Services: Furnish services of technician to supervise installation, adjustments, final connections, system testing, and to train Owner’s personnel.

3.3 CLOSEOUT ACTIVITIES

A. Demonstrate normal and abnormal modes of operation, and required response to each.

B. Provide 4 hours of instruction each for two persons.

1. Conduct instruction at project site.

END OF SECTION

SECTION 28 1300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Access control devices to be relocated and/or added to existing PP&R TRACS System based on the Lenel OnGuard PROI Access Control System (ACS).

B. Additional power supplies and door controllers, if required to accommodate new devices.

1.2 RELATED REQUIREMENTS

A. Section 01 33 00, Submittals

B. Section 08 71 00, Door Hardware

C. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables

D. Section 28 05 00, Common Work Results for Electronic Safety and Security

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most recent edition adopted by Authority Having Jurisdiction, including all applicable amendments and supplements.

1.4 SYSTEM OPERATION

A. Magnetic Card Readers will allow access to the facility when a valid Card Key is presented to the reader.

B. Card Readers will be controlled from a security control panel.

C. Electric door locks and exit hardware will be provided by the door hardware supplier at access-controlled doors, as shown on Drawings.

D. Request-to-exit sensors will be provided at access-controlled doors to allow unalarmed egress.

E. Magnetic door contacts will be included at each access-controlled door to provide intrusion detection.

1.5 SUBMITTALS

A. Section 01 33 00, Submittals

B. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required.

C. Product Data: Provide electrical characteristics and connection requirements.

D. Test Reports: Indicate satisfactory completion of required tests and inspections.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of access authorization equipment.

G. Operation Data: Operating instructions.

H. Maintenance Data: Maintenance and repair procedures.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of experience and with service facilities within 50 miles of the project.

C. Installer Qualifications: Company specializing in installing the products specified in this section with minimum five years documented experience installing and servicing the Lenel OnGuard Platform. The Contractor shall have at least two Lenel Certified Master Level Application Engineers on staff in Oregon.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and matching existing system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Control System Software provided by Owner. Contractor provided devices shall match existing components.

2.2 ACCESS CONTROL SYSTEM

A. Access Control System: Control access to building and selected areas using existing proximity cards.

1. Building Areas: Control access into selected areas as shown on drawings.

2.3 COMPONENTS

A. Provide components that are UL listed for this application and ADA compliant.

B. Provide minimum 4-hour battery backup for all powered components.

2.4 PROXIMITY MAGNETIC CARD READER

A. Provide ADA compliant reader with a bi-color LED which is illuminated red or green to indicate operational status, XCEED HID

B. Reader may be located up to 500-feet away from main controller.

2.5 REQUEST TO EXIT SENSOR

A. Provide motion detector to allow unalarmed egress from secured areas, DS 160.

B. Provide detector with adjustable sensitivity and field of view.

2.6 MAGNETIC DOOR CONTACTS

A. Provide 3/4-inch diameter self-locking magnetic contacts.

B. Coordinate with architectural door hardware requirements.

2.7 POWER SUPPLIES

A. If required, provide additional Altronix 12 VDC, 6 amp power supplies with 4 hour battery backup.

2.8 DOOR CONTROLLERS

A. If required, provide additional Lenel Reader Interface Modules (Single and/or Dual).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Make conduit and wiring connections to door hardware devices furnished and installed under Section 08 71 00, Door Hardware.

C. The cabling, raceway, backboxes and device/component mounting provisions are installed as part of the project work.

D. Cable specifications, quantity and routing is provided from an Owner pre-qualified installation Contractor. This access control system installation Contractor is independent of the project direct contract work. The project contract work is responsible for coordination and schedule of obtaining all required installation information required to support the final device installation, termination, testing and operation from the access control system installation Contractor.

E. The final access control system, device termination, mounting, programming and testing is by a separate Owner Contract. This separate access control system installation contract is in coordination with the project construction contract.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 45 00.

B. Manufacturer Services: Furnish services of technician to supervise installation, adjustments, final connections, system testing, and to train Owner's personnel.

3.3 CLOSEOUT ACTIVITIES

A. Demonstrate normal and abnormal modes of operation, and required response to each.

B. Provide 4 hours of instruction each for two persons.

1. Conduct instruction at project site.

END OF SECTION

SECTION 28 2000 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. IP Cameras.

B. Enclosures.

C. Lenses.

D. Cable and accessories.

E. Network Video Recorder

F. Software to Control, Monitor and Record camera views.

1.2 RELATED REQUIREMENTS

A. Section 28 05 00, Common Work Results for Electronic Safety and Security

B. Section 27 10 00, Structured Cabling

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 33 00, Submittals

B. Shop Drawings: Indicate electrical characteristics and connection requirements, including system wiring diagrams.

C. Product Data: Provide cut-sheets showing electrical characteristics and connection requirements for each component. Where multiple products are called for on the same cut-sheet, clearly mark or highlight proposed product.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of cameras and routing of cabling.

F. Operation Data: Instructions for starting and operating system.

G. Maintenance Data: Routine trouble shooting procedures.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience and with service facilities within 100 miles of Project.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE SYSTEM

A. Video Surveillance System: Provide a complete video surveillance system as indicated on the contract drawings. System shall extend from the designated communications room to each of the camera locations shown on the drawings. System shall include all necessary cabling, connections, mounts, recording and archival system, cameras, and all associated lenses.

