



*PUGET
SOUND
ENERGY*

PROJECT MANUAL FOR:

Operational Training Center

Puget Sound Energy
Puyallup, Washington

100% CD SET
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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Administrative and supervisory personnel.
 - 4. Project meetings.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 01 32 00 - Construction Progress Documentation for preparing and submitting the Contractor's Construction Schedule.
 - 2. Section 01 77 00 - Closeout Procedures for coordinating Contract closeout.

1.2 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate schedule and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

- 1.3 SUBMITALS:** Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, cellular, and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Submit home office and/or project office fax number.

1.4 PROJECT MEETINGS

- A. General: Architect will schedule and conduct weekly project meetings.
1. Attendees: Participants and others involved, and individuals whose presence is required will be informed of date and time of each meeting.
 2. Agenda: Architect will prepare the meeting agenda and distribute the agenda to all invited attendees.
 3. Minutes: Architect will record significant discussions and agreements achieved and will distribute the meeting minutes to everyone concerned, within 5 days of the meeting.
- B. Preconstruction Conference: Architect will schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 5 days after execution of the Agreement. The conference will be held at Project site or another convenient location. The meeting will be conducted to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discussion of items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises and surrounding areas.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability, use, and permits required.
 - m. Office, work, and storage areas.
 - n. Equipment deliveries and priorities.
 - o. First aid.
 - p. Security.
 - q. Progress cleaning.
 - r. Working hours.
 - s. Waste Disposal.
 - t. Environmental Hazards.
 - u. Protection of pedestrians.

- C. Pre-installation Conferences: Contractor shall conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction and as specified.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of schedule meeting dates.
 2. Agenda: Review progress of other construction activities and preparation for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Deliveries.
 - d. Submittals.
 - e. Possible conflicts.
 - f. Time schedules.
 - g. Weather limitations.
 - h. Manufacturer's written recommendations.
 - i. Warranty requirements.
 - j. Compatibility of materials.
 - k. Acceptability of substrates.
 - l. Temporary facilities and controls.
 - m. Space and access limitations.
 - n. Regulations of authorities having jurisdiction.
 - o. Testing and inspecting requirements.
 - p. Required performance results.
 - q. Protection of construction and personnel.
 - r. Disposition of waste equipment or materials.
 - s. Elimination of environmental hazards.
 3. Record significant conference discussions, agreements, and disagreements.
 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Architect will conduct progress meetings at weekly intervals. Dates of meetings will be coordinated with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Minutes of the previous progress meeting will be reviewed and corrected or approved. Other items of significance that could affect progress will also be reviewed.
 - a. Contractor's Construction Schedule: Contractor shall review progress since the last meeting and determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site Utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
- 3. Reporting: Architect will distribute minutes of the meeting to each party present and to parties who should have been present. Minutes shall include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Contractor shall revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.5 REQUEST FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. RFI number, numbered sequentially.
 - 5. Specification Section number and title and related paragraphs, as appropriate.
 - 6. Drawing number and detail references, as appropriate.
 - 7. Field dimensions and conditions, as appropriate.
 - 8. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 9. Contractor's signature.
 - 10. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thickness, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: Form at the end of this Section
 - 1. Identify each page of attachments with the RFI number and sequential page number.

- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 - 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures".
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR
INTERPRETATION

Project: _____ R.F.I. Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____ Contract For: _____

Specification Section:	Paragraph:	Drawing Reference:	Detail

Request:

Signed by: _____ Date: _____

Response:

☐ Attachments

Response Form:	To:	Date Rec'd:	Date Ret'd:

Signed by: _____ Date: _____

Puget Sound Energy
Operational Training Center
Puyallup WA
100% CD Set 01.26.24

01 31 00
PROJECT MANAGEMENT AND COORDINATION

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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. Special reports

1.2 SUBMITTALS: Contractor's Construction Schedule: Submit 6 printed copies of initial schedule large enough to show entire schedule for entire construction period.

1.3 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 – SCHEDULE

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
- C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- D. Project phases: include commencement, completion, and critical dates.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractor's personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Show complete sequence of construction by activity, including but not limited to:
 - a. Date for notice to proceed.
 - b. Date for substantial completion.
 - c. Shop drawing submittals and approvals.
 - d. Work activities.
 - e. Material ordering and delivery to job site.
 - f. Utility shutdowns.
 - g. Intermediate completion dates (if applicable).
 - h. Owner relocation of contents (if applicable).
 - i. Show interrelationships and dependencies.
 - j. Indicate critical path of activities.
 - k. Planned and actual performance.
5. Interval Schedule: Prepare and update weekly a 4-week interval schedule. Show 1 week of actual progress (planned vs. actual performance). Forecast 3 weeks of start and completion dates for each activity, task or event in comparison to the prepared schedule.
 1. Activities in interval schedule shall relate directly to activities in the construction schedule.

2.3 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 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 Actual Completion percentage for each activity.

- B. Distribution: Distribute copies of approved schedule to Architect, Owner, 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

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
 - 1. Section 01 29 00 - Payment Procedures, for submitting Applications for Payment.
 - 2. Section 01 32 00 - Construction Progress Documentation, for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
 - 3. Section 01 77 00 - Closeout Procedures, for submitting warranties.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

- A. General: Electronic copies of drawings of the Contract Drawings will be provided for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements of Section 01 32 00 – Construction Progress Documentation for list of submittals and time requirements for scheduled performance of related construction activities.
 - 1. Contractor to prepare a list of all required submittals for review by the Architect. List shall be submitted to Architect within 30-days of Notice to Proceed.
 - a. List should identify each required submittal by specification section.
- D. Processing Time: Allow 15 calendar days for submittal review, not including time for resubmittals. Time for review shall commence on Architect's receipt of submittal.
 - 1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Number of Copies: Submit five copies of each submittal, unless submitted electronically. Architect will return two copies, unless submitted electronically. Mark up and retain one returned copy as a Project Record Document.
 - 2. Contractors option to submit electronic files in lieu of paper copies is acceptable, however, physical samples demonstrating color, texture, and appearance are still required.
- B. Product Data (for Basis of Design and comparable products by Other Acceptable Manufacturers): Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operating and maintenance manuals.
 - k. Compliance with recognized trade association standards.
 - l. Compliance with recognized testing agency labels and seals.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.

- c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 2. Wiring Diagrams: Differentiate between manufacturer-installed wiring.
 3. Sheet size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
- D. Samples: Prepare physical units of materials or products, or paint samples and manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available where specified in individual Sections.
- E. Contractor's Construction Schedule: Comply with requirements in Section 01 32 00 - Construction Progress Documentation.
- F. Submittals Schedule: Comply with requirements in Section 01 32 00 - Construction Progress Documentation.
- G. Application for Payment: Comply with requirements in Section 01 29 00 - Payment Procedures.
- H. Schedule of Values: Comply with requirements in Section 01 29 00 - Payment Procedures.
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontractor or supplying products.
 2. Number and title of related Specification Selection(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Architect will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.
- B. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Section 01 77 00 - Closeout Procedures.

- C. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, if applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- D. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Cause for Outright Rejection of Submittal:
 - a. Submittal stamped but not reviewed by Contractor prior to issuance to Architect.
 - b. Submittal lacking Contractor's Approval Stamp
 - c. Insufficient or partial submittal

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 1. Submittals received by Architect without accompanying product samples will not be reviewed until required samples are received.
- B. Action Submittals: Architect will review submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PRELIMINARY WORK

- A. Prior to the start of and during the course of above and below ground Work the Contractor shall make a thorough survey of the entire worksite to determine all potential hazards and notify the Owner in writing of any such hazards prior to the commencement of work. Workmen shall be made aware of those hazards and shall be instructed in procedures and the use of equipment for their protection. The Contractor shall verify the location, condition, and whether it is active or inactive of all utilities on and near the worksite and take precautions to protect all people working on the project, the general public, and the property.
- B. Submit a site-specific safety plan.

1.03 IMMINENT DANGER

- A. The Contractor shall be wholly responsible for all accidents or death occurring at any time during the progress or completion of this project which may happen to any person employed to perform work on this project; or for any injury or death its work, operations, or persons performing work on this project may cause to any person not employed in the work of this project; or for any damage its work, operations, or persons performing work on this project may cause to the work being constructed, or to any existing public or private property, either on or adjoining the project site or along any routes of travel. Completion of this project includes any time work is being performed on this project, even after final acceptance by the Owner.

1.04 SAFETY

- A. The Contractor shall ensure that all persons, while on the work site, comply with the requirements of WISHA, these requirements, and the safety precautions contained in the several Specification Sections. The Contractor shall promptly and fully comply with, execute and, without separate charge thereof to the Owner, shall enforce compliance with the provisions of the latest adopted Washington Industrial Safety and Health Act, with particular attention paid but not limited to Chapter 296-155, WAC Safety Standards for Construction Work; with particular attention paid but not limited to Chapter 296-24 WAC General Safety and Health Standards; with particular attention paid but not limited to Chapters 296-27, 196-350 and 296-360 WAC regarding Administrative Safety and Health Act Chapter 49-17 RCW, and any addenda thereto.
- B. The Contractor shall immediately advise the Owner of inspections conducted by WISHA at the work site, and shall transmit copies of reports, citations and violations to the Owner and A/E.
- C. Entry Into Permit-Required Confined Spaces:
 - 1. Entry into confined spaces such as steam tunnels, storm sewers, and as otherwise defined in Section 296-809-20002 of Chapter 296-809 WAC, Confined Spaces, shall be performed in conformance with permit entry procedures set forth in Section 296-809-500.
 - 2. Employee training for employees entering a confined space shall conform to WAC Section 296-809-400.

3. It is recommended that when entry into a confined space is anticipated, a sub-consultant such as Pipe Experts LLC (360-943-5840) be contacted.

1.05 SAFETY RESPONSIBILITIES

A. Contractor shall be responsible to:

1. Ensure compliance with these requirements, WISHA requirements, and other safety requirements.
2. Authorize immediate action to correct substandard safety conditions.
3. Review and act to ensure compliance with safety procedures with its supervisors, subcontractors, and suppliers.
4. Make thorough daily safety inspections of the work site and immediately act to eliminate unsafe acts and unsafe conditions.
5. Investigate worksite accidents and recommend immediate corrective action.
6. Assist in the preparation of accident investigation and reporting procedures.
7. Be responsible for the control, availability, and use of safety equipment, including employee personal protective equipment.
8. Submit copy of site specific safety plan to Owner.

1.06 REQUEST FOR VARIANCES

- A. Requests for variances to deviate from WISHA requirements must follow the current established procedures by that Agency.

1.07 FAILURE TO COMPLY

- A. If work on the project is stopped due to the Contractor's failure to comply with the requirements of WISHA or other applicable safety requirements, no part of the time loss due to any such suspension of operations or stop orders shall be made the subject of a claim for extension of time or for increased cost or damage by the Contractor.

END OF SECTION 01 35 20

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements, including removal or replacement of deficient or unsatisfactory work.
- C. Inspections required: (Refer also to Structural Notes):
 - 1. Foundation: Optimum density, compaction tests of fill under footings and slabs. Inspect footing excavations just prior to concrete placement to verify that material is at proper moisture level and density.
 - 2. Concrete work including slump, air content and strength, cylinders and placement of concrete (except for non-structural slabs-on-grade).
 - 3. Reinforcing: Placement of all reinforcing per plans, (except for non-structural slabs on grade), cover, size, number and laps.
 - 4. Anchor bolts.
 - 5. Structural steel.
 - 6. Welding.
 - 7. Structural panel diaphragms and shear walls.
 - 8. Base for foundations, exterior paving and utility line backfill: Optimum density compaction tests.
 - 9. Unsuitable soil determination and limits of over excavation.
 - 10. Other special inspections required by IBC.

1.2 RESPONSIBILITIES

- A. The Owner will engage the services of an independent agency to perform inspections and tests specified.
- B. Retesting: The contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
- C. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - 1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - 2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - 3. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 5. Security and protection of samples and test equipment at the Project site.
- D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
- The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
- The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
- The agency shall not perform any duties of the Contractor.
- E. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.
- F. Inspections required by IBC: Contractor shall provide adequate notice to the Building Department when work is ready for inspection and shall cause the work to remain accessible and exposed until approved by the Building Official. Contractor shall be responsible for removal or replacement of any material required to allow inspections and to correct any work found to be deficient or unsatisfactory.

PART 2 - SUBMITTALS

2.1 TESTING AGENCY: The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate.

2.2 REPORT DATA

- A. Written reports of each inspection, test or similar service shall include, but not be limited to:
1. Date of issue.
 2. Project title and number.
 3. Name, address and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making the inspection or test.
 6. Designation of the Work and test method.
 7. Identification of product and Specification Section.
 8. Complete inspection or test data.
 9. Test results and an interpretation of test results.
 10. Ambient conditions at the time of sample-taking and testing.
 11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting.

PART 3 - QUALITY ASSURANCE

- 3.1 QUALIFICATION FOR SERVICE AGENCIES: Inspection and testing service agencies, including independent testing laboratories, shall be prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
- 3.2 INDEPENDENT INSPECTION AND TESTING AGENCY: Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state in which the Project is located.

PART 4 - REPAIR AND PROTECTION

- 4.1 GENERAL: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- 4.2 PROTECTION: Protect construction exposed by or for quality control service activities, and protect repaired construction.
- 4.3 REPAIR AND PROTECTION: Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the conditions of the Contract.
- B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Day": Day shall refer to calendar day.
- J. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- K. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- L. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged on construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication.
- F. Standard data of the following organizations are referenced in the specifications, and the organization names are abbreviated as noted.

AAMA:	American Architectural Manufacturer's Association, 1827 Walden Office Square, Ste. 104, Schaumburg, IL 60173-4628
ACI:	American Concrete Institute, P.O. Box 4754, Redford Station, Detroit, Michigan 48219
AIA:	American Institute of Architects, 1735 New York Avenue, Washington D.C. 20006
AIMA:	Acoustical and Insulating Materials Association, 205 West Touhy Avenue, Park Ridge, Ill. 60068
AISC:	American Institute of Steel Construction, 101 Park Avenue, New York, NY 10017
AISI:	American Iron and Steel Institute, 150 East 42nd St., New York, NY 10018
AMCA:	Air Moving and Conditioning Association, Inc., 30 West University Drive, Arlington Heights, Ill. 60004

ANSI:	American National Standards Institute, 1430 Broadway, New York, NY 10018
APA:	American Plywood Association, P.O. Box 11700, Tacoma, WA 98411
ARIB:	Asphalt Roofing Industry Bureau, 757 Third Avenue, New York, NY 10018
ASCE:	American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400
ASME:	American Society of Mechanical Engineers, 29 West 39th St., New York, NY 10018
ASTM:	American Society for Testing & Materials, 1916 Race St., Philadelphia, PA
AWI:	Architectural Woodwork Institute, Chesterfield House, Suite A, 5055 S. Chesterfield Road, Arlington, VA 22206
AWS:	American Welding Society, 33 West 39th Street, New York, NY 10018
AWWA:	American Water Work Association, 2 Park Avenue, New York, NY 10000
CRSI:	Concrete Reinforcing Steel Institute, 38 South Dearborn St., Chicago, Ill.
CSI:	Construction Specifications Institute, 1717 Massachusetts Ave. N.W., Washington D.C. 20036
FGMA:	Flat Glass Marketing Association, 3310 Harrison, White Lakes Prof. Bldg., Topeka, KS. 66611
ICC:	International Code Council
IBC:	International Building Code
IEBC:	International Existing Building Code
IMC:	International Mechanical Code
IPC:	International Plumbing Code
IEEE:	Institute of Electrical & Electronic Engineers, 33 West 39th St., New York, NY 10018
IPCEA:	Insulated Power Cable Engineers Association, 283 Valley Road, Montclair, NJ 07042
NEMA:	National Electrical Manufacturer's Association, 155 East 44th Ave., New York, NY 10017
SDI:	Steel Door Institute, 1230 Keith Building, Cleveland, Ohio 44115
SMCNA:	Sheet Metal & Air Conditioning Contractor National Association, 107 Center St., Elgin, Ill. 60210
UL:	Underwriter's Laboratories, 333 Pfingsten Road, Northbrook, Ill. 60062

WABO	Washington Association of Building Officials, P. O. Box 7310, Olympia, WA 98507
WSDOT:	Washington State Department of Transportation, P.O Box 47300, Olympia, WA 98504-7300
WWPA:	Western Wood Products Association, Yeon Building, Portland, OR 97204

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Sewers and drainage.
 - 2. Water service and distribution.
 - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 4. Heating and cooling facilities.
 - 5. Ventilation.
 - 6. Electric power service.
 - 7. Lighting.
 - 8. Telephone service.
- C. Support facilities include, but are not limited to, the following:
 - 1. Temporary roads and paving.
 - 2. Dewatering facilities and drains..
 - 3. Waste disposal facilities.
 - 4. Storage and fabrication sheds.
 - 5. Temporary stairs.
 - 6. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to the following:
 - 1. Environment protection.
 - 2. Stormwater control.
 - 3. Plant protection.
 - 4. Site enclosure fence.
 - 5. Security enclosure and lockup.
 - 6. Barricades, warning signs, and lights.
 - 7. Temporary enclosures.
 - 8. Temporary partitions.
 - 9. Fire protection.

- 1.2 DEFINITIONS:** Permanent Enclosure: As determined by Architect and Owner's Construction Representative permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 - 1. Owner's construction forces.
 - 2. Occupants of Project.
 - 3. Architect.
 - 4. Testing agencies.
 - 5. Personnel of authorities having jurisdiction.

- B. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
- C. Electrical Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.4 SUBMITTALS: Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.5 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
 - Building Code Regulations
 - Health and Safety Regulations
 - Utility Company Regulations
 - Police, Fire Department and Rescue Squad rules
 - Environmental Protection Regulations
- B. Provide products for and the execution of the work in this section that will satisfy NECA, OSHA, and local codes. Provide products that satisfy requirements of NEMA and are UL listed. Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
- C. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- D. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
 - 1. Temporary use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously unused materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Portable Chain-Link Fencing: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete block and galvanized steel bases for supporting posts.
- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed index of 25.
- D. Paint: Comply with requirements in Division 9 Section "Painting."
- E. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
- F. Water: Potable.

2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices: Prefabricated or Mobile units with lockable entrances, operable windows, and serviceable finishes; adequate heat; on foundations adequate for normal loading.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA -recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units including paper cup supply.
- F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110-to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
 - 1. Provide rubber hoses as necessary to serve Project site.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 - 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.

3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
 1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimized energy consumption.
- G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
- H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
 2. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
- J. Telephone/Data Service: Provide temporary telephone/data service throughout construction period for common-use facilities used by all personnel engaged in construction activities.
 1. Provide additional telephone/data lines for the following:
 - a. Provide a dedicated telephone/data line for facsimile machine and or computer in field office.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.