2.2 COMPONENTS

A. Fixed and PTZ Cameras:

1. Pan-Tilt-Zoom IP Cameras with RJ45 port and PoE capability. Lenses are individually aligned to provide Owner-approved Field of View.
2. Single lens IP cameras with RJ45 port and PoE capability.
3. Cameras shall incorporate motion detection capability to allow viewing/recording when motion is detected.
4. Camera system shall incorporate video analytic data with surveillance feeds. Data shall include:

    a. Dynamic Masking
    b. Flame and Smoke detection
    c. Motion Detection
    d. Shape recognition
    e. Tamper Detection
    f. Loitering Detection

5. Approved Manufacturers

    a. Avigilon
    b. Axis
    c. Pelco
    d. Bosch
    e. Or Approved Equal

B. Enclosures:

1. Fixed Cameras shall be wall or parapet mount, tamper-resistant dome style housings which allow full X, Y and Z aiming. Provide wall mount as required to provide Owner-specified field of view.

    a. Approved Manufacturers

        1) Avigilon
        2) Axis
        3) Pelco
        4) Bosch
        5) Or Approved Equal

C. Lenses:

1. Select and position appropriate auto-iris or fixed-iris lenses at each location to provide owner-approved exact fields of view.

D. Video Management System

1. Provide network-based video management system to record and archive video surveillance feeds from each of the specified cameras.
2. Video Management System shall retain 14 days of surveillance footage.
3. System shall provide user-authenticated access on select internal PCs
4. System provided shall be compatible with all cameras provided as part of this project.

    a. Approved Manufacturers

        1) S2
        2) Milestone
        3) Avigilon
        4) Or Approved Equal

E. Cables:

1. TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with white jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. Provide NFPA 70 type CMR riser-rated cable.
2. Power Supply Cabling:

    a. Provide applicable cabling to provide power to all exterior camera locations.
    b. Cabling shall be rated for its installed environment.

F. Power Supplies

1. Honeywell HP300ULM power supply, 12V DC option.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Remove systems previously utilized for video surveillance that are being replaced.

B. Provide existing system to owner.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Adjust final location to provide Owner-approved exact field of view.

C. Route Category 6 cables from camera outlet to the appropriate patch panel in the nearest IDF room. Labels to be determined by Owner.

3.3 FIELD QUALITY CONTROL

A. See Section 01 45 00, Quality Control Requirements.

B. Provide the services of manufacturer's technical representative to interface to existing network and supervise final wiring connections and camera adjustments.

3.4 ADJUSTING

A. Adjust field of view to meet Owner requirements.

END OF SECTION

SECTION 28 4621.11 – ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

B. Related Requirements:
1. Section 27 1513 "Communications Copper Horizontal Cabling" for cables and conductors for fire-alarm systems.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Owner.
2. Shop Drawings shall be prepared by persons with the following qualifications:
a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified, fire-alarm technician; [Level III] [Level IV] minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.
1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.

7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

E. Permits: Prior to construction, contractor is to secure a permit to install from the City's Fire Marshal's Office, the application can be found here: https://www.portlandoregon.gov/fire/article/76836 .
1. Submit a copy of the approved permit to the Owner.

1.3 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 01 4000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

A. Qualification Data: For Installer.

Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 26 0548.16 "Seismic Controls for Electrical Systems." See ASCE/SEI 7 for certification requirements for equipment and components.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following[and deliver copies to authorities having jurisdiction]:
      a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
      b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
      c. Complete wiring diagrams showing connections between all devices and equipment.
      d. Riser diagram.
      e. Record copy of site-specific software.
      f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
         1) Equipment tested.
         2) Frequency of testing of installed components.
         3) Frequency of inspection of installed components.
         4) Requirements and recommendations related to results of maintenance.
         5) Manufacturer's user training manuals.
      g. Manufacturer's required maintenance related to system warranty requirements.
      h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm [Level II] [Level III] [Level IV] technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72 by <Insert certification agency>.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
   1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
   2. Warranty Period: [Five] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, [UL-certified] [FM Global-placarded] addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices[and systems]:
   1. Manual stations.

2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Carbon monoxide detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.
10. <Insert alarm-initiating devices and systems>.

B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit[and remote annunciators].
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate preaction system.
9. Recall elevators to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Activate emergency lighting control.

If supplies are not essential to life safety, retain first subparagraph below for shutoffs installed in supplies that may be hazardous.

12. Activate emergency shutoffs for gas and fuel supplies.
13. Record events in the system memory.
14. <Insert signal-initiating actions>.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Loss of communication with any panel on the network.
5. <Insert supervisory signal-initiating devices and actions>.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.

6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. <Insert trouble signal-initiating devices and actions>.

E. System Supervisory Signal Actions:
1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit[and remote annunciators].
3. After a time delay of [200 seconds] <Insert time delay>, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event]."

2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Silent Knight; Honeywell International, Inc.

B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, [80] <Insert number> characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, [Class B] [Class D] [Class E].
2. Pathway Survivability: [Level 0] [Level 1].

E. Notification-Appliance Circuit:
   1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
   2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
   3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Elevator Recall:
   1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
      a. Elevator lobby detectors except the lobby detector on the designated floor.
      b. Smoke detector in elevator machine room.
      c. Smoke detectors in elevator hoistway.
   2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
   3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
      a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall [be] [not be] connected to fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, [supervisory signals] [supervisory and digital alarm communicator transmitters] [and] [digital alarm radio transmitters] shall be powered by 24-V dc source.
   1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.5 MANUAL FIRE-ALARM BOXES

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
1. Single-action mechanism, [breaking-glass or plastic-rod] [pull-lever] type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.6 SYSTEM SMOKE DETECTORS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be [four] [two]-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated[and power-on status].
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition[and individually adjustable for sensitivity by fire-alarm control unit].
    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    a. Primary status.
    b. Device type.

c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

D. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.
1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.8 NONSYSTEM SMOKE DETECTORS

A. General Requirements for Nonsystem Smoke Detectors:
   1. Nonsystem smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
   2. Nonsystem smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

B. Single-Station Smoke Detectors:

   1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac[with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device].
   2. Auxiliary Relays: One [Form C, rated at 0.5 A] [Form A and one Form C, both rated at 0.5 A].
   3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet according to UL 464.
   4. Visible Notification Appliance: 177-cd strobe.
   5. Heat sensor, 135 deg F [combination rate-of-rise and]fixed temperature.
   6. Test Switch: Push to test; simulates smoke at rated obscuration.
   7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
   8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
   10. Integral Visual-Indicating Light: LED type, indicating detector has operated[and power-on status].

C. Single-Station Duct Smoke Detectors:
   1. Comply with UL 268A; operating at 120-V ac.
   2. Sensor: LED or infrared light source with matching silicon-cell receiver.
      a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot when tested according to UL 268A.
   3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
      a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; listed for use with the supplied detector.
   4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
   5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.9 HEAT DETECTORS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. General Requirements for Heat Detectors: Comply with UL 521.
1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.
1. Mounting: [Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.
1. Mounting: [Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.10 NOTIFICATION APPLIANCES

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Chimes: Vibrating type.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.

E. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
1. Mounting: Wall mounted unless otherwise indicated.
2. Flashing shall be in a temporal pattern, synchronized with other units.
3. Strobe Leads: Factory connected to screw terminals.
4. Mounting Faceplate: Factory finished, [red] [white].

2.11 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
   2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
   3. Rating: 24-V ac or dc.
   4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.12 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
   1. Provide Telguard TG-7FS LTE-V unless otherwise approved by Owner.
   2. Mounting: [Flush] [Surface] cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.13 ADDRESSABLE INTERFACE DEVICE

A. General:
   1. Include address-setting means on the module.
   2. Store an internal identifying code for control panel use to identify the module type.
   3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal [to elevator controller to initiate elevator recall] [to circuit-breaker shunt trip for power shutdown] <Insert functions>.
   1. Allow the control panel to switch the relay contacts on command.
   2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:
   1. Operate notification devices.
   2. Operate solenoids for use in sprinkler service.
   3. <Insert other functions>.

2.14 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture [one] [two] telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.
6. <Insert local function>.

D. Digital data transmission shall include the following:
1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.
9. <Insert signal to be transmitted>.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

C. Equipment Mounting: Install fire-alarm control unit on finished floor.
   1. Comply with requirements for seismic-restraint devices specified in Section 27 0548.16 "Seismic Controls for Communications Systems."

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
   1. Comply with requirements for seismic-restraint devices specified in Section 27 0548.16 "Seismic Controls for Communications Systems."

E. Manual Fire-Alarm Boxes:
   1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
   2. Mount manual fire-alarm box on a background of a contrasting color.
   3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.
   1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 7100 "Door Hardware." Connect hardware and devices to fire-alarm system.
   1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Smoke dampers in air ducts of designated HVAC duct systems.
   2. Magnetically held-open doors.
   3. Electronically locked doors and access gates.
   4. Alarm-initiating connection to elevator recall system and components.
   5. Alarm-initiating connection to activate emergency lighting control.
   6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
   7. Supervisory connections at valve supervisory switches.
   8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
   9. Supervisory connections at elevator shunt-trip breaker.
   10. Supervisory connections at fire-extinguisher locations.
   11. <Insert connections>.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 27 0553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by [Owner] [authorities having jurisdiction] <Insert names or titles of witnesses>.

B. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
      b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
   4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
   5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
   6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for [two] <Insert number> years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within [two] <Insert number> years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least [30] <Insert number> days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 11 10 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Locate existing utilities.
   2. Protection of existing vegetation, landscaping materials, utilities, pavement and site improvements 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 of curbs, slabs, fencing, catch basins, pavement, utility structures and lines and other items as required to install new improvements.
   6. Removal and legal disposal off site of material resulting from these operations.

1.2 REFERENCES

A. Reference the following standards
   1. Current WSDOT Standard Specifications for Road, Bridge and Municipal Construction.

1.3 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. Contractor shall provide temporary building access as indicated in the plans.

D. Maintain street drains and sewers open for free drainage.

E. Objectionable Noises: Conform with local governing 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. Contractor shall provide temporary building access as indicated in the plans.

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. The contractor shall hand-dig excavations below 4-feet in depth to protect the existing underground utilities.

1.5 DIMENSIONS 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 Engineer prior to commencing work.

B. Prior to commencement, meet with the Architect to review construction plan. Locate and clearly flag trees and vegetation to remain or be relocated. Provide protection for landscape materials to remain.

C. Verify that site improvement removal may safely and appropriately begin.

3.2 EROSION CONTROL

A. Refer to TESC plan.

B. Construct and maintain TESC measures in accordance with the plans and Section 31 25 00 Erosion and Sedimentation Controls.

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 as directed by Project Engineer and Project Landscape Architect.

B. Do no clearing within those areas that the Engineer and Landscape Architect specifies to remain undisturbed. Contractor to coordinate Engineer and Landscape Architect to be on site prior to site work.

3.4 GRUBBING

A. Grub all areas to be graded, except as noted below.

B. Do no grubbing within areas that the Engineer and Project Architect specifies 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.

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 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 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 or per the County inspector to prevent sediment transport either downstream or offsite. At no time shall more than one foot of sediment be allowed to accumulate within a catch basin, ditch, or swale. 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 in accordance with Section 31 20 00 Earth Moving. 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.
   1. Arrange to shut off indicated utilities with utility companies.
   2. 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.

B. Remove and dispose of existing structures and pipes as indicated on plan. Plug or cap all pipes to remain unless designated otherwise on plans.

C. Abandonment of existing catch basins, inlets and other utility structures: per Engineer.

D. Cap or plug pipes per Engineer.

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. 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

PART 1 - GENERAL

1.1 SUMMARY

A. 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.

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 hot-mix asphalt 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-grad 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.

1.3 REFERENCES

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. Contractor shall provide temporary building access as indicated in the plans.

D. Maintain street drains and sewers open for free drainage.

E. Objectionable Noises: Conform with local governing 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. Contractor shall provide temporary building access as indicated in the plans.

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. The contractor shall hand-dig excavations below 4-feet in depth to protect the existing underground utilities.