- d. Architect's office.
- e. Engineer's offices.
- f. Owner's office.
- g. Principal subcontractor's field and home offices.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Provide noncombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
 - 3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas as indicated within construction limits indicated on Drawings.
 - 1. Lay down 7/8" plywood over lawn and masonry paver areas where construction equipment (lifts, cranes, trucks, delivery vehicles, etc.) will be driven or staged on.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
- D. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is complete.
 - 3. Remove snow and ice as required to minimize accumulations and allow for work to be performed safely and efficiently.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
 - 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.
- F. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
1. Construct framing, sheathing and siding using fire-retardant-treated lumber and plywood.
 2. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.
- G. Provide all other construction aids and miscellaneous facilities, such as scaffolds, platforms, swing stages, ramps and bridges, incidental sheeting and shoring, and waste chutes as required.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Plant Protection: Install temporary fencing located as indicated to protect vegetation from construction damage.
- D. Construction Area Enclosure Fence: Before construction operations begin, install portable chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
1. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
 2. Provide seven foot chain-link with three strands of barbed wire at property boundaries and as necessary to maintain existing site security of Owner occupied yard and buildings as indicated on Drawings.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

- F. Barricades, Warnings, Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Vertical Openings: Close openings of 25 sq. Ft. or less with plywood or similar materials.
 - 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
 - 5. Where temporary wood or plywood enclosure exceeds 100 sq. Ft. in area, use fire-retardant-treated material for framing and main sheathing.
- H. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
 - 1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on construction side.
- I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - b. Other locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
 - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe location.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
 - 5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
 - 6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identified signs.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements of Section 01 77 00 - Closeout Procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Section 01 42 00 – References, for applicable industry standards for products specified.
 - 2. Section 01 77 00 - Closeout Procedures, for submitting warranties for contract closeout.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term “product” includes the terms “material,” “equipment,” “system,” and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer’s product name, including make and model number or other designation, shown or listed in manufacturer’s published product literature, that is current as of date of the Contract Document.
 - 2. New Products: Items that have not previously been incorporated into another project or facility except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer’s product is named accompanied by the words “basis of design,” including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

- A. Product List: Prepare a list of products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer’s name and proprietary product names for each item listed.

- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- C. Basis-of-Design and Other Acceptable Manufacturer's Product Specifications Submittal: Comply with requirements of Section 01 30 00 – Submittal Procedures. Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
 - 1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Certify that all products are asbestos free and do not contain any hazardous materials.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's instructions.
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packing system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store materials in a manner that will not endanger Project structure.
 - 6. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 7. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 8. Protect stored products from damage.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Where products are accompanied by the term "as selected," Architect will make selection.
 - 4. Where products are accompanied by the term "match sample," sample to be matched is Architect's
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedure: Procedure for product selection:
 - 1. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included provide either the specified product or a comparable product. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product manufacturer and product name. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Substitutions may be considered but must be approved by the Architect and the Owner.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received by no later than (10) ten business days from bid/proposal due date. Requests received after that time may be considered or rejected at discretion of Architect and Owner. Utilize provided form.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution does not require extensive revisions to the Contract Document.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.

8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following in addition to other required submittals, to obtain approval of an unnamed product:
 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Owners.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

PUGET SOUND ENERGY – OPERATIONAL TRAINING CENTER

SUBSTITUTION REQUEST FORM

TO:

ATTN:

PROJECT NAME: *OPERATIONAL TRAINING CENTER*

We hereby submit for consideration, the following product instead of the specified item for above project:

SECTION	PARAGRAPH	SPECIFIED ITEM

_____	_____	_____

Proposed substitution: _____

Check reasons for substitution:

_____	Unavailability	_____	Unsuitability
_____	Code Requirements	_____	Warranty
_____	Owner's Benefit	_____	Comparable Product

Attach complete dimensional information and technical data, including laboratory tests, if applicable, for both the specified item and the requested substitution in a comparable format to the specified item.

Include complete information on changes to Drawings and Specifications which proposed substitution will require for its proper installation.

Submit with request all necessary samples and substantiating data to provide equal quality, performance, and appearance to that specified. Clearly mark Manufacturer's literature to indicate equality in performance. Indicate differences in quality of materials and construction.

Fill in blanks below:

- A. Does the substitution affect dimensions shown on Drawings:
Yes _____ If yes, clearly indicate changes: _____ No _____

- B. What effect does substitution have on other trades, other Contracts, and contract completion date?: _____

- C. What affect does substitution have on applicable code requirements? _____

- D. Differences between proposed substitution and specified item:

- E. Differences in noise generation, if applicable: _____

- F. Manufacturer's warranties of the proposed and specified items are: _____ Same _____ Different
(explain) _____

- G. List of names and addresses of 3 similar projects on which product was used, date of
installation, and Architect's name and address: (Attach list with requested information)
- H. Cost impact: _____
- Will the undersigned pay for changes to the building design, including engineering and
detailing costs caused by the requested substitution?:
- Yes _____ No _____

Undersigned attests function and quality equivalent or superior to specified items.

**CERTIFICATION OF EQUAL PERFORMANCE
AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE**

_____ Signature	By _____
_____ Firm	Date _____
_____ Address	Remarks _____
_____	_____

Signature must be by person having authority to legally bind its firm to the above terms.

For Use by Architect: _____ Accepted _____ Accepted as Noted
_____ Not Accepted _____ Received Too Late

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. General installation of products.
 - 3. Progress cleaning.
 - 4. Starting and adjusting.
 - 5. Protection of installed construction.
 - 6. Correction of the Work.
- B. Related Sections include the following:
 - 1. Section 01 73 10 - Cutting and Patching.
 - 2. Section 01 77 00 - Closeout Procedures.

- 1.2 QUALITY ASSURANCE:** 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Approved/Issued Permit Documents:
 - 1. Before construction take possession of approved/issued permit documents.
 - 2. In accordance with authority having jurisdiction post permit(s) on site with issued plans.
 - 3. It is the responsibility of the Contractor to incorporate review comments and conditions of issued permit(s).
- B. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- C. Existing Utilities: 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 and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- D. Acceptance of Conditions: 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to 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 Measures: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work area 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, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

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 Owner's Construction Representative promptly.
- B. General: Engage a licensed surveyor to lay out the Work using accepted surveying practices
 - 1. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, slope stakes, and grades necessary for the construction. Except for the survey control data to be furnished by the Engineer, calculations, surveying, and measuring required for setting and maintaining the necessary lines and grades shall be the Contractor's responsibility.
 - 2. 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.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
- D. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- E. Contractor Surveying: Copies of the Owner provided primary survey control data are available for the bidder's inspection at the architect's office.
1. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, slope stakes, and grades necessary for the construction of buildings, grading, utilities, walls, clearing limits, structures, curbs, pavement, and fence lines. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the necessary lines and grades shall be the Contractor's responsibility.
- F. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, and floor levels, including those required for mechanical and electrical work. Verify column grid stakes. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.4 INSTALLATION

- 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 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instruction 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
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.

- 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.

3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 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.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean 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: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. 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.

- J. 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.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.7 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 instruction for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Divisions and Sections include the following:
 - 1. Divisions 2 through 33, see Sections for specific requirements and limitations applicable for cutting and patching individual parts of the Work.

1.2 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of the other Work.

1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior storefront wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise and vibration control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.4 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings weathertight when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and backfilling: Comply with requirements in applicable Div. 2 Sections where required by cutting and patching operations.
 5. Mechanical and electrical services: Cut off pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
 7. Keep water or debris from entering existing construction.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

- A. The Owner desires that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
- B. Of the waste material that is generated, as much as economically feasible shall be reused, salvaged, or recycled. Recycle and/or salvage at least 50% of the non-hazardous construction and demolition. Recycle and/or salvage an additional 25% (75% total) of non-hazardous construction and demolition debris. This is consistent with the intent of RCW 39.04.135 and is mandated whenever practicable.
- D. With these goals, the contractor shall develop a Waste Management Plan for this project.

1.03 DEFINITIONS

- A. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial and industrial waste, including construction, remodeling, repair and demolition operations.
- C. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- D. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- E. Environmental Pollution and Damage: The presents of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- G. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.
 - 1. Inert Solids / Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete, that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board pursuant to local regulations and does not contain significant quantities of decomposable solid waste.
- H. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

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- I. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- J. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- K. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- L. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- M. Return: To give back reusable items or unused products to vendors for credit.
- N. Reuse: To reuse a construction waste material in some manner on the project site.
- O. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- P. Sanitary Wastes:
 - 1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution or consumption of food.
 - 2. Sewage: Domestic sanitary sewage.
- Q. Sediment: Soil and other debris that has been eroded and transported by storm or well production runoff water.
- R. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- S. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- T. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- U. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Landfill Alternatives Proposal – Draft Waste Management Plan: Within 14 working days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs first, Contractor shall submit to the A/E and Owner for review and approval three (3) copies of the Draft Waste Management Plan projecting trash/waste that will require disposal and alternatives to landfilling, with net costs. The plan shall contain, as a minimum, the following:
 - 1. An analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
 - 2. Describe as many alternatives to landfilling as possible.
 - a. List each material proposed to be salvaged, reused, or recycled during the course of the Project.
 - b. Estimate quantities for each waste stream.
 - c. State the proposed recycle or disposal method for each waste stream.
 - d. State on-site storage method for each waste stream.

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- e. State transportation method for each waste stream.
- f. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
- 3. Provide alternatives to landfilling for at least the following materials:
 - a. Aluminum and plastic beverage containers.
 - b. Corrugated cardboard.
 - c. Wood pallets.
 - d. Clean dimensional wood: May be used as blocking or furring.
 - e. Land clearing debris.
 - f. Excavated soils.
 - g. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 - h. Bricks.
 - i. Concrete masonry units (CMUs).
 - j. Precast concrete panels.
 - k. Asphalt paving: May be recycled into paving for project.
 - l. Metals, including packaging banding, metal studs and trim, ductwork, piping, sheet metal, structural steel, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - m. Glass.
 - n. Gypsum drywall and plaster.
 - o. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
 - p. Asphalt roofing shingles.
 - q. Paint.
 - r. Plastic sheeting.
 - s. Rigid foam insulation.
 - t. Plumbing fixtures.
 - u. Mechanical and electrical equipment.
 - v. Fluorescent lamps (light bulbs).
 - w. Acoustical ceiling tile and panels.
- 4. Include the names for each subcontractor who will transport solid or hazardous waste from the site and the name of the receiving facility that will accept waste for disposal.
- C. Review: The Draft Waste Management Plan will be reviewed by the A/E for comment with a copy going to the Owner.
 - 1. The plan is checked to make sure all materials that may be economically recycled are listed.
 - 2. The plan is also checked for the haulers, recyclers and disposal facilities, to include recycling, general waste and hazardous waste facilities.
 - 3. Plan review comments are made by the A/E. Once no further comments are necessary, the contractor may proceed with its plan.
- D. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.

- b. List the local market for each material.
 - c. State the estimated net cost, versus landfill disposal.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 - 7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.
- E. Implementation: The Contractor shall submit monthly a progress report summary of waste generated at the project. The summary shall be submitted on a form acceptable to the Owner and shall contain the following information:
- 1. For each material recycled, reused, or salvaged from the project, the amount (in tons or cubic yards), the date removed from the job site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, the net total cost or savings of salvage or recycling the material. Include manifests, weight ticket receipts or invoices.
 - 2. The amount (in tons or cubic yards) of material landfilled from the project, the location of the receiving facility, the total amount of tip fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipts and invoices.
- F. Recycling Incentive Programs:
- 1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
 - 2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

1.05 RESOURCES

- A. Contractor may request specific technical assistance or referrals from the following resources:

Waste Reduction Specialist
Solid Waste Services Program
Department of Ecology
(360) 407-6352

1.06 ADDITIONAL RECYCLING REQUIREMENTS

A. Handling

- 1. Materials shall be free of dirt, adhesives, solvents, petroleum contamination and other substances deleterious to recycling process. Clean materials which are contaminated prior to placing in collection containers.
- 2. Arrange for collection by or delivery to the appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.

B. Participation In Re-Use Programs

1. Industrial Materials Exchange (IMEX) program sponsored by the Local Hazardous Waste Management Program in King County.
 - a. IMEX is a free service designed to help businesses find markets for materials that traditionally would be discarded. The premise of the IMEX program is that material discarded by one business may be a resource for another business.
 - b. To obtain a current Materials Listings Catalog, call IMEX at (206) 296-4899.
 2. Habitat for Humanity - South Puget Sound, a non-profit housing organization that rehabilitates and builds housing for low income families.
 - a. Sites requiring donated materials vary. Contact HFH at (360) 956-3456.
- C. Rebate, Tax Credits, Etc.: Rebates, tax credits and other savings obtained for recycled or re-used materials shall accrue to Contractor.

PART 2 - PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. Notify Owner's Representative when Contractor is aware of materials, equipment or products that meet the aesthetic and programmatic intent of Contract Documents, but which are more environmentally-sensitive than materials, equipment or products specified or indicated in the Contract Documents.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 61 00:
 1. Relative amount of waste produced, compared to specified product.
 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 3. Proposed disposal method for waste product.
 4. Markets for recycled waste product.

PART 3 - EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Pre-bid meeting.
 2. Pre-construction meeting.
 3. Regular job-site meetings.
 4. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 2. Provide containers as required.
 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 5. Locate enclosures out of the way of construction traffic.
 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.
- J. Disposal Operations:
1. Promptly and legally transport and dispose of removed and demolished items and waste materials that are not identified to be recycled or reused.
 2. Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.
 3. Aggregating material and/or hauling it off site shall not occur between the hours of 10:00 PM and 7:00 AM unless it complies with Specification Section 01 10 00.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents.
 - 3. Operation and maintenance manuals.
 - 4. Final cleaning.
- B. Related Sections include the following:
 - 1. Other Divisions for specific closeout and special cleaning requirements for products of those Sections.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following: (List items below that are incomplete in request.)
 - 1. Prepare a list of items to be completed and corrected (punch list) and the value of incomplete work (by item and in total).
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
 - 5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 6. Terminate and remove facilities from Project site, along with mockups, construction tools, and similar elements.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 8. Complete final cleaning requirements, including touchup painting.
 - 9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - 10. Submit draft copy of O&M manual in digital format.
- B. Inspection Procedures: Upon receipt of the Contractor's request for inspection, the Architect/Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. Following the initial inspection, the Architect/engineer will either prepare the certificate of substantial completion, or will advise the Contractor of work which must be performed before the certificate will be issued. The Architect/Engineer will repeat the inspection when requested and when assured that the Work has been substantially completed. The Architect will perform one initial inspection and one re-inspection. Additional inspections will be done at Contractor's expense.

1.3 FINAL COMPLETION

- A. General: Complete the following before requesting the Architect/Engineer's final inspection for certification of final acceptance, and final payment as required by the General Conditions. List known exceptions, if any, in the request.
1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Architect/ Engineer's final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Architect/Engineer.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data either as of the date of substantial completion, or else when the Owner took possession of the responsibility for corresponding elements of the Work.
 5. Submit consent of surety.
 6. Submit a final liquidated damages settlement statement, acceptable to the Owner.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 8. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
 9. Deliver tools, spare parts, extra stock of material and similar physical items to the Owner.
 10. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mock-ups, and similar elements.
 11. Complete final cleaning up requirements, including touch-up painting of marred surfaces.
 12. Touch-up and otherwise repair and restore marred exposed finishes.
 13. Reinspection Procedure: The Architect/Engineer will reinspect the work upon receipt of the contractor's notice that the work, including punchlist items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect/Engineer. Upon completion of reinspection, the Architect/Engineer will either prepare a certificate of final acceptance, or will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance. If necessary, the reinspection procedure will be repeated. Additional inspections will be done at Contractor's expense.

1.4 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Document for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of black-line white prints of Contract Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 4. Note Construction Change Directive numbers, Change Orders, alternate numbers, and similar identification where applicable.
 5. Identify, sign and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
 6. Provide high resolution digital copy or scan of Record Drawings for review and approval. Once approved provide one black-line white print of Record Drawings and a digital copy to be included with final closeout documents.
- C. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation varies substantially from that indicated in Product Data.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.
 4. Provide digital copy of all approved submittals to be included with final closeout documents.
- D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Assemble 3 complete sets of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
1. Maintenance Data:

- a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventative and routine maintenance.
 - e. Maintenance record forms.
 - f. Source of spare parts and maintenance materials.
 - g. Copies of maintenance service agreements.
 - h. Copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket-inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.
- C. Provide draft digital copy of Operation and Maintenance Manual for review and approval prior to final printed and digital copy submittal.

- 1.6 CLOSEOUT PROCEDURES:** General Operating and Maintenance Instructions: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owners personnel to provide necessary basic instruction in the proper operation and maintenance of the entire work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives. As part of this instruction provide a detailed review of the following items: Maintenance manuals, record documents, spare parts and materials, tools, lubricants, fuels, identification systems, control sequences, hazards, cleaning, and warranties, bonds, maintenance agreements and similar continuing commitments. As part of this instruction for operating equipment demonstrate the following procedures: Start-up, shut-down, emergency operations, noise and vibration adjustments, safety procedures, economy and efficiency adjustments, and effective energy utilization.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project.
 - a. Clean Project site, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

- c. Remove tools, construction equipment, machinery, and surplus material from Project site.
- d. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- e. Sweep concrete floors broom clean in unoccupied spaces.
- f. Remove labels which are not required as permanent labels.
- g. Clean transparent materials, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are not noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
- h. Clean exposed exterior and interim hard-surfaced finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substance. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
- i. Wipe surfaces of mechanical and electrical equipment clean. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
- j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
- k. Removal of Protection: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.
- l. Compliance: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these materials to the Owner's best advantage as directed.
- m. Leave Project clean and ready for occupancy.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- D. Section 31 01 00 - Earthwork: Fill material for filling holes, pits, and excavations generated as result of removal operations.
- E. Section 31 11 00 - Clearing and Grubbing: Vegetation and existing debris removal.

1.03 DEFINITIONS

- A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: See Section 31 01 00.

PART 3 EXECUTION

3.01 DEMOLITION

- A. Remove paving and curbs required to accomplish new work.
- B. Remove all paving and curbs as indicated on drawings.
- C. Remove concrete slabs on grade as indicated on drawings.
- D. Remove manholes and manhole covers, curb inlets and catch basins.
- E. Remove fences and gates.
- F. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements to remain in place and not removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete foundation walls.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, thrust blocks, and manholes.
- G. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, and applied coatings
- B. Section 07 19 00 - Water Repellents
- C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- D. Section 32 16 00 - Concrete Paving: Curbs, gutters, sidewalks

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Concrete Construction; 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting; 2020.
- G. ACI 306R - Guide to Cold Weather Concreting; 2016.
- H. ACI 308R - Guide to External Curing of Concrete; 2016.
- I. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).
- J. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- M. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
- N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
- P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021b.
- Q. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

- R. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
- S. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- U. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.
- W. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes; 2018.
- X. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.
- Y. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- Z. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- AA. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.
- AB. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- AC. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).
- AD. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
- AE. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.
- AF. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
- AG. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.
- AH. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.
- AI. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- AJ. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.
- AK. ASTM E1993/E1993M - Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 1998 (Reapproved 2020).
- AL. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.
- AM. NSF 61 - Drinking Water System Components - Health Effects; 2021.
- AN. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures and the Structural Drawings.
 - 2. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
- D. Reinforcing: Submit reinforcing shop drawings in accordance with the requirements of the Structural Drawings.
- E. Joints: Submit slab joint plan per Structural Drawings.
- F. Samples for Pigment Color Verification and Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- G. Samples: Submit samples of underslab vapor retarder to be used.
- H. Samples: Submit 3, 12 inch (305 mm) long samples of construction joint devices and vapor retarder.
- I. Test Reports: Submit report for each test or series of tests specified.
- J. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- K. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: MDO plywood. Plywood may be used at below grade and not regularly occupied areas exposed to view such as crawlspaces.
 - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
 - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.
 - a. Fill cone snap tie voids with cementitious plugs at all locations with the exception of below grade and not regularly occupied areas exposed to view such as crawlspaces.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Type: Deformed billet-steel bars.

2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
 1. Form: Coiled Rolls.
 2. WWR Style: As indicated on drawings.
- C. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: Per the Structural Drawings.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 1. Packaging: If pigments are to be added to mix at site, furnish pigments in premeasured disintegrating bags to minimize job site waste.
 2. Color(s): As indicated on drawings.
 3. Manufacturers:
 - a. Master Builders Solutions; MasterColor:
www.master-builders-solutions.com/en-us/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- H. GGBF Slag: ASTM C989, Grade 100 minimum.
- I. Structural Fiber Reinforcement: ASTM C1116/C1116M.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- D. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- E. Accelerating Admixture: ASTM C494/C494M Type C.
- F. Retarding Admixture: ASTM C494/C494M Type B.
- G. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
 1. Installation: Comply with ASTM E1643.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
3. Manufacturers:
 - a. Stego Industries, LLC; Class A - 15 mils: www.stegoindustries.com.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Grout: Comply with ASTM C1107/C1107M.
 2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa). See Structural Drawings for other requirements

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
- D. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
- E. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
- F. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- G. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches (150 mm) on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

- A. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
 1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 3. VOC Content: Less than 100 g/L.
 4. Solids Content: 25 percent, minimum.
- B. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cubic meter), or as recommended by manufacturer for specific project conditions.
 1. Required only for slabs on grade.
- E. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: Per the Structural Drawings.
2. Fly Ash Content: See Structural Drawings for minimum and maximum percent cement substitution by weight
3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
5. Ground Granulated Blast Furnace Slag: See Structural Drawings for minimum and maximum percent cement substitution by weight.
6. Water-Cement Ratio: Maximum percent by weight per the Structural Drawings
7. Maximum Aggregate Size: Per the Structural Drawings.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 2. Use latex bonding agent only for non-load-bearing applications.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and use epoxy adhesive as indicated in the drawings and in accordance with the epoxy manufacturer's written instructions
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings. Provide joint plan for review and approval.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
 - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1-1/4 inch (____ mm) deep but not less than one quarter (1/4) the depth of the slab.
- E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 - 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - 2. Remove cone ties, repair spalled concrete around voids, and install cementitious plugs per manufacturer's recommendations. Unless noted otherwise apply sealer after holes are plugged.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Surfaces Not in Contact with Forms:
 - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 - 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-fog spray, or saturated burlap.
 - 3. Final Curing: Begin after initial curing but before surface is dry.
 - a. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.
- B. Protect slabs where scheduled as exposed finish floor from damage. Repair or replacement of damaged concrete will be determined by the Architect. The cost of repair or replacement shall be borne by Contractor when damaged concrete is identified.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.
- B. Liquid densifiers and hardeners.
- C. Cementitious urethane coatings.
- D. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Curing compounds that also function as sealers for slabs other than CN1 and CN2.

1.03 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.04 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet (3 m) square.
- C. Mock-up may remain as part of the work.
 - 1. Approved mock-up will constitute desired level of floor polishing sheen for all areas.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.
- B. Do not finish floors until interior heating system is operational or as required by manufacturer.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Liquid Densifier and Hardener:
 - 1. Use at following locations: Exposed concrete slabs U1, CN1 and CN2.
- B. Penetrating Clear Sealer:
 - 1. Use at following locations: All areas designated CN1 and CN2.
- C. Cementitious Urethane Coating: All areas designated U1

2.02 SURFACE TREATMENTS

- A. Troweling Aid, Densifier and Curing Agent: Liquid reactive colloidal silica-based topical treatment, spray-applied to wet concrete and floated or troweled into the surface.
 - 1. Product:
 - a. Solomon Colors; Solomon Colors Lythic Day1: www.solomoncolors.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 DENSIFIERS AND HARDENERS

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
 - 1. Products:
 - a. Lythic; Densifier and XL: www.lythic.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 COATINGS

- A. Cementitious Urethane Coating: 100% Solids, Aromatic, Cementitious Urethane Coating System.
 - 1. Products:
 - a. Dur A Flex; POLY-CRETE HF: www.dur-a-flex.com
 - b. Color: As indicated in Drawings.
 - 2. All areas designated U1
- B. Penetrating Sealer: Transparent, nonyellowing, water- or solvent-based coating.
 - 1. Location: All areas designated CN1 and CN2.
 - 2. Composition: Colloidal Silica.
 - 3. Products:
 - a. Lythic; SPD Protector: www.lythic.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Installation of reinforcement.
- B. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.
- C. Section 09 91 13 - Exterior Painting: Painting exposed exterior masonry.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2021.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
- G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
- I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- L. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
- M. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
- N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- O. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- P. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements and the Structural Drawings for submittal procedures.
- B. Product Data: Provide data for grout, masonry units, mortar, masonry accessories, and reinforcement.
- C. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
 - 2. Special Shapes: Provide nonstandard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block.
 - b. Exposed Faces: Manufacturer's standard color and texture.

2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type M.
 - 2. Color: Standard gray.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed billet bars; galvanized.
- B. Reinforcement Type and Placement: Per the Structural Drawings.

2.04 FLASHINGS

- A. Metal Flashing Materials:
 - 1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch (0.48 mm) thick; finish 2B to 2D.

2.05 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.06 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at nonmasonry construction.
- B. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

- C. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.07 LINTELS

- A. Install reinforced unit masonry lintels over openings in accordance with the Structural Drawings.
 - 1. Do not splice lintel reinforcing bars.
 - 2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
 - 3. Place and consolidate grout fill without displacing reinforcing.
 - 4. Allow masonry lintels to attain specified strength before removing temporary supports.

3.08 GROUTED COMPONENTS

- A. Lap splices per the Structural Drawings.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. Grout all cores solid unless otherwise noted.

3.09 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.10 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.

3.11 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members, support members and struts.
- B. Base plates, shear stud connectors and expansion joint plates.
- C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joist Framing.
- B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 40 00 - Cold-Formed Metal Framing: Metal stud curtain wall framing attached to structural frame.
- D. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.
- E. Section 09 91 13 - Exterior Painting: Painting exposed exterior structural steel.
- F. Section 09 91 23 - Interior Painting: Painting exposed interior structural steel.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- I. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- J. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- K. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.
- L. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2014a.
- M. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- O. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- P. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- Q. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

- R. 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; 2014.
- S. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- T. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- W. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.
- X. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- Y. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections of all members.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).
 - 1. Other Acceptable Qualifications:
 - a. AISC Certification Standard for Steel Building Structures
 - b. ISO 9001:2000
- C. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Refer to Structural Notes and Drawings.
- B. Steel Angles, Plates, and Channels: ASTM A36/A36M typical, ASTM A572 Grade 50 where indicated.
- C. Steel W Shapes and Tees: ASTM A992/A992M.
- D. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.
- E. Hollow Structural Sections: ASTM A500 Grade C

- F. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.
- G. Typical Structural Bolts, Nuts, and Washers: ASTM A325 or A325M, Type 1, medium carbon, plain, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.
- H. High-Strength Structural Bolts: ASTM A490 or ASTM A490M; Type 1 alloy steel, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
- K. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by intermittent welds and plastic filler. Grind exposed welds smooth.
 - 1. Exterior, exposed to view, continuously seal joined members by continuous weld.
- C. Develop required camber for members.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be galvanized.
- B. Galvanize structural steel members and fasteners per the Structural Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components and shear studs indicated on the Structural Drawings.
- D. Do not field cut or alter structural members without approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Provide all parts, materials, and labor required for the design, delivery, testing and erection of buckling-restrained braces, which are designed by the manufacturer to meet stiffness, yield strength, and elongation requirements as indicated on the Drawings and other requirements specified herein.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Superstructure
- B. Section 05 40 00 - Cold-Formed Metal Framing: Metal stud curtain wall framing attached to structural frame.
- C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.
- D. Section 09 91 13 – Exterior Painting: Painting of exposed exterior BRBs.
- E. Section 09 91 23 – Interior Painting: Painting of exposed interior BRBs.

1.03 REFERENCE STANDARDS

- A. The following applicable standards are to be adhered to unless indicated otherwise.
- B. American Institute of Steel Construction (AISC):
 - 1. “Code of Standard Practice for Steel Buildings and Bridges”, latest edition.
 - 2. AISC Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341), latest edition.
- C. American Society for Testing and Materials (ASTM) Standard Specifications:
 - 1. A6 – Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, latest edition.
 - 2. A36 – Specification for Carbon Structural Steel, latest edition.
 - 3. A325– Specification for Structural Bolts, 120/105 ksi Minimum Tensile Strength, latest edition.
 - 4. A490 – Specification for Structural Bolts, 150 ksi Minimum Tensile Strength, latest edition.
 - 5. A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, latest edition.
 - 6. A572 – Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, latest edition.
 - 7. F959 – Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, latest edition.
 - 8. F1852 – Specification for “Twist-off” Type Tension Control Structural Bolts, 120/105 ksi Minimum Tensile Strength, latest edition
 - 9. F2280 – Specification for “Twist-off” Type Tension Control Structural Bolts, 150 ksi Minimum Tensile Strength, latest edition
- D. American Welding Society (AWS):
 - 1. 2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination.
 - 2. A5.1 –Specification for Carbon Steel Electrodes
 - 3. A5.18 –Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
 - 4. A5.20 – Carbon Steel Electrodes for Flux Cored Arc Welding
 - 5. D1.1 – Structural Welding Code-Steel, latest edition.

- E. Steel Structures Painting Council (SSPC):
 - 1. Steel Structures Painting Manual, latest edition.

1.04 DEFINITIONS

A. Buckling-Restrained Brace (BRB): A steel brace consisting of an outer steel casing, an inner steel core, and a concrete matrix between the core and the outer steel casing. The inner steel core resists against tensile and compressive axial loads and is restrained from buckling by the concrete contained in the outer steel casing.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Proposed Design of Buckling-Restrained Braces:
 - 1. Design Drawings shall clearly display size, thickness and length of exterior brace casing as well as configuration and size of the full length of the core plates.
 - 2. Calculations shall be provided to display the ability of the proposed "BRB's" to meet the Performance Criteria described herein.
 - 3. The Design Drawings and Calculations shall be sealed and stamped by a Professional Engineer (P.E.) licensed in Washington State.
 - 4. Preliminary design: At contractor's option, make an initial submittal of the above items without sealed P.E. stamp for review by project Structural Engineer of Record, Architect and Jurisdictional Authority and coordination with structural steel contractor. Once all reviews are complete and incorporated, resubmit with sealed P.E. stamps for record.
- C. Shop Drawings
 - 1. Shop drawings shall clearly display all geometries necessary to manufacture BRB's including plate thickness, lengths, plate dimensions inside and outside of the casing, and casing dimensions.
 - 2. Shop drawings shall clearly display all connection information including location of bolts, bolt types, bolt diameters, hole size, and faying surface types.
- D. Material Test Reports
 - 1. Tensile tests and chemical analysis for all steel.
 - 2. Independent coupon tests used to verify core plate initial yield stress, tensile stress, and ultimate elongation.
 - a. Where core plates are fabricated from plate material, coupon tests shall be performed on each plate.
 - b. Where core plates are fabricated from bar stock, coupons shall be made at intervals of each 5 tons of material of same heat and thickness.
 - c. Coupon tests to be taken at point of manufacture. Mill test reports (MTR) may not be used.
 - 3. Core plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing in accordance with ASTM A673, Frequency P, or approved equal. The impact test shall meet

a minimum average value of 20 ft-lbs absorbed energy at +70 degrees Fahrenheit and shall be conducted in accordance with AISC Specification, or approved equal.

E. Technical Report

1. The Manufacturer shall submit a BRB testing report. The testing configurations used, and the results obtained shall meet the criteria found in the AISC Seismic Provisions and those indicated in Article 2.5.

F. Welding Certificates

1. Welder Performance Qualification Records (WPQR's)
2. Welding Procedure Specification (WPS) written in conformance with AWS D1.1 for each proposed type of welded joint, whether pre-qualified or qualified by testing.

G. Manufacturer's Quality Assurance Plan

H. Manufacturer's in-house Quality Assurance Inspection Report for each brace upon completion of fabrication.

I. Outside Testing Agency Quality Control Report where applicable.

1.06 QUALITY ASSURANCE

A. The Manufacturer shall have a detailed Quality Assurance Plan.

1. The Quality Assurance Plan shall contain the procedures for manufacturing buckling-restrained braces including:
 - a. Welding procedures.
 - b. Methodology for verifying and documenting material properties.
 - c. Indication of how the product is to be identified, such that it can be traced back to production quality assurance records.
 - d. A flow chart of the process by which the product is manufactured, including description of production methods.
 - e. Identified manufacturing tolerances for each production process.
 - f. In-process quality control including all points of internal inspection for control and monitoring of the fabrication and assembly process.
2. Design Engineer Requirements: The Design Engineer shall be registered in Washington State, have experience with designing buckling-restrained braced frame systems, and have a thorough knowledge of the submitted BRB test report.
3. Qualification testing shall conform to Article 2.5.

B. The Manufacturer shall notify Owner of fabrication schedule at least 30 days prior to fabrication in order to allow Owner or Owner's Representative to observe fabrication process.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Plants fabricating buckling-restrained braces shall comply with the following:

1. Obtain and maintain accreditation from The American Institute of Steel Construction (AISC Certified Fabricator) in conjunction with any additional certifications required by the local jurisdiction.
 2. Have a minimum of 5 years of documented continuous experience in the fabrication of buckling-restrained braces with a minimum of 30 completed projects over this same period.
 3. Buckling-restrained braces for this project shall be manufactured in the same facility (following the same quality assurance procedures) as the braces manufactured and tested to fulfill the AISC 341 testing requirements.
- B. Buckling-Restrained Braces shall be designed, manufactured and supplied by the following vendor or equal.
1. CoreBrace, LLC
5789 West Wells Park Road
West Jordan, UT 84081
801.280.0701
- C. Documentation showing evidence of valid accreditation and experience shall be submitted to the Engineer of Record during the bidding phase for any proposed manufacturer not listed above.

2.02 MATERIALS

- A. Core Plate
1. ASTM A36 with F_y as noted on the drawings.
 - a. F_y of all core plate material shall be verified via coupon test per Article 1.4.D.2.
 - b. Core plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing per Article 1.4.D.3.
 - c. If not noted on the drawings, use $38\text{ksi} \leq F_y \leq 46\text{ksi}$
- B. Casing
1. ASTM A500, Gr. B or similar for square or rectangular sections.
 2. ASTM A500, Gr. B or A53, Gr. B or similar for round sections.
- C. Primer
1. Standard shop primer.
- D. Structural Bolts, Nuts, and Washers:
1. ASTM A325 or A490 for conventional high-strength bolts, ASTM A563 nuts. To match grade specified on BRB submittal drawings.
 2. ASTM F1852 or F2280 for twist-off type Tension Control Bolt/Nut/Washer Assemblies. To match grade specified on BRB submittal drawings.
 3. ASTM F3148 fixed-spine type Torque-and-Angle (TNA) Bolt/Nut/Washer Assemblies.
- E. Welding Materials
1. Shielded metal arc welding electrodes conform to AWS A5.1, flux-cored arc welding electrodes conform to AWS A5.20, and electrodes used for gas metal arc or submerged arc conform to the requirements of AWS A5.18.
 2. The minimum tensile strength of the E70 class electrodes used in production is 70,000 psi (470 MPa).

3. Materials shall provide production welds with minimum Charpy V Notch properties of 20 ft-lbs (27 J) at -20°F (-30 C).
- F. Infill Grout
1. Manufacturer's standard infill that has been demonstrated suitable by sub-assembly testing per the Recommended Provisions.
- G. Debonding Agent
1. Manufacturer's standard: demonstrated suitable to maintain separation of steel core and grout encasement when subjected to a minimum of 30 cycles of inelastic yielding at 2% strain; resistant to aging effects for a life cycle of 50 years.

2.03 DESIGN REQUIREMENTS

- A. A Professional Engineer shall design the buckling-restrained braces to meet the Performance Requirements. The Engineer shall have a thorough knowledge of the qualifying cyclical tests and competently apply the test results to the Project conditions.
- B. Interpolation or extrapolation of test results for different member sizes shall be justified by rational analysis that demonstrates stress distributions and magnitudes of internal strains that are consistent with or less severe than the tested assemblies and that considers the adverse effects of larger material and variations in material properties.
- C. Stability calculations shall include beams, columns and gussets adjoining the BRB's.
- D. End rotation effects corresponding to the larger of 2.0 times Design Story Drift or .025 radians minimum shall be considered.
- E. Bracing connections are to be designed to a minimum of 1.0 times the adjusted brace strength as defined in the AISC Seismic Provisions with overstrength parameters determined per Article 2.4.F. Connection design shall include length effects for long BRBs as described in Article 2.3.F.
- F. Buckling-restrained braces longer than 35 feet (or greater than 200% of the qualifying test specimen length) shall account for length effects in the determination of the compression overstrength factor (ϕ). BRB manufacturer shall submit design methodology to justify values used to determine length effects. This methodology must include the comparison of test results of at least (2) long BRBs (minimum of 40 feet long) to a control sample of one-half the length of the long specimen. Both the control sample and the long specimen shall be of similar capacity ($\pm 5\%$) for comparison.

2.04 PERFORMANCE REQUIREMENTS

- A. Core plate material shall have a yield range of 42 ksi within ± 4 ksi unless indicated otherwise in the structural drawings. Coupon tests taken from plates at point of manufacture of BRBs shall

be used to verify conformance. Additional coupon tests may be performed to replace coupon tests that fall out of acceptable range.

- B. Increasing amplitude cyclic displacement tests per the AISC Seismic Provisions shall provide stable performance up to a displacement corresponding to $2.0 \times$ Design Story Drift.
 - 1. Hysteretic behavior shall display no post-yield loss of strength, degradation, or pinching.
 - 2. Fracture of any portion of the BRB shall not occur during the qualifying tests.
 - 3. The cumulative ductility factor requirement specified in AISC 341 shall be increased from 200 to 300.
- C. The steel core shall resist compression and tension forces. The steel core area shall be as per the project drawings and core material shall be within the yield stress range specified in Article 2.4.A.
- D. The concrete fill and steel casing shall prevent the steel core from buckling globally and locally during compressive loading without binding due to longitudinal shortening and transverse expansion. Demand for local and global stability of casing checks shall be based on the adjusted brace strength at the maximum yield stress ($F_{ysc,max}$) of the specified yield stress range of the core plate material. Casing design shall include length effects for long BRBs as described in Article 2.3.F.
- E. Steel core projections beyond the steel casing and brace connections shall develop the adjusted brace strength without instigation of fracture or instability. For core plate checks use the minimum ($F_{ysc,min}$) of the specified yield stress range for determining demand. For all other materials use $F_{ysc,max}$ to determine demand.
- F. The overstrength factors (Ω) shall be determined at a brace strain level associated with the greater of a 2% interstory drift or twice the design story drift, the latter of which is taken as $(2\Omega C_d F_{ysc,min}) / (\phi E)$, where C_d is the design drift deflection amplification factor, E is the nominal modulus of elasticity of the core plate material, ϕ is the Importance Factor, Ω is the Redundancy Factor. When actual brace demand is provided, twice the design story drift is taken as $(2C_d P_d) / (A_s \phi E)$, where P_d is the axial force demand in the BRBs at the controlling drift design load case. Compression overstrength determination shall include the effects of brace length as described in Article 2.3.F.

2.05 QUALIFICATION TESTS

- A. Buckling-restrained brace design shall be based on two qualifying cyclic tests conforming to the AISC Seismic Provisions for Buckling Restrained Braced Frames. As stated in the Provisions, at least one of the two qualifying tests needs to be a subassembly test to demonstrate the ability of the BRB to withstand rotational demands. The other test may be performed uniaxially or may also be a subassembly test.
- B. The requirements of the AISC 341 Seismic Provisions shall be met along with the modification in Article 2.4.B.3.

- C. The strain level during testing shall be equivalent to, or greater than, the strains that the project braces will be expected to withstand.
- D. Qualifying tests can be based on full-scale cyclical tests previously reported for projects or research that are deemed similar to project conditions by the Manufacturer and Project Engineer.
- E. Qualification testing of long braces, if BRBs on this project are of sufficient length, as required in Article 2.3.F.