1.5 DIMENSIONS 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 Engineer prior to commencing work.

B. Prior to commencement, meet with the Architect to review construction plan. Locate and clearly flag trees and vegetation to remain or be relocated. Provide protection for landscape materials to remain.

C. Verify that site improvement removal may safely and appropriately begin.

3.2 EROSION CONTROL

A. Refer to TESC plan.

B. Construct and maintain TESC measures in accordance with the plans and Section 31 25 00 Erosion and Sedimentation Controls.

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 as directed by Project Engineer and Project Architect.

B. Do no clearing within those areas that the Engineer and Architect specifies to remain undisturbed. Contractor to coordinate Engineer and Landscape Architect to be on site prior to site work.

3.4 GRUBBING

A. Grub all areas to be graded, except as noted below.

B. Do no grubbing within areas that the Engineer and Project Landscape Architect specifies 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.

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 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 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 or per the County inspector to prevent sediment transport either downstream or offsite. At no time shall more than one foot of sediment be allowed to accumulate within a catch basin, ditch, or swale. 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 in accordance with Section 31 20 00 Earth Moving. 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.
   1. Arrange to shut off indicated utilities with utility companies.
   2. 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.

B. Remove and dispose of existing structures and pipes as indicated on plan. Plug or cap all pipes to remain unless designated otherwise on plans.

C. Abandonment of existing catch basins, inlets and other utility structures: per Engineer.

D. Cap or plug pipes per Engineer.

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. 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

SECTION 312500 – EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

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. 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. The Contractor is responsible for installation, maintenance, and revisions to the erosion and sediment control measures as site conditions change.

1.2 REFERENCES

A. Washington State Department of Ecology (DOE) Stormwater Management Manual for Western Washington, Current Edition.

B. Temporary Erosion and Sedimentation Control (TESC) plans.

PART 2 - PRODUCTS

A. Erosion control and sediment control products are numerous and varied. The following is a listing of the 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 pre-fabricated silt fence, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Maintain, upgrade and/or relocate existing temporary erosion and sedimentation control measures as necessary.
   1. 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.
   2. 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.
   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. 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.
   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.

C. When the owner's execution requirements are more stringent than DOE, the owners requirement's shall be met.

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. Storm drains shall be installed in accordance with Section 33 41 00. Clean storm drain system of all debris following removal of TESC facilities and following permanent stabilization of site

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:
   1. Saw-cutting and removing existing asphalt concrete pavement.
   2. Removing unsuitable base material.
   3. Furnishing and placing base course materials for asphalt concrete pavement.
   4. Furnishing and placing plant mix asphalt concrete.
   5. Furnishing and placing extruded asphalt concrete curb.

B. Work shall be in accordance with WSDOT-APWA Section 5-04, except as modified herein.

C. Pavement sections shall be plans.

1.2 REFERENCES

A. Current WSDOT Standard Specifications for Road, Bridge and Municipal Construction.

B. ASTM D155 Methods of Test for Moisture-Density Relations of Soils, Using 10 lb (4.5 kg) Rammer and 18 In. (457 mm) Drop

C. ASTM D2922 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

D. APWA Designs and Specifications for Asphalt Concrete Pavements and Bases, 1990 Edition.

1.3 SYSTEM DESCRIPTION

A. This work shall consist of one or more courses of plant mixed asphalt concrete placed on a prepared foundation, base, or existing pavement 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.

B. Asphalt concrete shall be composed of asphalt and aggregate which, with or without the addition of mineral filler and blending sand as may be required, shall be mixed in the proportions specified to provide a homogenous, stable and workable mixture.

1.4 SUBMITTALS

A. Submit Certificates: Furnish certification that all materials comply with Specification requirements; include laboratory test reports verifying compliance. Tests shall have been performed within 4 months of anticipated use of material.
   1. Mixing plant to be member of Asphalt Paving Association of Washington (APAW) and approved by Engineer.
   2. Certified test results that meet WSDOT and or Washington Chapter of APWA. Testing requirements shall have been performed within 4 months of anticipated use of material.

1.5 PROJECT SITE CONDITIONS

A. Environmental Requirements:
   1. In accordance with referenced standard specifications and the following:
      a. Do no paving in rain or when subgrade or base is wet or frozen.
      b. Do not apply tack coats when temperature is below 50 degrees F. or when base is wet.
      c. Apply asphalt concrete paving only when temperature is above 40 degrees and when base is dry.

1.6 WARRANTY

A. Note that work correction is to include aggregate separation, soft spots, and excess porosity.

B. Repair cracks; repair unsatisfactory elevation irregularities immediately upon notification; replace any paving not draining properly.

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.
   1. Conform to APAW - Section II, "Specifications for Asphalt Paving" of above referenced manual.

2.2 CRUSHED SURFACING

A. Crushed surfacing shall conform to the requirements of Section 9-03.9(3) of the WSDOT Standard Specifications (see plans and soils report for more information).

2.3 ASPHALT CONCRETE

A. Asphalt concrete shall be Commercial Hot Mix. Asphalt concrete mixing and proportioning shall comply with APWA and WSDOT Section 5-04 (HMA Class ½”, PG 64-22):

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to plans 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. Maximum variations in finished grade of paving shall be +/- 1/16" in 10 feet.
   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.
   3. Where new pavement is to abut existing concrete or asphalt pavement, the existing pavement shall be sawcut to provide a neat and straight edge at the joint.

B. Preparation of Asphalt Patches:
   1. Where existing asphalt concrete pavement upon a granular base is required to be removed due to trenching or regrading, the area shall be uniformly defined in size and shape. The existing asphalt shall be removed by sawcutting pavement vertically at a sufficient distance of at least 6 inches outside the undisturbed base surface, and then the affected pavement shall be broken up and removed.

C. Preparation of Sub-grade: Sub-grade shall be prepared in accordance with these Specifications and the Geotech Report.

3.3 BALLAST AND CRUSHED SURFACING

A. Contractor Placement of crushed surfacing shall comply with WSDOT. Compaction shall be as specified in the soils report.

B. Prior to asphalt placement the prepared surface shall be treated in accordance with Section 5-04.3 of WSDOT.

3.4 ASPHALT CONCRETE

A. Placement of asphalt shall be in accordance with WSDOT.
   1. Asphalt shall be placed in one lift.
   2. All patching of existing asphalt paved surfaces shall be per the trenching detail in the plans.

B. Joints shall be constructed in accordance with Section 5-04.3(12). Surface smoothness shall be in accordance with section 5-04.3(13). Paving shall be accomplished in accordance with the weather limitations outline in Section 5-04.3(16).

3.5 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphaltic materials.

B. Do not permit vehicular traffic on asphaltic paving until it has cooled and hardened, and in no case sooner than six (6) hours after placing.

C. Provide barricades and warning devices as required and in accordance with WSDOT/APWA, and MUTCD.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete Walks
   2. Concrete Access Ramps
   3. Concrete Pavement
   4. Concrete Curbs

1.2 REFERENCES

A. Current WSDOT Specifications for Roads, Bridges and Municipal Construction.

B. American Concrete Institute (ACI)
   1. 301 – Specifications for Structural Concrete
   2. 315 – Details and Detailing of Concrete Reinforcement

C. American Society for Testing and Materials (ASTM)
   1. A615 Deformed and Plain Billet-Steel for Concrete Reinforcement
   2. C33 Specifications for Concrete Aggregates
   3. C94 Specifications for Ready Mixed Concrete
   4. C132 Test for Slump of Portland Cement Concrete
   5. C150 Specification for Portland Cement
   6. C156 Test Method for Water Retention by Concrete Curing Materials
   7. C171Specification for Sheet Materials for Curing Concrete
   8. C260 Specifications for Air-Entraining Admixtures for Concrete
   9. C309 Specification for Liquid Membrane Forming Compounds for Curing Compounds
   10. C494 Specifications for Chemical Admixtures for Concrete
   11. C595 Blending Hydraulic Cements (excluding slag cements)
   12. D1751 Performed Expansion Joint Fillers for Concrete Paving and Structural Construction

D. U.S. Army Corps of Engineers
   1. CRD-C-621-83 Specifications for Non-Shrink Grout

E. DOT / APWA - Specifications

1.3 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions following standards except where requirements that are more stringent as indicated:
   1. Section 8-04 and 9-14 of WSDOT Standard Specifications for Road, Bridges, and Municipal Construction 2018.
   2. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

B. Perform work in accordance with ACI 301, unless indicated or specified otherwise.

C. Concrete work is subject to special testing and inspection.

D. Acquire cement and aggregate from the same source for all work.

E. Conform to ACI 305R when placing concrete during hot weather.

F. Conform to ACI 306R when placing concrete during cold weather.

G. Field sample mock-ups:
   1. Provide mock-ups, as required by the Engineer, until approval is obtained.
   2. Do not proceed with subsequent work until approval of the mock-up is obtained.
   3. Approval of mock-up shall be the standard of workmanship and materials for the remainder of the work similar to the mock-up.
   4. Maintain mock-up in approved condition, until directed otherwise.
   5. Unless specified otherwise, remove mock-up at completion, when directed by the Engineer.

6. Unless specified or approved otherwise, schedule mock-ups a minimum of 5 working days between mock-up and actual installation of the work represented by the mock-up and actual installation of the work represented by the mock-up.
7. Notify the Engineer and Owner a minimum of 5 working days prior to mock-up.

1.4 SUBMITTALS

A. 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.

B. Letter of verification regarding manufacturer's recommendation.
   1. Curing agents and applied surfacing system compatibility.
   2. Slab finish and applied surfacing, system capability

C. Shop Drawings:
   1. Reinforcing and Concrete Configuration
      a. Detail reinforcing in accordance with ACI 315, or as shown on drawings. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing, bending and cutting schedules, splicing and supporting and spacing devices.
      b. Indicate embedded items.
      c. Show concrete configurations
   2. Slab Layouts: Dimension locations of control, expansion, and construction joints. Relate to stone banding surfacing.

D. Product Date: Submit for each accessory, admixture, and curing material proposed for the work.

E. Mix Designs: Prior to concrete work, submit mix designs and source supplier for approval and quality control monitoring.
   1. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

1.5 WARRANTY

A. Replace cracked sidewalk panels, unsatisfactory finish work, irregularities immediately upon notification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Sidewalks shall be commercial Class 3000 concrete per Section 6-02 of WSDOT.

B. Concrete Mix: Comply with requirements of Section 5-05.3(5) of WSDOT Standard Specifications for Road, Bridges, and Municipal Construction 2020.

2.2 FORMS

A. Forms shall be metal or wood and comply with Section 8-14.3(2) of WSDOT Standard Specifications for Road, Bridges, and Municipal Construction 2016.

2.3 ADMIXTURES

A. Air-Entrainment: ASTM C260; Master Builders Inc. "Micro-Air" or "MMBVR" Euclid Chemical Co. "Air Mix" or approved.

B. Water Reducer Normal: ASTM C494, Type A; Master Builders, Inc. "Pozzolith N" Euclid Chemical Co., "Eucon WR 75" or approved.

C. High Range Water Reducer (Superplasticizer): ASTM C494 Type F or G and shall be of the second or third generation type. Shall be batch planted added, extend plasticity time, reduce water 20 to 30 percent. Master Builders Inc. “Rheobuild”, Euclid Chemical “Eucon 37”, or approved.

D. Accelerator: ASTM C494, Type C or E non-corrosive, non-chloride; Master Builders “Pozzutech 20”, Euclid Chemical Co “Acclegard90” or approved.