PART 3 EXECUTION

3.1 FABRICATION

- A. Braces shall be fabricated in accordance with AISC Code of Standard Practice and in an AISC Certified Shop that participates in the AISC Quality Certification Program.
- B. Core plates shall be cut to profile shown on Design Drawings.
 - 1. The general roughness cannot exceed 1000 micro-inches in the yielding length.
 - 2. Notches in yield length region up to 1/8-inch may be repaired by grinding to a smooth transition. The length of the transition shall not be less than 10 times the notch depth.
 - 3. Notches in the yielding length region greater than 1/8-inch and less than or equal to 3/8-inch may be repaired using procedures outlined in the Company Quality Assurance Manual. The repairs shall be examined using Ultrasonic Testing (UT) procedures in conformance with AWS D1.1.
 - 4. Notches in the yielding length region greater than 3/8-inch in the yield length shall be rejected.
- C. No splices are allowed in the yielding region of the steel core plate.
- D. Minimum casing dimensions shall be as required by manufacturer or as specified on the project documents.
- E. Holes for bolted connections may be drilled, cut or punched in conformance with AISC standards and burs removed.
- F. Finish shall be manufacturer's standard shop primer. Do not paint connection faying surfaces if connection is designated slip critical unless paint used provides same slip resistance.
- G. Assembly of the different components of the brace shall be done in accordance with the manufacturer's Quality Assurance Manual in a manner that ensures proper performance of the brace.
- H. Pin connection hole shall be no more than 1/32" larger than connecting pin.

3.2 SHIPPING

- A. Manufacturer to package BRB's for protection against shipping damage.
- B. Manufacturer shall coordinate delivery dates and quantities with Contractor/Owner. Contractor/Owner shall provide adequate storage space and proper lay-down areas.
- C. Braces shall be stored on dunnage not touching the ground.
- D. Coordinate erection aid requirements with contractor/Owner.

3.3 ERECTION

- A. Braces are to be erected under the Structural Steel Specification Section and according to referenced AISC Specifications.
- B. Prior to erection, clean faying surfaces of bolted BRBs to remove any surface contaminants including temporary coatings that may have been applied for transport.
- C. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of buckling-restrained braces.
- D. No field welding to BRB's is allowed, including non-structural pieces unless approved by manufacturer and Engineer of Record (EOR).
- E. No field cutting or altering of the BRB's is permitted without the approval of the manufacturer and EOR.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for roof openings greater than 16 inches (- mm).

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Superstructure framing.
- B. Section 05 31 00 - Steel Decking: Support framing for openings less than 16 inches (- mm) in decking.
- C. Section 09 91 13 - Exterior Painting: Painting of exposed exterior joists.
- D. Section 09 91 23 - Interior Painting: Painting of exposed interior joists.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- E. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.
- F. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2014a.
- G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- H. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- I. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- J. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.
- M. SJI (SPEC) - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.
- N. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- Q. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.

- B. Shop Drawings: Refer to structural drawings for deferred submittal requirements. Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Design shall be performed by Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No.9.
- C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 10 years documented experience.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Open Web Joists: Types as indicated on drawings:
 - 1. Provide bottom and top chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: As shown on the drawings.
 - 3. Finish: Shop primed.
- B. Anchor Bolts, Nuts and Washers: []
- C. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FINISH

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).
- F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- G. Do not field cut or alter structural members without approval of joist manufacturer.
- H. After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof deck.
- B. Supplementary framing for openings up to and including 16 inches (- mm).
- C. Bearing plates and angles.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal deck.
- B. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.
- D. Section 05 21 00 - Steel Joist Framing: Support framing for openings larger than 16 inches (- mm).
- E. Section 05 40 00 - Cold-Formed Metal Framing: Metal framing.
- F. Section 05 50 00 - Metal Fabrications: Steel angle or bent plate at deck edges.
- G. Section 09 91 13 - Exterior Painting: Painting of exposed exterior deck.
- H. Section 09 91 23 - Interior Painting: Painting of exposed interior deck.
- I. Section 22 00 00: Reinforcement pans with drain hub assemblies.
- J. Section 26 05 33 - Raceways and Boxes: Electrical and data floor outlets, sleeves and gaskets.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.
- G. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc; 2013.
- H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Certificates: Certify that products furnished meet or exceed specified requirements.

- E. Submit manufacturer's installation instructions.
- F. Compliance with FM Global RoofNav requirements pertaining to metal deck.
- G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 STEEL DECK

- A. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
 - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - 3. Structural Properties:
 - a. Refer to Structural Notes and Drawings.

2.02 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
- B. Welding Materials: AWS D1.1/D1.1M.
- C. Fasteners: Galvanized hardened steel, self tapping.
- D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
- E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
- F. Weld Washers: Mild steel, uncoated, 3/4 inch (19 mm) outside diameter, 1/8 inch (3 mm) thick.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- I. Foam Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.
 - 1. Provide at all walls that do not align with flutes of decking.
- J. Metal Flute Closures: Sheet metal closures that match profile of metal deck.
 - 1. Metal Deck: www.metaldeck.com

2.03 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips and cover plates, 20 gage, 0.0359 inch (0.91 mm) thick sheet steel; of profile and size required to cover flutes perpendicular to abutting walls and partitions ; finished same as deck.
- B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum length per the Structural Drawings but not less than 2 inches where no specific bearing dimension is shown.
- C. Fasten deck to steel support members at ends, intermediate supports, and parallel edges per the Structural Notes and Drawings.
- D. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- E. Weld deck in accordance with AWS D1.3/D1.3M.
- F. At deck openings provide reinforcement per the Structural Drawings.
- G. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- H. Close openings above walls and partitions perpendicular to deck flutes with double row of foam cell closures and sheet metal closures.
- I. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- J. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing and exterior soffits as indicated on Drawings.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Structural building framing
- B. Section 05 31 00 - Steel Decking: Foam and sheet metal flute closures where walls abut decking.
- C. Section 06 10 00 - Rough Carpentry: Wood blocking and miscellaneous framing.
- D. Section 06 10 00 - Rough Carpentry: Roof and wall sheathing.
- E. Section 07 21 00 - Thermal Insulation: Insulation within framing members.
- F. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- G. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.
- H. Section 07 92 00 - Joint Sealants.
- I. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.
- J. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- C. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- I. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on framing members, hardware, and fasteners; describe materials and finish, product criteria, limitations and load capacities.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. For cold-formed steel exterior framing, provide framing elevations of all walls. Elevations shall show all framing members and references to all connection details.

2. Provide details for all typical and unique connections of cold-formed steel to other cold-formed steel and/or to primary structure.
 3. Submit drawings and calculations sealed by a Professional Engineer registered in the State of Washington.
 4. See the Structural Drawings (including Structural Notes) for additional requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .
- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
1. CEMCO: www.cemcosteel.com.
 2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 3. The Steel Network, Inc: www.SteelNetwork.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Framing Connectors and Accessories:
1. Simpson Strong-Tie: www.strongtie.com/#sle.
 2. The Steel Network, Inc.: www.steelnetwork.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Criteria: Provide completed framing system engineered per Structural Notes and Drawings.
- C. Deliver to project site in largest practical sections.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
1. Size: Depth per the Architectural Drawings, width and gage as required by Specialty Component Engineer retained by the Contractor.
 2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
 - a. G60/Z180 Coating acceptable for interior applications.
- B. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 33 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.

2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100.
3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings., and wherever differential movement may be reasonably anticipated. Movement shall be considered both in the vertical direction (due to live, snow, or wind uplift loads) and in the horizontal direction parallel to the slab or deck edge (i.e. building "drift" due to seismic loads).
 - a. Where continuous studs bypass roof framing, connect stud to roof structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1.0-inch downward or upward in vertical direction and 1.0-inch each way in horizontal direction.
 - b. Where top of stud wall terminates below roof framing, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1.0-inch downward or upward in vertical direction and 1.0-inch each way in horizontal direction
 - c. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 10 feet (3048 mm).
4. Fixed Connections: Provide non-movement connections at main floor level and also where the weight of the wall framing is supported by primary structure (such as spandrel panels). Segments of walls where the weight of the wall framing is supported by primary structure shall be continuously isolated from walls supported on the foundation walls, such that deflection of the primary structure may occur without damage to the wall framing or finishes.
5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that resist torsion and weak axis buckling induced by axial compression loads , as required by the cold-formed steel design Engineer.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated fasteners (where permitted by code and ICC report), concrete screws.
- C. Welding: Comply with AWS D1.1/D1.1M.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- C. Foam and sheet metal flute closures installed between top track and underside of steel decking per Section 05 31 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

- B. Align floor and ceiling top and bottom tracks; locate to wall layout. Secure in place with fasteners as required but not more than at maximum 16 inches on center. Coordinate installation of sealant with floor and ceilingtop and bottom tracks.
- C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks as required.
- D. Construct corners using minimum of three studs. Studs, headers, sills, jambs, and all associated connections shall meet the strength and deflection requirements of the Structural Drawings.
- E. Install studs full length in one piece. Splicing of studs is not permitted.
- F. Install studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Attach blocking between studs for attachment of fixtures anchored to walls.
- J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- K. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch (- mm).
- B. Maximum Variation of any Member from Plane: 1/4 inch (- mm).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items, including: Appliance Lab partition posts.
- B. Prefabricated ladders and ship ladders.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.
- C. Section 05 21 00 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- D. Section 05 31 00 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- E. Section 09 91 13 - Exterior Painting: Paint finish.
- F. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- H. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- I. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- K. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- L. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- T. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; 2 (1), 6063 alloy, T52 temper.
3. Finish: Mill finish aluminum.
4. Manufacturers:
 - a. O'Keeffe's Inc; Model 500: www.okeeffes.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 LADDER SAFETY SYSTEMS

- A. Climbing Ladder Fall Arrest System (CLAFS): Comply with 29 CFR 1910.29, 29 CFR 1926.1053, Section 7 of ALI A14.3 and ANSI/ASSP Z359.16; climbing ladder fall arrest system allows worker to climb up and down using both hands; does not require employee continuously, hold, push, or pull any part of system while climbing.
 1. Product: 3M DBI SALA 6118030 Lad-Saf Cable Vertical Safety System 30 FT - Industrial Safety Products
 2. Location: As indicated in Drawings.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.

- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire retardant treated wood materials.
- B. Miscellaneous framing and sheathing.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.
- E. Wall sheathing with factory applied water-resistive barrier.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Wall framing.
- C. Section 06 17 53 - Shop-Fabricated Wood Trusses.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- F. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill and through-wall flashings.
- G. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
- F. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- H. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.
- I. PS 20 - American Softwood Lumber Standard; 2010.
- J. WWP A G-5 - Western Lumber Grading Rules; 2017.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Hem Fir, unless otherwise indicated.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Subflooring: PS 2 type, APA rated Plywood Sheathing or Sturd-I-Floor, 23/32 inch minimum thickness.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 48/24.
 - 3. Performance Category: 23/32 PERF CAT.
- B. Roof Sheathing: PS 2 type, APA rated Plywood Sheathing, 15/32 inch minimum thickness.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 32/16.
 - 3. Performance Category: 15/32 PERF CAT.
- C. Wall Sheathing, wood-framed construction: PS 2 type. APA rated Plywood or OSB sheathing, 15/32 inch nominal thickness.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 32/16.
 - 3. Performance Category: 15/32 PERF CAT.
- D. Wall Sheathing, Steel-Framed Construction: Glass mat faced gypsum with integral water-resistive and air barrier, ASTM C1177/C1177M, 5/8 inch (15.9 mm) thick.
 - 1. Edges: Square.

2. Water Vapor Permeance: 30 perms (1723.5 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M (wet cut method).
3. Air Permeance, Assembly: 0.04 cfm/sq ft (0.2 L/s per sq m), maximum, when tested in accordance with ASTM E2357.
4. Fluid-Applied Flashing: Approved by sheathing manufacturer.
5. Warranty:
 - a. Exposure: Manufacturer's standard; 12 months, against exposure damage, and dated from installation of product.
 - b. Defect: Manufacturer's standard; 5 years, against manufacturing defects, and dated from purchase of product.
 - c. Material: Manufacturer's standard; 5 years, dated from Date of Substantial Completion.
6. Manufacturers:
 - a. Georgia-Pacific LLC; DensElement Barrier System: www.DensElement.com/#sle.
- E. Mechanical, Telecommunication, and Electrical Room Mounting Boards: Fire-treated PS 1 A-D plywood; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
- B. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
- C. Sill Flashing: See Section 07 62 00.
- D. Water-Resistive Barrier: See Section 07 25 00.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
- B. Fire Retardant Treatment:
 1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat exterior rough carpentry items.
 - c. Do not use interior fire retardant treated wood in direct contact with the ground.
 2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

- a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- b. Interior rough carpentry items are to be fire retardant treated.
- c. Treat rough carpentry items as indicated .
- d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 PREPARATION

- A. Install sill gasket under sill plate of exterior framed walls bearing on foundations and structural slabs; puncture gasket cleanly to fit tightly around protruding anchor bolts, conduit, etc.
- B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
 1. Cabinets and shelf supports.
 2. Wall brackets.
 3. Handrails.
 4. Grab bars.
 5. Towel and bath accessories.
 6. Wall-mounted door stops.
 7. Chalkboards and marker boards.
 8. Wall paneling and trim.
 9. Joints of rigid wall coverings that occur between studs.
 10. Mechanical and Electrical equipment.
 11. Wall mounted LCD/TV/Monitors.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Subflooring: Glue and nail to framing; staples are not permitted.
- B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 1. Nail panels to framing; staples are not permitted.

- C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
- D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 16 inches (- mm) on center on all edges and into studs in field of board.
 - 1. Install board over wall board per Section 09 21 16.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.06 CLEANING

- A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated wood trusses.
- B. Truss bridging.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Installation requirements for miscellaneous framing.
- B. Section 06 10 00 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. SBCA (BCSI) - Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses; 2018 (Updated 2020).
- D. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle trusses in accordance with SBCA (BCSI).
- B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.01 TRUSSES

- A. Wood Trusses: Design and fabricate trusses in accordance with ANSI/TPI 1 and to achieve specified design requirements indicated.
 - 1. Refer to Structural Notes in Drawings.

2.02 MATERIALS

- A. Lumber:
 - 1. Moisture Content: Between 7 and 9 percent.
 - 2. Lumber fabricated from old growth timber is not permitted.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.

- B. Fasteners: Electrogalvanized steel, type to suit application.
- C. Bearing Plates: Electrogalvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that supports and openings are ready to receive trusses.

3.02 ERECTION

- A. Install trusses in accordance with manufacturer's instructions, SBCA (BCSI); maintain a copy of applicable documents on site until installation is complete.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field-cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Frame openings between trusses with lumber in accordance with Section 06 10 00.

3.03 TOLERANCES

- A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glue laminated wood beams.
- B. Steel hardware and attachment brackets.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting: Field finishing.

1.03 REFERENCE STANDARDS

- A. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species; 2010.
- B. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber; 2007.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.
- E. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2015.
- F. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect members to AITC requirements for individually wrapped.

PART 2 PRODUCTS

2.01 GLUED-LAMINATED UNITS

- A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.
 - 1. Verify dimensions and site conditions prior to fabrication.
 - 2. Cut and fit members accurately to length to achieve tight joint fit.
 - 3. Fabricate member with camber built in.
 - 4. Do not splice or join members in locations other than those indicated without permission.
- B. Performance Criteria:
 - 1. As indicated in Structural Drawings.

2.02 MATERIALS

- A. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. Design for the following values:
- B. Steel Connections and Brackets: As indicated in Structural Drawings.

2.03 FABRICATION

- A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.
- B. Cut and fit members accurately to length to achieve tight joint fit.
- C. Do not splice or join members in locations other than those indicated without permission.
- D. Field Finishing of Members Exposed to View: Specified in Section 09 91 13.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that supports are ready to receive units.

3.02 PREPARATION

- A. Coordinate placement of support items.

3.03 ERECTION

- A. Set structural members level and plumb, in correct positions or sloped where indicated.
- B. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.
- C. Field Finishing: Specified in Section 09 91 13.

3.04 TOLERANCES

- A. Framing Members: 1/2 inch (12 mm) maximum from true position.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section _____: Cabinet hardware.
- C. Section 09 91 13 - Exterior Painting: Painting of finish carpentry items.
- D. Section 09 91 23 - Interior Painting: Painting of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
- E. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide instructions for attachment hardware and finish hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Woodwork Items:
 - 1. Wainscott: 5/8 AC plywood.

2.02 SHEET MATERIALS

- A. Softwood Plywood: Any face species, Plywood core; PS 1 Grade AC, glue type as recommended for application.

2.03 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application unless noted otherwise in Drawings.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Wood Filler: Solvent base, tinted to match surface finish color.

2.05 HARDWARE

- A. Hardware: Comply with BHMA A156.9.
- B. Countertop Support Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting.
 - 1. Material: Steel.
 - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 - b. Color: To be selected from full range of colors.
 - c. Height: 18 inches (460 mm).
 - d. Support Length: 21 inches (530 mm).
- C. Vanity Brackets: Fixed, ADA-Compliant, face-of-stud mounting.
 - 1. Material: Stainless steel; formed, compound shapes.
 - a. Finish: Brushed finish.
 - 2. Height: 18 inches (460 mm).
 - 3. Support Length: 21-1/2 inches (546 mm).

2.06 SITE FINISHING MATERIALS

- A. Field Finishing: See Section 09 91 23.

2.07 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
- D. Install hardware supplied by Section 08 71 00 in accordance with manufacturer's written instructions.

3.03 PREPARATION FOR SITE FINISHING

- A. Site Finishing: See Section 09 91 13 and 09 91 23.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 RELATED REQUIREMENTS

- A. 07 92 00 - Joint Sealants

1.03 REFERENCE STANDARDS

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 6 by 6 inch (- mm) in size illustrating material and surface design of panels.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc: www.cranecomposites.com/#sle.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
 - 2. Panel Thickness: 0.10 inch (2.5 mm).
 - 3. Surface Design: Smooth.
 - 4. Color: As selected by Architect.
 - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Aluminum; Clear Anodized
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.
- B. Section 31 01 00 - Earthwork.
- C. Section 33 46 00 - Subdrainage.

1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.
- B. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).
- C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).
- D. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
- F. NRCA ML104 - The NRCA Roofing and Waterproofing; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
 - 2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
 - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
 - 4. Applied Thickness: 1/8 inch (3 mm), minimum, wet film.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

- A. Foundation Walls: Apply two coats of asphalt dampproofing.
- B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.
- C. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- D. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- E. Apply bitumen per manufacturers recommendations.
- F. Apply from 2 inches (50 mm) below finish grade elevation down to top of footings.
- G. Seal items watertight with mastic, that project through dampproofing surface.
- H. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.
- I. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall, underside of floor slabs, over roof deck, and exterior wall behind exterior wall finish.
- B. Batt insulation in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Supporting construction for batt and rigid insulation.
- C. Section 06 10 00 - Rough Carpentry: Supporting construction for batt and rigid insulation.
- D. Section 07 21 19 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.
- E. Section 07 25 00 - Weather Barriers: Separate water resistive barrier and vapor retarder materials.
- F. Section 07 54 00 - Thermoplastic Membrane Roofing: Installation requirements for board insulation over low slope roof deck specified in this section.
- G. Section 07 92 00 - Joint Sealants.
- H. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 DEFINITIONS

- A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
 - 1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
 - 2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
 - 3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2012.