E. Set Retarder: ASTM C494, Type B

2.4 ACCESSORIES

A. Bonding Agent: Polyvinyl Acetate.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain or adversely affect concrete surfaces or court coating surface, and will not impact subsequent treatments of concrete surfaces when applied to forms or form liners.

C. Control Joints: ¼” thickness zinc plated or approved equal. As manufactured by Terrazo Stone and Marble. Depth to 1 ½” thickness of the slab.

D. Curing Materials:
   1. Waterproof Sheet Material: Waterproof paper in accordance with ASTM C171; reinforced waterproof Kraft paper; white color at exterior applications; Burke Kraft Curing Paper Type I-SK-30, or approved.
   2. Curing Compound: Must be thoroughly verified. ASTM C309; clear or translucent with fugitive dye; moisture loss not more than 0.03 gr./sq.cm. when tested in accordance with ASTM C156 and applied in a single coat at the manufacturer’s recommended rate. Euclid Chemical Co. “Kurz DR” or approved. Verify curing compounds are compatible with subsequently applied court surface coating and finishing systems.

2.5 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94, and in accordance with the requirements indicated on the drawings.

B. Concrete shall meet the requirements of ACI 318-11 for Type F1 concrete. Maximum water/cement ratio 0.45; Min compressive strength per plan; Air content per ACI 318-11 Table 4.4.1.

C. Admixtures:
   1. All exposed concrete is integral color mix.
   2. All concrete shall contain the specified water reducing or high range water reducing admixture, except architectural concrete, and concrete with a required water/cement ratio of 0.45 or lower shall contain a high range water reducing admixture.
   3. All concrete required to be air entrained shall contain air entraining admixture to produce 4% to 6% air.
   4. All concrete placed in ambient temperatures from 40o F to 20o F, all slab concrete placed in ambient temperatures below 50o F shall contain an accelerator at the manufacturer’s required dosage.

PART 3 - EXECUTION

3.1 PLACING AND FINISHING

A. Refer to plans

B. Comply with the requirements of Section 8-14.3(3) of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2020 and ACI 301.

C. Thoroughly compact concrete during and after pouring so as to eliminate honeycombing and voids.

3.2 CURING

A. Comply with the requirements of Section 8-14.3(4) of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2020.

3.3 CONSTRUCTION JOINTS

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 as directed by Project Engineer and Project Landscape Architect.

B. Do no clearing within those areas that the Engineer and Landscape Architect specifies to remain undisturbed. Contractor to coordinate Engineer and Landscape Architect to be on site prior to site work.

3.4 CONCRETE STRENGTH

A. At 28 days, 3,000 psi or 4,000 psi (per plan) compressive.

3.5 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete and control jointing concrete not conforming to required lines, details, dimensions, tolerances or specified requirements shall be removed and replaced at no additional cost to the Owner.

B. Replacement of defective concrete will be determined by the Engineer

END OF SECTION

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Painting Pavement Marking for parking lot

1.2 REFERENCES

A. Current WSDOT Standard Specifications for Road, Bridge and Municipal Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint for pavement markings shall meet the requirements of Section 8-22 and 9-34 of the WSDOT-APWA Standard Specifications.

B. Selection of paint must be from WSDOT Qualified Products 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 40 degrees. Weather is not to be rainy or foggy.

C. Ensure paint is applied in two coats as specific application rates in Section 8-22.3(3)F of the WSDOT-APWA Standard Specifications.

D. Protect painting area until paint is completely dry and drivable.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnishing and installing new service lines.
   2. Connections to water service.
   3. Furnishing and installing all appurtenances required for the above work.
   4. Disinfection and flushing water main and service lines.

1.2 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials, including pipes, hydrants, gate valves, valve boxes, and fittings.

1.3 REFERENCES

A. Uniform Plumbing Code

B. Washington Administrative Code

C. Current WSDOT Specifications for Roads, Bridges and Municipal Construction

D. American Society for Testing Materials

E. American Water Works Association Standards

1.4 REGULATORY REQUIREMENTS

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.

1.5 PERMITS

A. All permits, fees and inspections dealing with the water distribution system are to be obtained or scheduled by the contractor at its expense.

1.6 DIMENSIONS AND LAYOUTS

A. The Contractor will 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 must be assigned to the Contractor's crew for this work. This equipment and personnel must 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 is responsible for preserving all benchmarks and stakes and the replacement of any that are displaced.

C. The Contractor is responsible for review of all Utility 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.

D. The Contractor is to notify the Owner immediately if underground utilities not shown on the records are encountered.

PART 2 - PRODUCTS

2.1 WATER SERVICE

A. Water service fittings shall be per WSDOT Standard Specifications.

2.2 PIPE AND FITTINGS

A. Water mains, services and fittings shall conform to Section 7-09 of the WSDOT Standard Specification.

B. Pipe (greater than 4 inches) and fitting materials shall be Polyvinyl Chloride (PVC) conforming to AWWA C900-07 DR 18, Pressure Class 235 and shall conform to Section 9-30.1(5)A of the WSDOT Standard Specification or approved equal.

C. All pipe and services shall be installed with continuous tracer tape installed 12 to 18 inches under the final ground surface. The marker shall be plastic non-biodegradable, metal core or backing which can be detected by a standard metal detector. Tape shall be Terra Tape “D” or approved equal. For water pipe and services, in addition to tracer tape, install 14 gauge, direct bury, U.S.E. blue coated copper wire, wrapped around or taped to the top of pipe.

2.3 VALVES

A. Valves shall be Kennedy flanged and in accordance with Section 9-30.3 of the WSDOT Standard Specification.

2.4 WATER SERVICE

A. Ductile iron pipe shall shall conform to Section 9-30.1(1) of the WSDOT Standard Specification or approved equal.

B. Polyvinyl chloride pipe shall conform to Section 9-30.1(5)A of the WSDOT Standard Specification or approved equal.

C. Water service connections shall be in accordance with 9-30.6 of the WSDOT Standard Specifications.

2.5 FIRE HYDRANTS

A. Mix concrete in accordance with ASTM C94, and in accordance with the requirements indicated on the drawings.

B. Concrete shall meet the requirements of ACI 318-11 for Type F1 concrete. Maximum water/cement ratio 0.45; Min compressive strength per plan; Air content per ACI 318-11 Table 4.4.1.