- G. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- I. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation Over Metal Stud Framed Walls, Continuous: Mineral wool insulation board.
- D. Insulation on Inside of Concrete and Masonry Exterior Walls: Extruded polystyrene board.
- E. Insulation in Metal Framed Walls: Batt insulation with separate vapor retarder.
- F. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- G. Insulation Over Roof Deck: Polyisocyanurate board, tapered and non-tapered.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum beneath slabs, Type IV in all other locations.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
 - 5. R-value (RSI-value); 1 inch (25 mm) of material at 72 degrees F (22 C): 5 (0.88), minimum.
 - 6. Board Edges: Square.
 - 7. Thickness: As indicated in Drawings.
- B. Type 1 - Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 1.
 - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Compressive Strength: 16 psi (110 kPa)
 - 4. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
 - 5. Thermal Resistance: As indicated in Drawings.

6. Board Edges: Square.
 7. Tapered: Provide tapered units over base boards to achieve slope and thickness as indicated in Drawings
 8. Substitutions: See Section 01 60 00 - Product Requirements.
 - a. Substitutions must be an approved FM Global ROOFNAV assembly.
- C. Type 2 - Composite Polyisocyanurate (ISO) Board Insulation Faced with Plywood: Rigid cellular foam, complying with ASTM C1289.
1. Use: Over Type 1 - Polyisocyanurate Board Insulation, beneath composite roof shingles at control house, and as indicated in Drawings.
 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 4. Compressive Strength: 25 psi (172 kPa)
 5. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
 6. Plywood Thickness: 9/32" inch (- mm).
 7. Insulation Board Thickness: 3 inches (- mm).
 8. Thermal Resistance: R-value (RSI-value) minimum 15 (-).
 9. Board Edges: Square.
 10. Products:
 - a. Atlas; ACFoam Nail Base Roof Insulation: www.atlasroofing.com.
 11. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FIBERBOARD INSULATION MATERIALS

- A. Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 2. Board Size: 48 by 72 inches (_____ mm).
 3. Board Thickness: 2-1/2 inches (65 mm).
 4. Thermal Resistance: As indicated in Drawings.
 5. Maximum Density: 11 lb/cu ft (- kg/cu m).
 6. Products:
 - a. ROXUL, Inc; Comfortboard CIS: www.roxul.com.
 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Formaldehyde Content: Zero.
 5. Thermal Resistance: As indicated in Drawings
 6. Facing: Aluminum foil, flame spread 25 rated; one side, unless indicated otherwise.
- B. Flexible Blanket Insulation: Thin profile insulation that complies with complex shapes, unfaced; flame spread index of 5 (five) and smoke development index of 10 (ten) or less when tested in accordance with ASTM E84.

2.05 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 25 00.
- B. Insulation Fasteners at Concrete Walls: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

1. Use at locations where only covered by FSK scrim. Use adhesive at all other locations unless noted otherwise.
- C. Insulation Fasteners at Roof Decks: Appropriate for purpose intended and approved by roofing manufacturer.
 1. Length as required for thickness of insulation material and penetration of deck and wall substrate, with metal washers.
- D. Adhesive: Type recommended by insulation manufacturer for application.
- E. Foamed-In-Place Insulation: Where indicated in Drawings fill voids or cavities to inhibit passage of air per Section 07 21 19.
- F. Scrim: Metallized polypropylene to cover rigid foam insulation that is exposed as indicated in Drawings, complying with the following:
 1. Flame Spread: 10 or less.
 2. Smoke Developed: 10 or less.
 3. Attachment: Manufacturer's recommendation based on application.
 4. Basis of Design: Lamtec Corporation; www.lamtec.com; WMP-10.
 5. Accessories: Manufactures approved seam tape.
- G. Thermal Break Girt: Used in conjunction with exterior continuous insulation system (mineral fiberboard insulation) to eliminate thermal break and allow for structural attachment of cladding system to building framing.
 1. Basis-of-Design Manufacturer: Armatherm, 4 Middle Street, Fairhaven, MA 02719. Tel: 844-360-1036. Email: sales@armatherm.com. Web: www.armatherm.com.
 2. Compressive Strength: ASTM D638 40,000 psi.
 3. Compressive Modulus: ASTM D695 673,400 psi.
 4. Shear Strength: ASTM D732 16,000 psi.
 5. Thermal Conductivity: ASTM C518 1.05 BTU in/ hr sf degree F.
 6. Coefficient of Thermal Expansion: ASTM E831 2.2×10^{-6} in/in/degree F.
 7. Thermal Resistance (R value): ASTM C518 0.95 hr sf degree F/ BTU.
 8. Surface Burning Characteristics: ASTM E84.
 - a. Flame Spread: 25 (class A).
 - b. Smoke Developed: 50 (class A)
 9. Spacing: 24 inches on center, coordinate with mineral fiberboard insulation size
 10. Connectors and Fasteners: Minimum ultimate pull-out capacity from Armatherm Z GIRT shall be 450 pounds.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 1. Place boards to maximize adhesive contact. Use impaling clip type at locations not covered by gypsum wall board.
 2. Install in running bond pattern.
 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
 1. Use foamed-in-place to fill voids at protrusions.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install rigid insulation directly on water-resistant-barrier over exterior grade sheathing with manufacturer recommended mechanical fasteners.
- B. Install boards horizontally on walls.
 - 1. Install in running bond pattern.
 - 2. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
 - 1. Use foamed-in-place to fill voids at protrusions.
- D. Install thermal break girts in accordance with manufacturer's instructions and approved submittals and the following:
 - 1. Install in proper relationship with adjacent materials.
 - 2. Field verify girt spacing relative to steel stud locations and other points of attachment.
 - 3. Protect from damage until acceptance.

3.04 BOARD INSTALLATION UNDER UN-HEATED CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.
- D. Place insulation to minimize thermal bridging.

3.05 BOARD INSTALLATION UNDER HEATED CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted and vapor retarder has been installed.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent vapor retarder from being displaced or damaged while placing insulation.
- D. Place insulation to minimize thermal bridging.

3.06 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
 - 1. See applicable roofing specification section for specific board installation requirements.
 - 2. Ensure vapor retarder is clean and dry, continuous, and ready for application of roofing system.
 - 3. Fasten insulation to deck in accordance with roofing manufacturer's written instructions.
 - 4. Do not apply more insulation than can be covered with roofing on the same day.

3.07 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
 - 1. Refer to Section 07 21 19 - Foamed-In-Place Insulation for gaps and voids where batt insulation is not suitable or indicated in Drawings.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Where necessary retain insulation batts in place with spindle fasteners at 12 inches (300 mm) on center.
- F. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches (152 mm) on center. Lap and seal sheet retarder joints over face of member.

- G. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member
- H. Tape seal tears or cuts in vapor retarder.
- I. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.
- J. Coordinate work of this section with requirements for vapor retarder, see Section 07 26 00.
- K. Coordinate work of this section with construction of air barrier seal, see Section 07 27 00.

3.08 PROTECTION

- A. Do not permit installed insulation and associated vapor retarder to be damaged prior to its concealment. Insulation and vapor retarder damaged or removed to perform other work to be replaced and shall be the responsibility of the Contractor.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In exterior framed walls.
 - 2. In exterior wall crevices, and cavities not suitable for batt insulation.
 - 3. At junctions of dissimilar wall and roof materials.
- B. Protective intumescent coating when exposed on interior.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, and preparation requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
- D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation:
 - 1. Icynene-Lapolla; Icynene ProSeal (MD-C-200 v3): www.icynene.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Thermal Resistance: R-value (RSI-value) of 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
 - 2. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
 - 3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
 - 5. Closed Cell Content: At least 90 percent.
 - 6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 7. Basis of Design:
 - a. Icynene-Lapolla; Icynene ProSeal LE: www.icynene.com/#sle.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.
- B. Protective Coating: Intumescent type, spray applied; flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 1. Apply only when spray applied insulation is exposed in occupiable areas of building.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply protective coating monolithically, without voids, to fully cover foam insulation, if exposed on interior..
- C. Patch damaged areas.
- D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- E. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.
- B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.
- B. Section 07 54 00 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- D. Section 07 92 00 - Joint Sealants: Sealing building expansion joints.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Water Vapor Permeance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.
- C. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2010.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- G. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc; 2011.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.07 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct weather barrier mock-up, 10 feet (- m) long by 10 feet (- m) wide, indicating full system. Mock-up to include window opening.
- C. Locate where directed.
- D. Mock-up may remain as part of work.
- E. Coordinate review with Owner provided third party inspector.

1.08 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls use air barrier sheet, self-adhesive type.
- B. Interior Vapor Retarder:
 - 1. On inside face of studs of exterior walls, under gypsum wall board or other cladding, and beneath roof board insulation use mechanically fastened vapor retarder sheet.
 - 2. On bottom face of rafters, under gypsum wall board or other cladding, use mechanically fastened vapor retarder sheet.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
 - 6. Manufacturers:
 - a. VaproShield, LLC; WrapShield RS: www.vaproshield.com/#sle.
 - 1) Location: OTC Building.
 - b. Dupont; Tyvek Commercial Wrap: www.dupont.com
 - 1) Location: All Outdoor Village structures.

2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

- A. Vapor Retarder for roofs see Section 07 54 00.
- B. Vapor Retarder Sheet for Walls: ASTM D4397 polyethylene film reinforced with glass fiber square mesh, clear.
 - 1. Thickness: 10 mil, 0.010 inch (0.254 mm).
 - 2. Water Vapor Permeance: As required by referenced standard for thickness specified.

3. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material.

2.04 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
 1. Width: 4 inches (102 mm).
 2. Composition: Modified bituminous sheet laminated to polyethylene sheet.
 3. Thickness: 40 mil (0.040 inch) (1.02 mm), nominal.
- C. Pre-formed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, tear resistant.
- D. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
- E. Vapor Retarder Tape: Coated polyester film with acrylic adhesive backing; pressure sensitive.
- F. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- D. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- E. Mechanically Fastened Exterior Sheets:
 1. Install sheets shingle-fashion to shed water, with seams aligned horizontal.
 2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.
 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.
 4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches (305 to 460 mm) on center along each framing member supporting sheathing.
 5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 6. Where stud framing rests on concrete or masonry substrate, extend lower edge of barrier sheets at least 4 inches (102 mm) below bottom of framing and seal to substrate with sealant or approved mounting tape.

7. Install water-resistive barrier over jamb flashings.
 8. Install air barrier and vapor retarder UNDER jamb flashings.
 9. Install head flashings under water-resistive barrier.
 10. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- F. Mechanically Fastened Sheets - Vapor Retarder On Interior:
1. When insulation is to be installed in assembly, install vapor retarder over insulation.
 2. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
 3. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
 4. Seal entire perimeter to structure, window and door frames, and other penetrations.
 5. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.
- G. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
 4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Owners Inspection and Testing: Cooperate with Owners testing agency.
 1. Allow access to work areas and staging.
 2. Notify Owners testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
 3. Do not cover work of this section until testing and inspection is accepted.
- C. Do not cover installed weather barriers until required inspections have been completed.
- D. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured metal panels for exterior wall panels, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Wall panel substrate.
- B. Section 07 21 00 - Thermal Insulation: Continuous insulation and girt system beneath cladding.
- C. Section 07 25 00 - Weather Barriers: Air barrier under wall panels.
- D. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
- C. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.
- D. Installer's qualification statement.
- E. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- D. Prevent contact with materials that may cause discoloration or staining of products.

1.07 FIELD CONDITIONS

- A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.08 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.

- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty: Provide 5-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Wall Panels - Exposed Fasteners:
 - 1. AEP Span; HR-36: www.aepspan.com.
 - a. Location: Mechanical screen as indicated in Drawings.
 - 2. AEP Span; Mini-V Beam: www.aepspan.com
 - a. Location: Cladding Type 3 as indicated in Drawings.

2.02 METAL WALL PANEL SYSTEM

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels.
 - 2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 3. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
 - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - 6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.
- B. Exterior Wall Panels:
 - 1. Profile: Vertical and horizontal, as indicated; style as indicated.
 - 2. Material: Precoated steel sheet, 24 gauge, 0.0232 inch (___ mm) minimum thickness.
 - 3. Color: As selected by Architect from manufacturer's full line.
- C. Subgirt Framing Assembly: See Section 07 21 00.
- D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- E. Expansion Joints: Same material, thickness and finish as exterior sheets; 24 gauge, - inch (- mm) thick; manufacturer's standard brake formed type, of profile to suit system.
- F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- G. Anchors: Galvanized steel.

2.03 MATERIALS

- A. Base Metal:
 - 1. Material:
 - a. Steel conforming to ASTM A792 Zinalume®/Galvalume®, minimum yield 50,000 psi, thickness 24 gauge.
 - 2. Protective Coating:
 - a. Steel conforming to ASTM A653 (formerly ASTM A446), G-90 Galvanized, minimum yield 40,000 psi, thickness 24 gauge.

2.04 FINISHES

- A. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.
- B. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss to match sample.

2.05 ACCESSORIES

- A. Support for Cladding and Continuous Insulation: Thermal clips.
 - 1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing, see Section 07 21 00.
- B. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00
- C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
- D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
- E. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing members are ready to receive panels.
- B. Verify weather barrier, see Section 07 25 00, has been installed over wall panel substrate; see Section 05 40 00.

3.02 PREPARATION

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced Intervals as required for design loads.

3.03 INSTALLATION

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Fasten panels to structural supports; aligned, level, and plumb.
- C. Scribe/cut panels consistently around all penetrations, seal water tight.
- D. Locate joints over supports.
- E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.05 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.

3.06 PROTECTION

- A. Protect metal wall panels until completion of project.
- B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber cement siding.
- B. Accessory trims for fiber cement siding.
- C. Rain screen furring for fiber cement siding.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Siding substrate.
- B. Section 07 21 00 - Thermal Insulation: Continuous insulation and girt system under cladding.
- C. Section 07 25 00 - Weather Barriers: Weather barrier under siding.
- D. Section 07 90 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.
- E. Section 09 91 13 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Installer's Qualification Statement.
- D. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- C. Store products under waterproof cover and elevated above grade, on a flat surface.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide multi-year manufacturer warranty as indicated under Siding article sub-heading

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

- A. Lap Siding Type 2: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying to ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.

1. Style: Standard lap style.
 2. Texture: Smooth.
 3. Length: 12 ft (3.7 m), nominal.
 4. Width (Height): 7-1/4 inches (184 mm).
 5. Thickness: 5/16 inch (___ mm), nominal.
 6. Finish: Factory applied primer. Field applied topcoat.
 7. Color: Topcoat color to be selected from full range of paint manufacturer's color options.
 8. Warranty: 50 year limited; transferable.
 9. Manufacturers:
 - a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
- B. Panel Siding Type 1: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with machined edges, for nail attachment.
1. Texture: Smooth.
 2. Length (Height): 120 inches (3000 mm), nominal.
 3. Width: 48 inches (1220 mm).
 4. Thickness: 5/16 inch (8 mm), nominal.
 5. Finish: Factory applied primer. Field applied topcoat.
 6. Color: Topcoat color to be selected from full range of paint manufacturer's color options.
 7. Warranty: 50 year limited; transferable.
 8. Manufacturers:
 - a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 - b. Nichiha USA, Inc: www.nichiha.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
1. Texture: Smooth.
 2. Length: 96 inches (2400 mm), nominal.
 3. Width: 48 inches (1220 mm).
 4. Thickness: 5/16 inch (8 mm), nominal.
 5. Finish: Factory applied primer. Field applied topcoat.
 6. Color: Topcoat color to be selected from full range of paint manufacturer's color options.
 7. Manufacturer: Same as siding.

2.02 ACCESSORIES

- A. Support for Cladding and Continuous Insulation: See Section 07 21 00.
1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing.
 2. Fasteners: As recommended by clip manufacturer.
- B. Furring Strips: Plastic, breathable batten.
1. Basis of Design: Cor-A-Vent, Sturdi-Strip
- C. Trim: Basis of Design Tamlyn 'Xtreme Trim'.
1. Material: Aluminum
 2. Profiles: Provide 'H' Moulding at vertical joints and 'J' at all panel edges.
 3. Finish: Paint, color as indicated in Drawings.
- D. Fiber-Cement Siding Trim:
1. Manufacturer: James Hardie
 2. Product: Hardi Trim Boards
 - a. Thickness: 4/4

- b. Texture: Smooth
- c. Size: As indicated in Drawings
- E. Fasteners: Hot-dipped-galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch (32 mm).
- F. Flashing: Section 07 62 00 - Sheet Metal Flashing and Trim
- G. Sealants: Section 07 90 00 - Joint Sealants
- H. Finish: Section 09 91 13 - Exterior Painting.
- I. Exterior Soffit Vents: One piece, perforated, primed, with edge to capture fiber cement panel and manufactured especially for soffit application, and provide continuous vent.
 - 1. Basis of Design: EZ 29 – Perforated Soffit 5/16" Panel Trim

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that weather barrier has been installed over substrate completely and correctly.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Protect surrounding areas and adjacent surfaces during execution of this work.
- B. Install Sheet Metal Flashing:
 - 1. As indicated in Drawings.
- C. Coordinate penetrations with other trades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Use trim details indicated on drawings.
 - 3. Touch up field cut edges before installing.
 - 4. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.
- C. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.
- D. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- G. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.
- H. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings, and provide vent area specified.
- I. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

J. Finish Painting: See Section 09 91 13.

3.04 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean faced panels in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to manufacturer.

3.05 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mechanically attached system with thermoplastic roofing membrane.
- B. Vapor retarder.
- C. Cover boards.
- D. Flashings.
- E. Roofing cant strips, stack boots, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 21 00 - Thermal Insulation: Board insulation for roofs.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings and other related roof flashing.
- D. Section 07 71 23 - Manufactured Gutters and Downspouts.
- E. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.
- F. Section 11 01 14 - Fall Protection Systems

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- D. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
- E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2013.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- G. FM DS 1-28 - Wind Design; 2020.
- H. NRCA (RM) - The NRCA Roofing Manual; 2017.
- I. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
- J. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Specimen Warranty: For approval.

- D. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and paver layout.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.
 - 1. Approved by membrane manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above 80 degrees F (- degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.

2. For repair and replacement include costs of both material and labor in warranty.
3. Exceptions are not Permitted:
 - a. Damage due to wind speed greater than 56 mph (90 km/h) but less than 90 mph (145 km/h).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
 1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com/#sle.

2.02 ROOFING - UNBALLASTED APPLICATIONS

- A. Thermoplastic Membrane Roofing: One ply membrane, mechanically fastened.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

- A. Membrane Roofing Materials:
 1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrim.
 - a. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
 2. Reinforcing: Internal fabric.
 3. Thickness: 0.060 inch (1.5 mm), minimum.
 4. Sheet Width: Factory fabricated into largest sheets possible.
 5. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
 6. Color: Gray.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Fasteners: As recommended and approved by membrane manufacturer.
- D. Vapor Retarder: Carlisle, VapAir Seal 725TR; compatible with roofing and insulation materials.
- E. Flexible Flashing Material: Same material as membrane.
- F. Membrane Coated Metal: Thermoplastic polyolefin (TPO) clad sheetmetal.

2.04 COVER BOARDS AND DECK SHEATHING

- A. Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (13 mm) thick.
 1. Manufacturers:
 - a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Deck Sheathing: Fiber-mat reinforced cement roofing boards, ASTM C1325, fire-resistant type, mold-resistant, 5/8 inch (15.9 mm) thick.

2.05 INSULATION

- A. Polyisocyanurate Board Insulation: See Section 07 21 00 - Thermal Insulation.