C. Admixtures:
   1. All exposed concrete is integral color mix.
   2. All concrete shall contain the specified water reducing or high range water reducing admixture, except architectural concrete, and concrete with a required water/cement ratio of 0.45 or lower shall contain a high range water reducing admixture.
   3. All concrete required to be air entrained shall contain air entraining admixture to produce 4% to 6% air.
   4. All concrete placed in ambient temperatures from 40o F to 20o F, all slab concrete placed in ambient temperatures below 50o F shall contain an accelerator at the manufacturer’s required dosage.

2.6 BACKFLOW ASSEMBLIES

A. Backflow assemblies shall conform to Washington State Department of Health Water System Design Manual. The provided backflow assembly shall be compatible with the following electrical requirements: 120V, single phase, and maximum 20 amps.

2.7 THRUST BLOCKS

A. Concrete thrust blocking shall conform to the referenced WSDOT Standard Specifications Section 7-09.3(21).

2.8 BEDDING AND BACKFILL

A. Bedding and backfill shall be per Section 31 20 00 Earth Moving.

2.9 PAINTING

A. Paint hydrants, valve boxes, and indicator posts just prior to project substantial completion.

2.10 FITTINGS

A. Fittings shall be in accordance with Section 9-30.2 of the WSDOT Standard Specifications and shall be of the same material as the main pipe. All fittings will be connected by flanges or mechanical joints. Where required, mega-lug retainer glands will be used

2.11 METERS

A. Meter vault shall be sized properly to meet minimum piping clearance requirements. The concrete meter vault shall be bedded with 6” of crushed rock. The installation shall be level and set to match final grade. All piping shall be a minimum of 12” above vault floor and be supported by adjustable jack stands. The stands shall be placed in four locations to provide firm support. The top of the meter and valve wheels shall be minimum 12” below the lid. An electronic meter reader is required at vault lid. Provide material submittal to engineer for review.

B. Water meters shall be Badger, Hersey, Neptune, Sensus, or approved equal.

2.12 BACKFLOW PREVENTION

A. Prior to beginning work verify installation conditions as satisfactory to receive materials of this Section.

B. Beginning of installation means Contractor’s acceptance of existing conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to plans

B. Comply with the requirements of Section 8-14.3(3) of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2020 and ACI 301.

C. Thoroughly compact concrete during and after pouring so as to eliminate honeycombing and voids.

3.2 INSTALLATIONS

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. Shall be in accordance with the WSDOT Standard Specifications Sections 7-08, 7-09, and 7-15.

D. Connections to Existing Mains: The Contractor shall coordinate all connections and associated work in accordance with the local utility requirements.

E. Provide concrete thrust blocks at all water distribution line elbows and tees.

F. Pipe deflection at joints shall be one half the manufacturer's allowable amount.

3.3 TESTING

A. Contractor shall pressure test pipe in accordance with AWWA C600.

3.4 FLUSHING AND DISINFECTION

A. Contractor shall provide and pay all costs for disinfection, sampling, and testing for water service. Testing and verification by approved agency. Flushing of the water lines shall be accomplished in such a manner as not to cause flooding or downstream property damage.

B. All new water mains and repaired portions of, or extensions to, existing mains shall be flushed and disinfected in accordance with WSDOT Standard Specifications Section 7-09.3(24).

END OF SECTION

SECTION 333113 – SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnishing and installing sanitary sewer service pipe and fittings of the type and sizes designated in the plans and Specifications.
   2. Coordinate and provide connections to building plumbing. Site civil contractor shall extend sewer pipe to within 5 feet of the building, terminating with a cleanout assembly. Building contractor installing building sewer shall be responsible for making final connection to cleanout.

1.2 REFERENCES

A. Reference the following standards:
   1. Current WSDOT Specification for Roads, Bridges, and Municipal Construction.
   2. Washington State Department of Ecology's Criteria of Sewage Works Design.
   3. Uniform Building code
   4. The International Association of Plumbing and Mechanical Officials Standards.

1.3 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials including pipe and fittings.

1.4 PERMITS

A. All necessary permits, fees and inspections are to be obtained and scheduled by the Contractor at Contractor's expense.

B. All necessary permits, fees and inspections are to be obtained and scheduled by the Contractor at Contractor's expense.

1.5 DIMENSIONS AND LAYOUTS

A. The Contractor will 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 must be assigned to the Contractor's crew for this work. This equipment and personnel must 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 is responsible for review of all 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 locate and pothole existing 6" dia. sewer force main, that is to be connected to, prior to construction in order to verify pipe size, type, and location, both vertically and horizontally. If changes to connection are required, contractor shall notify engineer 48 hours prior to connection to pipe. Contractor shall restore excavation of pothole upon completion of potholing with temporary asphalt, cost of pothole and restoration are incidental to pipe connection.

D. The Contractor is to notify the Owner immediately if underground utilities not shown on the records are encountered.

E. The Contractor is responsible for preserving all benchmarks and stakes and the replacement of any that are displaced.

PART 2 - PRODUCTS

2.1 PIPING

A. All gravity piping shall be C900 pipe and shall conform to ASTM D 3034 SDR 35 solid wall pipe or ASTM F 794 for solid seamless profile pipe. All joints will conform to ASTM D3212 with rubber gaskets conforming to ASTM F 477.

B. All pressure piping, except where noted differently on plans, shall be PVC ASTM D2241, SDR 21 (200) pressure pipe with rubber gasketed joints. All joints will conform to ASTM D 1869 with rubber gaskets conforming to ASTM F 477.