2.06 ACCESSORIES

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- C. Sheathing Adhesive: Non-combustible type, for adhering gypsum sheathing to metal deck.
- D. Sheathing Joint Tape: Paper type, 3 inch (____ mm) wide, self adhering.
- E. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
- G. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- H. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- I. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.
- J. Sealants: As recommended by membrane manufacturer.
- K. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 1. Composition: Roofing membrane manufacturer's standard.
 2. Size: As indicated.
 3. Surface Color: gray

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.02 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips, nailing strips, and reglets are in place.

3.03 PREPARATION - METAL DECK

- A. Install preformed sound absorbing glass fiber insulation strips supplied by Section 05 31 00 in acoustic deck flutes. Install in accordance with manufacturer's instructions.
- B. Install deck sheathing on metal deck:
 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 3. Tape joints.
 4. Mechanically fasten sheathing to roof deck, in accordance with roofing manufacturer's instructions.

3.04 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.05 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

- A. Apply vapor retarder to deck surface (over deck sheathing) with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane in accordance with WA State NREC.
- B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- C. Attachment of Insulation:
 - 1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions.
- D. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions.
- E. Do not apply more insulation than can be covered with membrane in same day.

3.06 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (75 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- D. Mechanical Attachment: Apply membrane and mechanical attachment devices in accordance with manufacturer's instructions.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches (100 mm) onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Coordinate installation of roof accessories and related flashings.

3.07 FINISHING UNBALLASTED SURFACES

- A. Install walkway pads. Space pad joints to permit drainage.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
 - 1. Coordination third party inspection of vapor barrier prior to cover.

3.09 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- C. Remove bituminous markings from finished surfaces.
- D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- E. Repair or replace defaced or damaged finishes caused by work of this section.

3.10 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Metal flashings embedded in masonry.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Sheet metal strapping for sheet metal work.
- C. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- D. Section 07 46 10 - Metal Siding.
- E. Section 07 46 46 - Fiber-Cement Siding
- F. Section 07 71 00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- G. Section 07 71 23 - Manufactured Gutters and Downspouts.
- H. Section 07 90 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
- G. CDA A4050 - Copper in Architecture - Handbook; current edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ____ years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.
 - 1. Location: Concealed flashing.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's full colors.
 - 3. Location: Exposed or semi-exposed flashing.

2.02 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
 - 1. Provide stainless steel, with soft neoprene washers at locations to receive stainless steel flashings.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyl.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: 1; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; color to match metal.
- F. Plastic Cement: ASTM D4586, Type I.
- G. Solder: 1; Sn50 (50/50) type.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 2 inches (____ mm) wide, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

2.04 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished galvanized steel gutters and downspouts.

1.02 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim.
- B. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gutters and Downspouts:
 - 1. ATAS International, Inc; Water Control System: www.atas.com/#sle.
- B. Scupper and Collectors:
 - 1. ATAS International, Inc; Scuppers and Collector Boxes: www.atas.com/#sle.

2.02 MATERIALS

- A. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
 - 1. Concealed applications only.
- B. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
 - 1. Finish: Shop pre-coated with modified silicone coating.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- C. Primer: Zinc molybdate type.
- D. Protective Backing Paint: Zinc molybdate alkyd.

2.03 COMPONENTS

- A. Gutters: SMACNA rectangular style profile.

Puyallup WA
100% CD Set 01.26.24

- B. Downspouts: SMACNA round profile.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- D. Fasteners: Galvanized steel, with soft neoprene washers.

2.04 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604, multiple coat, thermally cured fluoropolymer finish system; color as indicated.
- B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

2.06 ACCESSORIES

- A. Gutter Expansion Joint: Pre-made expansion joint coupler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.381 mm).

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Factor expansion joints in long continuous runs in accordance with SMACNA. No run to be more than 50' withough 1/4-inch gap. Use preformed expansion couplers.
- C. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- D. Slope gutters 1/8" inch per foot (- mm/m), 1% percent minimum.
- E. Connect downspouts to storm sewer system. Seal connection watertight.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof hatches, with ladder up safety post.
- B. Non-penetrating pedestals.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Pre-fabricated roof access ladders and ladder fall arrest system.
- B. Section 07 71 00 - Roof Specialties: Other manufactured roof specialty items.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for roof hatch. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS

- A. Roof Hatch Manufacturers:
 - 1. Bilco Company; Type TB (various types and special size): www.bilco.com/#sle.

- B. Roof Hatches and Smoke Vents: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
 - 1. Style: Provide flat metal covers unless otherwise indicated.
 - 2. Mounting Substrate: Provide frames and curbs suitable for mounting on standing seam metal roof panel system.
 - 3. Thermally Broken Hatches: Provide insulation within frame and cover.
 - 4. For Ladder Access: Single leaf; 30 by 36 inches (762 by 914 mm).
- C. Metal Covers: Flush, insulated, hollow metal construction.
 - 1. Capable of supporting 40 psf (1.92 kPa) live load.
 - 2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch (2.3 mm) thick, liner 0.04 inch (1.0 mm) thick.
 - 3. Insulation: Manufacturer's standard 1 inch (25 mm) rigid glass fiber.
 - 4. Gasket: Neoprene, continuous around cover perimeter.
- D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
 - 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
 - 2. Hinges: Heavy duty pintle type.
 - 3. Hold open arm with vinyl-coated handle for manual release.
 - 4. Latch: Upon closing, engage latch automatically and reset manual release.
 - 5. Manual Release: Pull handle on interior.
 - 6. Locking: Padlock hasp on interior.
- E. Safety Post: Powder coated steel (yellow), basis of design Bilco LU-1.

2.02 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
 - 1. Design Loadings and Configurations: As required by applicable codes.
 - 2. Height: Provide minimum clearance of 6 inches (152 mm) under supported items to top of roofing.
 - 3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - 5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
- C. Duct Supports: Provide extruded aluminum supports and sized in accordance with diameter of supported ducts, and with base that is non-penetrating of roofing membrane.
- D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
 - 1. Bases: High density polypropylene.
 - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015.
- D. ITS (DIR) - Directory of Listed Products; current edition.
- E. FM (AG) - FM Approval Guide; current edition.
- F. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- H. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Verification of minimum three years documented experience installing work of this type.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. Hilti, Inc: www.us.hilti.com/#sle.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.

- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for assembly ratings.

2.03 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Joint sealant for fire rated penetrations.
- B. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018.
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.
- J. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Executed warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Sika Corporation: www.usa.sika.com/#sle.
 - 2. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
 - 3. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
- B. Self-Leveling Sealants:
 - 1. Sika Corporation: www.usa.sika.com/#sle.
 - 2. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 3. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use nonsag silyl-terminated polyether/polyurethane sealant, unless otherwise indicated.

- C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 - 1. Type ____ - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 2. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: To be selected by Architect from full range manufacturers options.

2.04 NONSAG JOINT SEALANTS

- A. Type ____ - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
- B. Silyl-Terminated Polyether (STPE) and Silyl-Terminated Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's full range.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's full range.
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's full range.

2.05 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multicomponent; explicitly approved by manufacturer for horizontal expansion joints.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's full range.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 - 1. Width/depth ratio of 2:1.
 - 2. Neck dimension no greater than 1/3 of the joint width.
 - 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for flush wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 -Thermal Insulation: Filling frame cavities with insulation at interior and exterior door frames.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Head, jamb, and sill flashings for exterior frames.
- C. Section 07 92 00 - Joint Sealants: Sealing frames to adjacent materials.
- D. Section 08 71 00 - Door Hardware.
- E. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- F. Section 09 91 13 - Exterior Painting: Field painting.
- G. Section 09 91 23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. SDI: Steel Door Institute.
- C. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- G. 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; 2014.
- H. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- K. ITS (DIR) - Directory of Listed Products; current edition.

- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- R. UL (BMD) - Building Materials Directory; current edition.
- S. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 9. Finish: Factory primed, for field finishing.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 HOLLOW METAL DOORS

- A. Exterior Doors, Fire Rated and Non-Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 2 - Heavy-Duty, Physical Performance Level B, Model 2 - Seamless.
 - a. Level 2 - Heavy-duty.
 - b. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - c. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
 2. Core Material: Polyurethane.
 3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
 4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 5. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 6. Insulating Value: U-value of 0.37, when tested in accordance with ASTM C1363.
 7. Weatherstripping: Refer to Section 08 71 00.
 8. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
 - a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL
- B. Interior Doors Fire Rated and Non-Fire Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 2 - Heavy-Duty, Physical Performance Level B, Model 2 - Seamless.
 - a. Level 2 - Heavy-duty.
 - b. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - c. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
 3. Core Material: Mineral board.
 4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.03 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. General:
1. Comply with the requirements of grade specified for corresponding door.
 - a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 - SDI-100, Level 2, 16 gage, 0.053 inch (- mm)

- 2. Finish: Factory primed, for field finishing.
- D. Exterior Door Frames: Fully welded.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, G90/Z275 galvanized coating.
 - 2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
 - 3. Weatherstripping: Separate, see Section 08 71 00.
- E. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
- F. Door Frames, Fire-Rated: Fully welded type.
 - 1. Fire Rating: Same as door, labeled.
- G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- I. Transom Bars: Fixed, of profile same as jamb and head.
- J. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.
- K. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

2.04 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, baked on.

2.05 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch (1.21 mm), galvanized steel.
- B. Glazing: As specified in Section 08 80 00.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 08 71 00.
 - 1. Fire-Rated Doors: Steel, shape as required for fire rating.
- E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- H. Frame Cavity Insulation: Specified in Section 07 21 00 - Thermal Insulation.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 71 00.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- E. Comply with glazing installation requirements of Section 08 80 00.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- H. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- I. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Specimen warranty.
- E. Samples: Submit two samples of door construction, 12 x 12 inch (- mm) in size cut from top corner of door.
- F. Samples: Submit two samples of door veneer, 12 x 12 inch (- mm) in size illustrating plastic laminate pattern and color.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
- C. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire-rating as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.

- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
 - 1. Oregon Door; Architectural Series: www.oregondoor.com/#sle.
 - 2. Lynden Door; Architectural (LD) Series; www.lyndendoor.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. High pressure decorative laminate (HPDL) finish.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color to be selected from full range of options; textured, low gloss finish.
- B. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color to be selected from full range of options; textured, low gloss finish.
- C. Facing Adhesive: Type I - waterproof.

2.05 ACCESSORIES

- A. Glazing: As specified in Section 08 80 00.
- B. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
 - 1. Finish: Paint to match facings in accordance with site finishing requirements in Section 09 90 00 - Paintings and Coatings.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.07 ACCESSORIES

- A. Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.
- B. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished or Laminated Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory-assembled and factory-finished metal doors and wood frames, including hardware for door opening assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware: Additional hardware to be installed on these doors.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).
- C. BHMA A156.22 - Standard for Gasketing; 2021.
- D. BHMA A156.32 - American National Standard for Integrated Swinging Door Opening Assemblies; 2023.
- E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Indicate details of each opening showing elevations, glazing, frame profiles, hardware, and different finish locations, if any.
- D. Specimen warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units preassembled and prefinished, with door hardware mounted and functioning, and packaged to protect contents from damage.
 - 1. Supply single door units as completely functioning prehung units.
- B. Store in a clean, dry, and ventilated space having controlled temperature and relative humidity between 30 and 60 percent and in accordance with manufacturer's written instructions.
- C. Stack doors flat and off the floor to prevent warping.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Manufacturer Warranty: Provide five-year manufacturer warranty for entire door opening assembly. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Integrated Door Opening Assemblies:
 - 1. Alco Doors: Steel Entry Doors; www.alcodoors.com.

2.02 ASSEMBLIES

- A. Door, Frame, and Hardware Assemblies: Provide fully functional, factory-assembled and factory-finished door opening units, complete with door, frame, and hardware; complying with BHMA A156.32 and specified requirements.
 - 1. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 2. Provide additional hardware; see Section 08 71 00.
- B. Applications:

1. As indicated on drawings and designated in Door Schedule.
 - a. All Outdoor Village units, unless noted otherwise.

2.03 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of local building code and authorities having jurisdiction, and the following:
 1. Force to Open Interior Swinging Egress Doors, Non-Fire Doors: Not more than 5 lb (22.2 N).

2.04 COMPONENTS

- A. Steel Doors: Steel, 6-panel, doors with insulated core.
 1. Thickness: 1.75 inch
 2. Color: White
 3. Size: As indicated in Drawings.

2.05 DOOR HARDWARE

- A. See Section 08 71 00 for door hardware requirements.
- B. Standard Butt Hinges: With non-removable pins.
 1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
- C. Weatherstripping and Gasketing: Complying with BHMA A156.22.
 1. Head and Jamb Type: Self-adhesive.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.
 4. Provide door bottom sweep and threshold on each exterior door.

2.06 FINISHES

- A. Doors and Frames:
 1. Primed Frames and Brickmold Casing: Site finish per Section 09 91 13.
 2. Door Factory Finish: Complying with ANSI/SDI A250.3, door manufacturer's standard coating.
 - a. Color: As selected by Architect from manufacturer's standard range.

2.07 ACCESSORIES

- A.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this Work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's requirements and the specified performance requirements.
- B. Coordinate with wall construction.
- C. Touch up damaged factory finishes.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted access units.
- B. Ceiling mounted access units.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting: Field paint finish.
- B. Section 09 91 23 - Interior Painting: Field paint finish.
- C. Divisions 21 - 23: Access to plumbing and mechanical controls, valves, and devices within ceiling and wall assemblies.
- D. Divisions 26 - 28: Access to electrical devices within ceiling and wall assemblies.

1.03 REFERENCE STANDARDS

- A. 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; 2014.
- B. FM (AG) - FM Approval Guide; current edition.
- C. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units with Return Air Grille:
 - 1. Location: Provide at all mechanical or electrical devices required to have access that is indicated in the Drawings to be concealed within a wall or ceiling assembly.
 - 2. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
 - 3. Size: 12 inch by 12 inch (305 mm by 305 mm) or minimum size suitable for conditions and access requirements.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 5. Tool-operated spring or cam lock; no handle.
 - 6. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- B. Fire-Rated Wall-Mounted Units:
 - 1. Location: Provide at all mechanical or electrical devices required to have access that is indicated in the Drawings to be concealed within a wall assembly.
 - 2. Wall Fire-Rating: As indicated on drawings.
 - 3. Panel Material: Steel.
 - 4. Size: 12 inch by 12 inch (305 mm by 305 mm) or minimum size suitable for conditions and access requirements.
 - 5. Insulated, double skin door panel.
 - 6. Tool-operated spring or cam lock; no handle.
- C. Fire-Rated Ceiling-Mounted Units:
 - 1. Location: Provide at all mechanical or electrical devices required to have access that is indicated in the Drawings to be concealed within a hard-lid ceiling assembly..
 - 2. Ceiling Fire-Rating: As indicated on drawings.

3. Panel Material: Steel.
4. Size: 12 inch by 12 inch (305 mm by 305 mm) or minimum size suitable for conditions and access requirements.
5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
6. Tool-operated spring or cam lock; no handle.

2.02 WALL AND CEILING MOUNTED ACCESS UNITS

- A. Manufacturers:
 1. ACUDOR Products Inc: www.acudor.com/#sle.
 2. Babcock-Davis: www.babcockdavis.com/#sle.
 3. Cendrex, Inc: www.cendrex.com/#sle.
- B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 1. Style: Exposed frame with door surface flush with frame surface.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
 2. Door Style: Double-skinned hollow panel.
 3. Frames: 16 gauge, 0.0598 inch (1.52 mm), minimum thickness.
 4. Double-Skinned Hollow Steel Sheet Door Panels: 16 gauge, 0.059 inch (1.52 mm), minimum thickness, on both sides and along each edge.
 5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 6. Steel Finish: Primed.
 - a. Field finish in accordance with Section 09 90 00 - Painting and Coating.
 7. Door/Panel Size: Minimum size required for access to mechanical and electrical devices.
 8. Hardware:
 - a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Cased opening.
- C. Division 26 - See Electrical sections for power and security.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.
- E. NEMA MG 1 - Motors and Generators; 2014.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation Data: Include normal operation, troubleshooting, and adjusting.
- H. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Comply with applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.
- D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Overhead Door; Thermacore Model 596 manufactured by www.overheaddoor.com.

2.02 STEEL DOORS

- A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Door Nominal Thickness: 2 inches (51 mm) thick.
 - 2. Thermal Transmittance: U-Factor 0.10, R-Value 17.4 (Minimum U-Value 0.31)
 - 3. Thermal Break: PVC
 - 4. Air infiltration: .08 cfm/ft².
- B. Door Panels: Steel construction; interior and exterior outer steel sheet of 20 gage, exterior surface flush, textured.
 - 1. Impact Panels: Replace lower section of panels with impact resistant panels (up to 6 feet).
- C. Finish: Manufacturer's color system.
 - 1. Color: Gray.

2.03 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch (2.3 mm) minimum thickness; 3 inch (75 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.
 - 1. Provide vertical and high lift tracks as dictated by overhead structure.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
- D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.04 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Insulation: Foamed-in-place polyurethane, bonded to facing.
- C. Metal Primer Paint: Zinc molybdate type.

2.05 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
 - 2. Provide timer close expansion module in conjunction with access controls.
- B. Electric Operators:
 - 1. Mounting: Side mounted on cross head shaft.
 - 2. Motor Enclosure:
 - a. Interior Doors: NEMA MG 1, Type 1; open drip proof.
 - 3. Motor Rating: 1/2 hp (375 W); continuous duty.
 - 4. Motor Voltage: 120 volts, three phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA 250, Type 1.
 - 7. Opening Speed: 12 inches per second (300 mm/s).
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. Refer to Divisions 26-28 for electrical requirements.
- C. Motor: NEMA MG 1, Type 1.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- E. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at interior door jamb.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.
- G. Electric Operator: Side mounted on cross head shaft, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- H. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.
- I. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
 - 1. 24 volt circuit.
 - 2. Surface mounted.
 - 3. Locate at interior side of jamb, unless indicated otherwise in Drawings.

- J. Provide interconnection to security system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Paint hollow metal frame prior to installing weatherstripping.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).
- B. Maximum Variation from Level: 1/16 inch (1.5 mm).
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

- A. Clean doors and frames.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of glass.
- C. Aluminum doors .
- D. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Stud attachment members.
- C. Section 05 50 00 - Metal Fabrications: Steel attachment devices.
- D. Section 07 25 00 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.
- E. Section 07 62 00 - Sheet Metal Flashing and Trim: Concealed flashing.
- F. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- G. Section 08 44 13 - Glazed Aluminum Curtain Walls.
- H. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- I. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- E. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2015.
- F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- M. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

- N. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- O. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- P. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- Q. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2014.
- R. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Samples: Submit two samples 2 x 12 inches (- mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum-Framed Storefront and Doors:
 - 1. Kawneer North America: www.kawneer.com.
 - a. System: Trifab VG 451T Framing System
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Front-set.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
 - 3. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 4. Finish Color: As selected by Architect from manufacturer's standard line.
 - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.
- B. Performance Requirements
 - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of applicable code.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
5. Overall assembly (including glazing) F-Factor Value of 0.34 or less and an SHGC of 0.38 or less. Refer to WSEC Envelope Compliance in Drawings.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Framing members for interior applications need not be thermally broken.
 2. Glazing stops: Flush.
- B. Glazing: See Section 08 80 00.
- C. Entrance System: Glazed aluminum.
 1. Basis of Design: Kawneer, Tuffline 500
 - a. Thickness: 2 inches (50 mm).
 - b. Top Rail: 5 inches (____ mm) wide.
 - c. Vertical Stiles: 5 inches (____ mm) wide.
 - d. Bottom Rail: 10 inches (254 mm) wide.
 - e. Glazing Stops: Square.
 - f. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Structural Supporting Anchors: See Section 05 12 00.
- E. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.
- F. Fasteners: Stainless steel.
- G. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- H. Concealed Flashings: See Section 07 62 00 - Sheet Metal Flashing and Trim.
- I. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- J. Sealant for Setting Thresholds: Non-curing butyl type.
- K. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- L. Glazing Accessories: See Section 08 80 00.
- M. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Color: As selected by Architect from manufacturer's full range.

- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: See Section 08 71 00.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install operating sash.
- J. Set thresholds in bed of sealant and secure.
- K. Install hardware using templates provided.
 - 1. See Section 08 71 00 for hardware installation requirements.
- L. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

- A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
- B. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and entrance system for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extruded aluminum windows with fixed sash and operating sash.
- B. Factory glazing.
- C. Operating hardware.
- D. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Rough opening framing.
- B. Section 06 10 00 - Rough Carpentry: Rough opening framing.
- C. Section 07 25 00 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
- D. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.

- D. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

1.08 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Marlin series #1505.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 - 1. Frame Depth: 2-1/4 inches (57.1 mm).
 - 2. Operable Units: Double weatherstripped.
 - 3. Provide factory-glazed units.
 - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 - 5. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 6. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Performance Requirements: Provide products that comply with the following:
 - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - a. Performance Class (PC): R.

2. Thermal Resistance: Assembly U-Value of (minimally) 0.28 and north facing to SHGC 0.51 or less (all others to have 0.38). See WSEC Envelope Compliance Report in Drawings.
- C. Fixed, Non-Operable Type:
 1. Construction: Thermally broken.
 2. Exterior Finish: Class I natural anodized.
 3. Interior Finish: Class I natural anodized.
- D. Outswinging Casement Type:
 1. Construction: Thermally broken.
 2. Provide screens.
 3. Exterior Finish: Class I natural anodized.
 4. Interior Finish: Class I natural anodized.

2.03 COMPONENTS

- A. Glazing: See Section 08 80 00.
- B. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable hardware allowing screen removal without use of tools.
 1. Hardware: Spring loaded steel pins; four per screen unit.
 2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
 3. Frame Finish: Same as frame and sash.
- C. Fasteners: Stainless steel.
- D. Glazing Materials: See Section 08 80 00.
- E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.
 1. See Section 07 92 00 for additional requirements.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5005 alloy, H12 or H14 temper.
- C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.05 HARDWARE

- A. Sash lock: Lever handle with cam lock.
- B. Operator: Lever action handle fitted to projecting sash arms with limit stops.
- C. Projecting Sash Arms: Cadmium plated steel, friction pivot joints with nylon bearings, removable pivot clips for cleaning.
- D. Pulls: Manufacturer's standard type.
- E. Bottom Rollers: Stainless steel, adjustable.
- F. Limit Stops: Resilient rubber.

2.06 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Finish Color: As selected by Architect from manufacturer's full range.
- C. Apply one coat of bituminous coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 25 00.

3.02 PRIME WINDOW INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill and sill end angles.
- F. Set sill members and sill flashing in continuous bead of sealant.
- G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Install operating hardware not pre-installed by manufacturer.
- I. Install glass and infill panels in accordance with requirements; see Section 08 80 00.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

Hardware for swinging, sliding, and folding doors except special types of unique and non-matching hardware specified in other sections.

1.2 RELATED WORK

- A. Section 08 11 13 - Hollow Metal Doors and Frames
- B. Section 08 14 16 - Flush Wood Doors and Frames
- C. Section 08 17 00 – Integrated Door Opening Assemblies
- D. Section 08 43 13 – Aluminum-Framed Storefront

1.3 REFERENCES

- A. Standards: Current edition at date of bid.
 - 1. ADAAG-Americans with Disabilities Act, Accessibility Guidelines for Buildings and Facilities.
 - 2. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
 - 3. ANSI/BHMA A156.18 – Materials and Finishes.
 - 4. DHI - Recommended Locations for Builders Hardware for Standard Steel Doors and Frames.
 - 5. NFPA 80 – Standard for Fire Doors and Windows.
 - 6. NFPA 252 – Standard for Fire Tests of Door Assemblies.
 - 7. Washington State Rules and Regulations for Barrier Free Facilities, as adopted by AHJ.
- B. Codes:
 - 1. International Building Code, as adopted by public Authority Having Jurisdiction (AHJ).
 - 2. Chapter 51-50 WAC Washington State Building Code.

1.4 DOOR HARDWARE TYPES

- A. Types of finish hardware required include, but is not necessarily limited to, the following:
 - 1. Pivot sets and intermediate pivots.
 - 2. Hinges.
 - 3. Lock cylinders.
 - 4. Keys, keying, and key control.
 - 5. Locksets, latchsets, and privacy sets.
 - 6. Exit devices.
 - 7. Closers.
 - 8. Mullions.
 - 9. Overhead, wall, and floor stops.

10. Protection plates.
 11. Gasketing for exterior and interior doors, as required.
 12. Door holders.
 13. Door bottoms.
 14. Thresholds.
 15. Silencers.
- B. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of door hardware is indicated elsewhere in this section or in the Door Hardware Schedule at the end of this section. Refer to Part 2 Products for Manufacturer's identification and allowable substitutions.

1.5 SUBMITTALS

- A. Under provisions of Section 01340, submit the following:
1. Product information: Manufacturer's published technical product data for all specified door hardware items indicating compliance with the requirements.
 2. Hardware Schedule:
 - a. Hardware schedules are intended for the Contractor's coordination of the work. Review and acceptance by the Architect or Owner does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.
 - b. Submit hardware schedule in the manner and format as specified, complying with the actual construction progress schedule requirements for each draft. Include the following information:
 - 1) Explanation of all abbreviations, symbols, codes, at the like, including door handing.
 - 2) Type, style, function, size, and finish of each hardware item.
 - 3) Door and frame sizes and materials cross referenced to the Architect's marks in the door schedule.
 - 4) Room identification (name and number) on each side of door opening as indicated on the drawings.
 - 5) Product name, model number, description, and name of manufacturer of each item.
 - 6) Fastenings and other pertinent information.
 - 7) Locations of hardware cross referenced to architectural floor plans and door schedules.
 - 8) Mounting heights and locations of each type of hardware.
 3. Key Schedule:
 - a. Require qualified representative of the hardware supplier to personally meet with the Owner and obtain the Owner's written key requirements.
 - b. Include a separate key schedule, showing clearly how the Owner's instructions on keying of locks has been fulfilled.
 4. Samples: Upon request, submit actual material samples of items indicated as for color selection.
 5. Templates: Hardware supplier will furnish hardware templates to the Contractor for each fabricator of doors, frames, and other work to be shop prepared or factory prepared for the installation of hardware. Upon request check shop

drawings of such other work, to conform that adequate provisions are made for proper location and installation of hardware.

- B. Under provisions of Section 01700, submit the following:
1. Product information.
 2. Hardware schedule.
 3. Manufacturer's published operation and maintenance data. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 4. Tools and extra materials as required.
 5. Manufacturer's warranties, revised to meet criteria as established within this section. Warranties shall commence upon acceptance of the building by the owner.

1.6 QUALITY ASSURANCE

- A. Acceptable Designs:
1. Items specified in this section are products which are of acceptable design.
 2. Do not substitute other products without Architect's written prior approval per Section 01600. Requests for approval shall be submitted by factory authorized distributor firms representing the products proposed for substitution.
- B. Qualifications:
1. Manufacturer: Manufacturers named in Part 2 of this section with not less than 5 years experience in manufacturing commercial door hardware of the type indicated.
 2. Hardware Supplier:
 - a. A recognized architectural finish hardware supplier who has been furnishing hardware in the same state as the project for a period of not less than 5 years.
 - b. Hardware supplier's organization shall include an experienced Architectural Hardware Consultant (AHC), certified by the Door and Hardware Institute (DHI), who is physically available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor. Mail or telephone correspondence is not acceptable.
 - c. Hardware supplier shall have local warehousing facilities and shall maintain an adequate parts inventory of items supplied for future service to the owner. Supplier will be a factory authorized distributor of all hardware specified.
 3. Installer: Company specializing in installing work of this section with not less than 3 years experience and acceptable to the manufacturer and the hardware supplier. Maintain regular work force of qualified personnel, trained, skilled, and experienced in installing door hardware and constant, competent supervision. The hardware installer shall meet with the representatives of the general contractor and hardware supplier to jointly inventory all hardware items. Upon satisfactory inventory of products, the hardware installer accepts responsibility for all hardware items inventoried.
- C. Regulatory Requirements:
1. Provide hardware for fire rated openings, whether specified or not, in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of

doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in UBC-97.

2. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990.

1.7 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Deliver, store, handle, and protect products to project site under provisions of Section 01600 and as specified herein.
- B. Require hardware supplier to:
 1. Tag each item or package separately, with identification related to final hardware schedule.
 2. Include manufacturer's basic installation instructions with each item or package.
 3. As material is received by hardware supplier from various manufacturers, sort and repackage in containers with each item clearly marked with appropriate opening numbers to match the approved hardware schedule. Two or more identical items may be packed in the same container.
 4. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
 5. Inventory hardware jointly with representatives of the general contractor, hardware supplier and the hardware installer until each is satisfied that count is correct. Refer to paragraph 1.6-B-3.
- C. Protect hardware from theft by cataloging and storing in a secure and lockable area. Control the handling and installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation. Replace lost, missing, damaged, or stolen door hardware items at no additional cost to the Owner as required to meet schedule requirements.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate work of this section with the work of other sections of work under provisions of Section 01040
- B. Furnish hardware templates to each fabricator of doors, frames, and other work to be shop or factory prepared for the installation of hardware.
- C. Verify completeness and suitability of door hardware with the hardware supplier and the hardware installer.

1.9 MAINTENANCE MATERIALS

- A. Under provisions of Section 01700, furnish to Owner a complete set of special wrenches and tools applicable to each different or special hardware component as needed for Owner's continued adjustment, maintenance, removal, and replacement of door hardware.
- B. Tools and accessories shall be supplied by the hardware component manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General:
 - 1. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.
 - 2. Quantities listed, in any instance, are for the Contractor's convenience only and are not guaranteed.
 - 3. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation. Match the quality and finish of items specified.
 - 4. Provide miscellaneous hardware as listed in hardware groups.
- B. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Door schedule indicates door and frame sizes, materials, required fire ratings, and other pertinent information. Furnish each item of hardware for proper installation and operation of door movement as indicated.
- C. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable name plates), except in conjunction with required UL or FM labels and as otherwise acceptable to the Architect. Manufacturer's identification will be permitted on rim of lock cylinders and latch faceplates only.
- D. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- E. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self tapping sheet metal screws, except as specifically indicated.
 - 1. Screws: Furnish screws for installation, with each hardware item. Provide Phillips flat head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finishes of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
 - 2. Concealed Fasteners: Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

2.2 HINGES

- A. Manufacturer:
 - 1. Listed in Door Hardware Schedule: BEST(DORMAKABA) & IVES
 - 2. Approved Substitutions: NONE

- B. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template produced units.
- C. Screws: Furnish Phillips flat head or machine screws for installation of units, except furnish Phillips flat head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges.
- D. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Steel Hinges: Steel pins.
 - 2. Non-ferrous Hinges: Stainless steel pins.
 - 3. Exterior doors: Non removable pins.
 - 4. Reverse bevel interior doors (lockable): Non removable pins.
 - 5. Interior doors: Non rising pins.
- E. Pin Tips: Flat button and matching plug, finished to match leaves.
- F. Number of Hinges: Provide number of hinges indicated, but not less than 3 hinges per door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
- G. Butt type hinges are to be warranted for the life of the building. Continuous hinges shall be warranted for a period of three years.

2.3 LOCK CYLINDERS

- A. Manufacturer:
 - 1. Listed in Door Hardware Schedule: BEST-HOUSINGS & CONSTRUCTION CORES OWNER PROVIDED SCHLAGE SFIC CORES AFTER CONSTRUCTION
 - 2. Approved Substitutions: None
- B. Equip locks with cylinders for interchangeable core pin tumbler inserts with construction key feature which voids the construction key upon activation of the permanent key system.
- C. Construct lock cylinder parts from brass/bronze, stainless steel, or nickel silver.

2.4 KEYS, KEYING, AND KEY CONTROL

- A. Keys:
 - 1. Material: Provide keys of nickel silver only.
 - 2. Quantities: These quantities are to establish a maximum allowable quantity of cut keys to service the project and may not necessarily be assigned as noted. A lesser quantity of cut keys required will not result in any credits, nor a quantity of uncut keys to be issued unless noted otherwise.
 - a. 3 change keys per each cylinder unit.
 - b. 5 master keys per master.
 - c. 5 grandmaster keys.
 - d. 3 control keys.
 - e. 10 construction keys.
 - f. 1 additional key blank per cylinder unit.
 - 3. Deliver keys to the Owner's representative: Send masterkeys to Owner via U.S. registered mail direct from hardware supplier.

B. Keying:

1. Comply with Owner's written instructions for masterkeying and, except as otherwise indicated, provide individual change keys for each lock which is not designated to be keyed alike with a group of related locks.
2. Grandmaster key all cylinder items to coordinate with the Owner's existing grandmasterkey system. Existing system is Corbin/Ruswin. Permanently inscribe each key with the notation "DO NOT DUPLICATE".

C. Key Control:

1. Provide a key control system including envelopes, labels, tags with self locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by the system manufacturer, with capacity for 150% of the number of locks required for the project.
2. Provide a hinged panel type cabinet, for wall mounting, Telkee AWC-350S or equal.
3. Provide cylinder units with concealed key control and keys with visual key control.

2.5 LOCKSETS, LATCHSETS, AND PRIVACY SETS:

A. Manufacturer:

1. Listed in Door Hardware Schedule: BEST (DORMAKABA)
2. Approved Substitutions: None

B. Types: Locksets, latchsets, and privacy sets as indicated in Door Hardware Schedule.

C. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt. Provide dust-proof strikes for foot bolts, except where not available. At these locations, provide manufacturer's standard recessed strike. Provide roller type strikes where recommended by lock, latch or bolt manufacturer.

D. Lock Throw: Provide 3/4" minimum throw of mortise type latches and deadbolts used. Cylindrical latches will be 1/2" minimum. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

E. Locks and latches shall be warranted for a period of two years.

2.6 EXIT DEVICES, MULLIONS, POWER TRANSFERS, POWER SUPPLIES, WIRE HARNESS

A. Manufacturer:

1. Listed in Door Hardware Schedule: VONDUPRIN
2. Approved Substitutions: None

B. Provide risers, as needed, to prevent interference with door glazing kits.

C. Provide spacers as needed for proper application of removable mullions on narrow stop type frames.

D. Exit devices and related hardware shall be warranted for a period of two years.

2.7 CLOSERS:

A. Manufacturer:

1. Listed in Door Hardware Schedule: NORTON
2. Approved Substitutions: None

- B. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending on the size of the door, exposure to weather and anticipated frequency of use.
- C. Provide manufacturer's standard through bolt attachment where door construction is not adequate for support.
- D. Arms:
 - 1. Provide parallel arms for all overhead closers, except as otherwise indicated. Provide drop plates as needed to prevent glazing interference.
- E. Where closer arms incorporate dead stop features, mount closers to the maximum degree of opening available before conflict with adjacent structures, or, if adjacent structures are not considered, to the maximum allowable by closer manufacturer's template. If not apparent on the contract documents, verify the use of open space with the Architect or Owner's Representative to determine the maximum allowable degree of opening.
- F. Access Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force. Fire protection has precedence over handicap compatibility, check with local jurisdiction.
- G. Provide certified flame retardant oils at locations which must comply with pressure testing criteria as dictated in UBC-97.
- H. Door closers and related hardware shall be warranted for a period of ten years. Electronic closers shall be warranted for a period of two years.

2.8 OVERHEAD STOPS

- A. Manufacturer:
 - 1. Listed in Door Hardware Schedule: RIXSON
 - 2. Approved Substitutions: ABH
- B. Mount stops to the maximum degree of opening available before conflict with adjacent structures, or, if adjacent structures are not considered, to the maximum allowable by stop manufacturer's template.
- C. If not apparent on the contract documents, verify the use of open space with the Architect or Owner's Representative to determine the maximum allowable degree of opening.
- D. Overhead stops in exterior doors must be manufactured from stainless steel, US32D finish.
- E. Overhead stops shall be warranted for a period of two years.

2.9 WALL AND FLOOR STOPS

- A. Manufacturers:
 - 1. Listed in Door Hardware Schedule: TRIMCO
 - 2. Approved Substitutions: Rockwood
- B. General: Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
- C. Import products lesser in quality than the specified items are not acceptable.

2.10 PROTECTION PLATES

- A. Manufacturers:
 - 1. Listed in Door Hardware Schedule: TRIMCO
 - 2. Approved Substitutions: Rockwood
- B. Types: Armor Plates, Kick Plates, Mop Plates
- C. Fasteners: Provide manufacturer's standard exposed Phillips head fasteners for door trim units; either machine screws or self tapping sheet metal type screws per manufacturer's recommendations for application to the specified door construction.
- D. Sizes: Fabricate protection plates (armor, kick or mop) not more than 2" less than door width on stop side and not more than 1" less than door width on pull side, x the height indicated.
- E. Metal Plates: Stainless Steel, 18 gauge (0.050) thick. Satin finish, US32D (630), beveled four edges (B4E).

2.11 GASKETS AND SWEEPS

- A. Manufacturer:
 - 1. Listed in Door Hardware Schedule: PEMKO
 - 2. Approved Substitutions: National Guard
- B. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf. Provide type, sizes and profiles indicated as drawn or scheduled.
- C. Fasteners: Provide non-corrosive fasteners as recommended by the manufacturer for applications indicated.
- D. Replaceable seal strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by the manufacturer.
- E. Perimeter weatherstripping: Flexible, hollow neoprene bulb or loop insert, conforming to MIL R 6055, Class II, Grade 40.
- F. Weatherstripping at Door Bottoms: Provide door bottoms consisting of contact type resilient insert and metal housing of design and size indicated.
- G. Gaskets and sweeps shall be warranted for a period of three years.

2.12 THRESHOLDS

- A. Manufacturer:
 - 1. Listed in Door Hardware Schedule: PEMKO
 - 2. Approved Substitutions: National Guard
- B. Except as otherwise indicated provide standard metal threshold unit of type, size and profile as detailed or scheduled.
- C. Where there is conflict between scheduled thresholds and details, details shall have precedence. Revise details only if necessary to comply with handicap accessibility requirements. Notify the Architect of such required modifications.
- D. Thresholds and related items shall be warranted for a period of three years, abrasive coatings shall be warranted for a period of ten years.

2.13 SILENCERS

- A. Manufacturers:
 - 1. Listed in Door Hardware Schedule: Trimco
 - 2. Approved Substitutions: Rockwood

2.14 FINISHES

- A. Exposed surfaces of hardware shall be Satin Stainless Steel (US32D, 630), unless otherwise indicated.
- B. The designations used in the schedule and elsewhere to indicate hardware finishes are the industry recognized standard commercial finishes common to the product's manufacturer listed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Under provisions of Section 01040, examine and verify that substrates and project site conditions are ready to receive work of this section.
- B. Do not begin installation until finishes indicated to be field applied have been applied to doors, frames, and similar items requiring project site finishing and are thoroughly dry and cured.
- C. Do not begin installation until unsatisfactory conditions are corrected in a manner acceptable to the installer. Beginning installation means installer accepts project site conditions and substrates as ready to receive work of this section.