2.2 CONDUCTIVE WARNING TAPE

A. Conductive warning tape shall be plastic non-biodegradable metal core or backing, marked “sewer” that can be detected by a standard metal detector.

2.3 FITTINGS, COUPLINGS AND JOINTS

A. Fittings shall be the same material as the pipe.

2.4 BEDDING AND BACKFILL

A. Bedding and backfill shall per Section 31 20 00 Earth Moving.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER WORK

A. Before installation, Contractor shall make proper provisions for site sewer 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.

3.2 INSTALLATIONS

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. Shall be in accordance with the WSDOT Standard Specifications Sections 7-08, 7-17, and 7-18.

D. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings.

E. Pipe shall be installed in conformance with Section 7-17.3 and 7-18.3 of the WSDOT Standard Specifications.

3.3 BEDDING AND BACKFILLING

A. Pipe Bedding shall be per Section 7-08 of the WSDOT Standard Specifications.

B. All pipe and services shall be installed with continuous tracer tape installed 12 to 18 inches under the final ground surface.

3.4 CLEANING AND TESTING

A. Gravity Sewer pipe shall be cleaned and tested after backfilling by the low pressure air method specified in Section 7-17.3(2) of the WSDOT Standard Specification.

B. Pressure Sewer pipe shall be cleaned and tested after backfilling by the hydrostatic pressure test method specified in Section 7-09.3(23) of the WSDOT Standard Specification.

END OF SECTION

SECTION 333900 – SANITARY SEWAGE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manholes
   2. Cleanouts

1.2 REFERENCES

A. Reference the following standards:
   1. Current WSDOT Specification for Roads, Bridges, and Municipal Construction.
   2. WSDOT Standard Plans.

1.3 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials, relating to manholes, frames, and covers.

PART 2 - PRODUCTS

2.1 MANHOLES

A. Manholes shall be precast concrete structures conforming to Section 7-05 of the WSDOT Standard Specification. Metal castings shall conform with the requirements of Section 9-05.15 of the WSDOT Standard Specification.

2.2 FRAME AND COVER

A. Frame and cover shall be per WSDOT Standard Plan B-30.70-03.

2.3 CLEANOUTS

A. Cleanout, frame and cover shall be per WSDOT Standard Plan B-85.40-00.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER WORK

A. Before installation, Contractor shall make proper provisions for site sewer 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.

B. Site sewer 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 INSTALLATIONS

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. Shall be in accordance with the WSDOT Standard Specifications Sections 7-05 and 7-19.

C. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings.

D. Construction of manholes shall conform to Section 7-05.3 of the WSDOT Standard Specifications.

3.3 CLEANING AND TESTING

A. All sewers and appurtenances shall be cleaned and tested after backfilling per WSDOT Standard Specifications and as recommended by manufacturers of tanks.

END OF SECTION

SECTION 334100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site-storm sewerage drainage piping, fittings, and accessories and bedding.
   2. Pressure drainage piping fittings, and accessories and bedding.
   3. Cleaning and testing storm sewerage drainage piping.

1.2 REFERENCES

A. WSDOT Reference the following standards:
   1. Current WSDOT Specifications for Roads Bridges and Municipal Construction.

1.3 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:

B. Notify Owner no fewer than two business days in advance of proposed interruption of service.

C. Do not proceed with interruption of service without Owner's written permission.

1.4 PERMITS

A. Submit The Contractor is responsible for permits, fees and inspections are to be obtains and scheduled buy the Contractor at its own expense.

1.5 DIMENSIONS AND LAYOUTS

A. The Contractor will 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 must be assigned to the Contractor's crew for this work. This equipment and personnel must 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 is responsible for review of all 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 is to 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.

1.6 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials, relating to pipe installation.

PART 2 - PRODUCTS

2.1 DRAIN PIPE

A. Drain pipe shall be as referenced in the drawings. Drain pipe shall conform to the requirements of Section 7-04 Storm Sewers in WSDOT Specifications for Roads Bridges and Municipal Construction.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER WORK

A. Verify location from the records of Owner.

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 TRENCHING AND PIPE LAYING

A. 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.

B. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings.

3.3 BEDDING AND BACKFILLING

A. Pipe bedding and backfill shall be per Section 31 20 00

3.4 CLEANING AND TESTING

A. Storm pipe shall be cleaned and tested after backfilling by either exfiltration test per Section 7-17.3(2)B of WSDOT or low pressure air method per section 7-17.3(2)F at the option of the Contractor, except where the ground water table is such that the engineer my required the infiltration test per Section 7-17.3(2)C.

3.5 TEMPORARY BYPASS

A. Provide temporary bypass or system to allow for new construction without interruption of storm drain service.

END OF SECTION

SECTION 334413– CATCH BASINS AND CLEANOUTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Catch Basins
   2. Cleanouts

1.2 REFERENCES

A. WSDOT Reference the following standards:
   1. Current WSDOT Specifications for Roads Bridges and Municipal Construction
   2. WSDOT Standard Plans

1.3 SUBMITTALS

A. Submit cut sheets or shop drawings for all materials, relating to catch basins, frames, and grates.

PART 2 - PRODUCTS

2.1 CATCH BASIN TYPE 1

A. Catch Basin Type 1 shall be per WSDOT Standard Specifications.

2.2 FRAME

A. Frame shall be per WSDOT Standard Plan B-5.20-03.

2.3 GRATE

A. Grate shall be per WSDOT Standard Plan B-30.30-03 or B-30.40-03.

2.4 SOLID METAL COVER

A. Solid metal cover shall be per WSDOT Standard Plan B-30.20-04.

2.5 CLEANOUTS

A. Cleanouts shall be in accordance with WSDOT Standard Specifications and Standard Plan B-85.20-00.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION

A. Structure shall be installed in accordance with WSDOT requirements and the drawings.

END OF SECTION