3.2 INSTALLATION

- A. General: The types and approximate quantities of door hardware required for this project are indicated at the end of this section.
- B. Key Cabinet: Install in location as indicated on drawings or as directed by the Architect.
- C. Heights: Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for /standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Architect.
- D. Substrates: Adjust and reinforce attachment substrates as necessary for proper installation and operation of hardware.
- E. Installation:
 - 1. Install each hardware item in compliance with the manufacturer's instructions, requirements of NFPA 80, IBC, ADA, and Washington State Rules and Regulations for Barrier Free Facilities and recommendations of the DHI.
 - 2. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
 - 3. Drill and countersink units which are not factory prepared for fasteners. Space fasteners and anchors in accordance with industry standards.
 - 4. Where not factory machined, machine cut for hardware per template, as required.

5. Cut and fit thresholds and floor covers to profile of door frames with mitered corners and hairline joints where required for aesthetical appearance. Join units with concealed welds. Cut smooth openings for spindles, bolts, or similar items. Screw thresholds to substrate with the manufacturer's standard flat head sleeve anchor (FHSL), 1/4-20 x 2". Fill cavities of thresholds at sound rated openings with 1 inch thick (uncompressed thickness) low density fiberglass sill sealer insulation full width and length of the threshold. In addition to fastening requirements, set thresholds for exterior doors in a full bed of butyl-rubber or polyisobutylene mastic sealant.
 6. Do not install hardware which is incomplete or apparently improper for application. Notify the hardware supplier immediately of any such deficiencies. Failure to comply with this requirement indicates the hardware installer's acceptance of responsibility for proper application and performance.
- F. Cutting and Patching:
Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections.

3.3 ADJUSTING

- A. Initial Adjustment:
1. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Adjust resilient faced sound stops for continuous contact with door and threshold. Adjust weatherstripping and sweeps to completely seal doors with frames and to adjacent structures.
 2. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean 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.

3.4 DEMONSTRATION

Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.5 CLEANING AND DEBRIS

- A. Cleaning:
1. Clean work under provisions of Section 01700
 2. Clean adjacent surfaces soiled by work of this section.
- B. Debris: Under provisions of Section 01500, remove debris from project site and legally dispose of off-site.

3.6 MAINTENANCE

- A. Approximately six months after the acceptance of hardware in each area, the installer, accompanied by the representatives of the lock, latch, and closer manufacturers, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
- B. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
- C. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units.
- D. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

3.7 PROTECTION

Under provisions of Section 01500, protect work of this section as required so that work will be without damage or deterioration at the time of completion and acceptance by the Owner.

3.8 DOOR HARDWARE SCHEDULE

Hardware Group #1 – Doors #100A

2 ea. Pivot Sets	195 x 3/4" Offset US26D
2 ea. Intermediate Pivots	M19 x 3/4" Offset US26D
2 ea. Power Transfer Devices	EPT-10 628 CON
1 ea. Electrified Exit Device	QEL-RX-3347A-NL-OP-360T 626 CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Final Keyed Core (Trim)	By Puget Sound Energy
1 ea. Electrified Exit Device	QEL-RX-3347A-DT-OP 626 CON
2 ea. Pulls	1191-4N 630
2 ea. Overhead Stops	6-036 630
1 ea. Automatic Operator	6020 628
2 ea. Wall Activation Switches	505
1 ea. Door Closer	PR7500 x 6891 x 7788 689
1 ea. Threshold	2748A (or as detailed)
2 ea. Door Bottoms	315CN
1 ea. Perimeter Weather Strip	By Frame Manufacturer
1 ea. Meeting Stile Weather Strip	By Door Manufacturer
2 ea. Wire Harnesses	CON-12P
1 ea. Power Supply	PS902 x 990-2RS x 900-4RL
2 ea. Door Position Switches	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #2 – Doors #100B

2 ea. Pivot Sets	195 x 3/4" Offset US26D
2 ea. Intermediate Pivots	M19 x 3/4" Offset US26D
2 ea. Power Transfer Devices	EPT-10 628 CON
1 ea. Electrified Exit Device	QEL-RX-3347A-NL-OP-360T 626 CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Final Keyed Core (Trim)	By Puget Sound Energy
1 ea. Electrified Exit Device	QEL-RX-3347A-DT-OP 626 CON
2 ea. Pulls	1191-4N 630
2 ea. Overhead Stops	6-036 630
1 ea. Automatic Operator	6020 628
2 ea. Wall Activation Switches	505
1 ea. Door Closer	PR7500 x 6891 x 7788 689
2 ea. Wire Harnesses	CON-12P
1 ea. Power Supply	PS902 x 990-2RS x 900-4RL
2 ea. Door Position Switches	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #3 – Doors #102

1 ea. Pivot Set	195 x 3/4" Offset US26D
1 ea. Intermediate Pivot	M19 x 3/4" Offset US26D
1 ea. Power Transfer Device	EPT-10 628 CON
1 ea. Electrified Exit Device	QEL-RX-33A-NL-OP-360T 626 CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Pull	1191-4N 630
1 ea. Overhead Stop	6-036 630
1 ea. Door Closer	PR7500 x 6891 x 7788 689
1 ea. Threshold	2748A (or as detailed)
2 ea. Door Bottoms	315CN
1 ea. Perimeter Weather Strip	By Frame Manufacturer
1 ea. Wire Harness	CON-12P
1 ea. Power Supply	PS902
2 ea. Door Position Switches	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #4 – Door #101, 128A, 129B, 133A, 137B

2 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Electrified Hinge	5BB1HW 4.5 x 4.5 630 TW8 CON
1 ea. Electrified Exit Device	QEL-RX-99NL 626 CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Final Keyed Core (Trim)	By Puget Sound Energy
1 ea. Door Closer	PR7500 x 6891 x 7788 689
1 ea. Overhead Stop	1-036 630
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Threshold	2748A (or as detailed)
1 ea. Door Bottom	315CN
1 ea. Weather Strip	S773B
1 ea. Rain Guard	346C
1 ea. Wire Harness	CON-12P
1 ea. Power Supply	PS902
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #5 – Door #111, 112, 113

3 ea. Hinges	CB179 4.5 x 4.5 US26D
1 ea. Passage Set	45H0N14H630
1 ea. Wall Stop	1270CV 630
1 ea. Automatic Door Bottom	430CRL
1 ea. Gasket	S88D (Head & Jambs)

Hardware Group #6 – Door #105, 107B, 127, 139

3 ea. Hinges	CB179 4.5 x 4.5 US26D
1 ea. Lockset	45H7D14H630 x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #7 – Door #106A

5 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Electrified Hinge	5BB1HW 4.5 x 4.5 630 TW8 CON
1 ea. Removable Mullion	4954 USP
1 ea. Mullion Weather Strip	5100BL
1 ea. Electrified Exit Device	QEL-RX-99NL 626 CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Final Keyed Core (Trim)	By Puget Sound Energy
1 ea. Exit Device	99DT 626
2 ea. Overhead Stop/Hold	1-026 630
2 ea. Closers	PR7500 689
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
1 ea. Threshold	2748A (or as detailed)
2 ea. Door Bottoms	315CN
1 ea. Weather Strip	S773B (Head & Jambs)
1 ea. Rain Guard	346C
1 ea. Wire Harness	CON-12P
1 ea. Power Supply	902
2 ea. Door Position Switches	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #8 – Door #106B, 137A

2 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Electrified Hinge	5BB1 4.5 x 4.5 626 TW8 CON
1 ea. Electrified Exit Device	QEL-RX-99L CON
1 ea. Cylinder Housing (Trim)	12E72 x Brass Construction Core
1 ea. Final Keyed Core (Trim)	By Puget Sound Energy
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608
1 ea. Wire Harness	CON-12P
1 ea. Power Supply	PS902
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor
1 ea. Automatic Door Bottom	430CRL @137A only
1 ea. Gasket	S88D (Head & Jambs) @137A only

Hardware Group #9 – Doors #107A, 108, 123C, 124B, 125C, 126C

2 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Electrified Hinge	CE-CB199-C8 4.5 x 4.5 US32D
1 ea. Electrified Lockset	45HW7DEU14H630-RQE-C x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Overhead Stop/Hold	1-026 630
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Threshold	2748A (or as detailed)
1 ea. Door Bottom	315CN
1 ea. Weather Strip	S773B (Head & Jambs)
1 ea. Rain Guard	346C
1 ea. Wire Harness	WH-38C
1 ea. Power Supply	By Access Control Contractor
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #10 – Door #114

3 ea. Hinges	CB179 4.5 x 4.5 US26D
1 ea. Passage Set	45H0N14H630
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #11 – Doors #115

3 ea. Hinges	CB179 4.5 x 4.5 US26D
1 ea. Electrified Hinge	CE-CB179-C8 4.5 x 4.5 US32D
1 ea. Electrified Lockset/Privacy Core	45HW7DEU14H630-VIN-PR-C x Brass Construction
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608
1 ea. Power Supply	By Access Control Contractor
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor
1 ea. Automatic Door Bottom	430CRL
1 ea. Gasket	S88D (Head & Jambs)

Hardware Group #12 – Doors #117A, 117B, 119A, 119B

3 ea. Hinges	CB179 4.5 x 4.5 US26D
1 ea. Push Plate	1001-3 630
1 ea. Pull Plate	1018-3 630
1 ea. Closer	7500 689
1 ea. Mop Plate	K1050 10" x 1" LTDW 4BE 630
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #13 – Doors #118, 120

3 ea. Hinges	CB191 4.5 x 4.5 US26D
1 ea. Privacy Set	45H0L14H630 – VIB Occupancy Indicator
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #14 – Doors #103, 104, 109, 116, 121, 122, 123A, 125A, 136

2 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Electrified Hinge	CE-CB179-C8 4.5 x 4.5 US26D
1 ea. Electrified Lockset	45HW7DEU14H630-RQE-C x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Closer	7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608
1 ea. Wire Harness	WH-38-C
1 ea. Power Supply	By Access Control Contractor
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor
1 ea. Automatic Door Bottom	430CRL @ 103, 104 only
1 ea. Gasket	S88D (Head & Jambs) @ 103, 104 only

Hardware Group #15 – Doors #123B, 124A, 125B, 126B

5 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Electrified Hinge	CE-CB179-C8 4.5 x 4.5 US26D
1 ea. Automatic Flush Bolt Set	2942 626
1 ea. Floor Strike	570 626
1 ea. Electrified Lockset	45HW7DEU14H630-RQE-C x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Coordinator	2672 x 2/AB,C Black
2 ea. Closers	PR7500 689
1 ea. Astragal	357C
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
2 ea. Wall Stops	1270CV 630
2 ea. Silencers	608
1 ea. Wire Harness	WH-38-C
1 ea. Power Supply	By Access Control Contractor
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #16 – Doors #128B, 133B

3 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Exit Device	99L-BE 626
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #17 – Door #130

6 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Automatic Flush Bolt Set	2942 626
1 ea. Floor Strike	570 626
1 ea. Passage Set	45H0N14H630
1 ea. Coordinator	2672 x 2/AB,C Black
2 ea. Closers	PR7500 689
1 ea. Astragal	355CS
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
2 ea. Wall Stops	1270CV 630
2 ea. Automatic Door Bottoms	430CRL
1 ea. Gasket	S88D (Head & Jambs)

Hardware Group #18 – Doors #131, 132

3 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Privacy Set	45H0L14H630 – VIB Occupancy Indicator
1 ea. Closer	7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
1 ea. Threshold	2748A (or as detailed)
1 ea. Door Bottom	315CN
1 ea. Weather Strip	S773B (Head & Jambs)
1 ea. Rain Guard	346C

Hardware Group #19 – Doors #135

3 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Lockset	45H7R14H630 x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
1 ea. Threshold	2748A (or as detailed)
1 ea. Door Bottom	315CN
1 ea. Weather Strip	S773B (Head & Jambs)
1 ea. Rain Guard	346C

Hardware Group #20 – Doors #141

6 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
2 ea. Manual Flush Bolts	555 US26D
1 ea. Floor Strike	570 626
1 ea. Lockset	45H7R14H630 x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Astragal	357C
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
2 ea. Wall Stops	1270CV 630
2 ea. Silencers	608

Hardware Group #21 – Doors #129A

4 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
2 ea. Electrified Hinges	5BB1 4.5 x 4.5 626 TW8 CON
2 ea. Electrified Exit Devices	QEL-RX-9927L 626 CON
2 ea. Cylinder Housings (Trim)	12E72 x Brass Construction Core
2 ea. Final Keyed Cores (Trim)	By Puget Sound Energy
2 ea. Closers	PR7500 689
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
2 ea. Wall Stops	1270CV 630
2 ea. Wire Harnesses	CON-12P
1 ea. Power Supply	PS902
2 ea. Door Position Switches	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #22 – Doors #140A

6 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
2 ea. Exit Devices	9927L-BE 626
2 ea. Closers	PR7500 689
2 ea. Kick Plates	K1050 10" x 2" LTDW 4BE 630
2 ea. Wall Stops	1270CV 630
2 ea. Silencers	608

Hardware Group #23 – Door #142A, 143

3 ea. Hinges	CB179NRP 4.5 x 4.5 US26D
1 ea. Exit Device	99L-BE 626
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Wall Stop	1270CV 630
3 ea. Silencers	608

Hardware Group #24 – Doors #123D, 124C, 125D, 126D, 129C, 137C
All Hardware By Overhead Door Manufacturer.

Hardware Group #25 – Doors #140B, 142B
All Hardware By Operable Partition Manufacturer.

Hardware Group #26 – Control House - Doors

2 ea. Hinges	CB199NRP 4.5 x 4.5 US32D
1 ea. Electrified Hinge	CE-CB199-C8 4.5 x 4.5 US32D
1 ea. Electrified Lockset	45HW7DEU14H630-RQE-C x Brass Construction Core
1 ea. Final Keyed Core	By Puget Sound Energy
1 ea. Overhead Stop/Hold	1-026 630
1 ea. Closer	PR7500 689
1 ea. Kick Plate	K1050 10" x 2" LTDW 4BE 630
1 ea. Threshold	2748A (or as detailed)
1 ea. Door Bottom	315CN
1 ea. Weather Strip	S773B (Head & Jambs)
1 ea. Rain Guard	346C
1 ea. Wire Harness	WH-38C
1 ea. Power Supply	By Access Control Contractor
1 ea. Door Position Switch	By Access Control Contractor
1 ea. Card Access Reader	By Access Control Contractor

Hardware Group #27 – Outdoor Training Buildings – Doors

1 ea. Lockset	9K37AB14DS3626
Balance of Hardware By Door Manufacturer, see Section 08 17 00.	

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers.
- B. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08 43 13 - Aluminum-Framed Storefronts: Glazed storefront system.
- F. Section 08 51 13 - Aluminum Windows: Glazing furnished by window manufacturer.
- G. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Mirrors within restrooms.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- J. GANA (GM) - GANA Glazing Manual; 2009.
- K. GANA (SM) - GANA Sealant Manual; 2008.
- L. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- M. ICC (IBC) - International Building Code; 2015.
- N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples 12 x 12 inch (- mm) in size of glass units.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

- A. Type 1 - Sealed Insulating Glass Units: Vision glass, double glazed.
 - 1. Application: All exterior glazing unless otherwise indicated.
 - 2. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E (solar control type), on #2 surface.
 - 3. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: Clear.
 - 4. Total Thickness: 1 inch (25 mm).
 - 5. Provide fully tempered, laminated units where required by code and at:
 - a. Door Lites.
 - b. Side lites adjacent to doors.
 - c. Lites below 18" from finish floor surface.
 - d. Adjacent to stair runs and landings.
 - e. Other locations as indicated in Drawings.
 - 6. Glazing Method: Exterior wet method, sealant and sealant.
 - 7. Thermal Performance: See Sections 08 43 13 and 08 51 13 for required WSEC minimum assembly U and SHGC factors.
- B. Type 2 - Sealed insulating Glass Units: Vision glass, double glazed.
 - 1. Application: All interior glazing unless otherwise indicated.
 - 2. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - 3. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - 4. Total Thickness: 1 inch.
 - 5. Provide fully tempered units where required by code and at:
 - a. Door lites.
 - b. Side lites adjacent to doors.
 - c. Lites below 18" from finish floor surface.
 - d. Adjacent to stair runs and landings.
 - e. Other locations as indicated in Drawings.

2.02 GLAZING UNITS

- A. Sealed Insulating Glass Units: Safety glazing.
 - 1. Application: Provide this type of glazing in the following locations:
 - a. Glazed lites in interior and exterior doors.
 - b. Glazed sidelights and panels next to interior and exterior doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on the drawings.
 - 2. Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

2.03 EXTERIOR GLAZING ASSEMBLIES

- A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
 - 1. Design Pressure: Calculated in accordance with Structural Notes.
 - 2. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
 - 3. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 - 4. Glass thicknesses listed are minimum.
- B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 - 2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.04 GLASS MATERIALS

- A. Float Glass Manufacturers:
 - 1. AGC Glass Company North America, Inc: www.us.agc.com.
 - 2. Cardinal Glass Industries: www.cardinalcorp.com.
 - 3. Pilkington North America Inc: www.pilkington.com/na.
 - 4. PPG Industries, Inc: www.ppgideascales.com.
 - 5. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Float Glass: Provide float glass based glazing unless noted otherwise.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
 - 3. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.
- C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
 - 2. Plastic Interlayer:
 - a. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch (0.762 mm) thick, minimum.
 - 3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.

2.05 SEALED INSULATING GLASS UNITS

- A. Sealed Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Edge Spacers: Aluminum, bent and soldered corners.
 - 3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
 - 4. Edge Seal Color: black.
 - 5. Purge interpane space with dry hermetic air.

2.06 GLAZING COMPOUNDS

- A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- B. Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.
- C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.07 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; Black color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Prime surfaces scheduled to receive sealant.
- C. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- D. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING AT STOREFRONT AND CURTAIN WALL)

- A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - EXTERIOR WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/4 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.

- C. Fill gaps between glazing and stops with specified type per 07 92 00, type sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior metal stud wall/partition and soffit framing.
- B. Interior cold-formed ceiling framing.
- C. Acoustic insulation.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Interior load-bearing metal stud framing.
- B. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.
- C. Section 06 10 00 - Rough Carpentry: Blocking product and execution requirements.
- D. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- E. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- F. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- G. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- C. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- F. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).
- G. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009).
- H. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- I. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

- M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- N. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- P. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- Q. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.
- R. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- S. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
- T. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- U. GA-216 - Application and Finishing of Gypsum Board; 2013.
- V. GA-600 - Fire Resistance Design Manual; 2015.
- W. ICC (IBC) - International Building Code; 2015.
- X. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Shop Drawings: For cold-formed steel interior walls, soffits, and ceilings, provide schedules, framing plans, elevations, and/or details as required to show all typical and unique conditions.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies as indicated in Drawings.
 - 1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS

- A. Design Criteria: Provide completed framing system engineered per Structural Notes and Drawings.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Phillips Manufacturing Company: www.phillipsmfg.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

- C. Non-Loadbearing Interior Wall and Ceiling Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated. Wall design pressure shall be 5 psf for typical conditions, 7.5 psf at elevator shafts. Maximum deflection of wall framing shall be L/240 typical, L/360 at surfaces covered in tile or other brittle finishes. Typical ceiling live load shall be 4 psf. Ceilings intended for storage shall have live load of 20 psf. Accessible ceilings shall be designed for a concentrated live load of 200 lbs in addition to uniform live loads. Maximum live load deflection of ceiling framing shall be L/240 typical.
 - 1. Studs: C-shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C-shaped.
 - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 5. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.
- D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- E. Partial Height Partitions (less than 54" height): Provide kneewall connections and other components as required to provide adequate strength and stiffness. Live load shall be 50 pounds per lineal foot or 200 pounds concentrated, applied in any direction at top of partial height partition. Deflection from live loads shall not exceed L/120.
- F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition. A minimum of 1-inch upward or downward structural deflection shall be accommodated without damage.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 2. USG Corporation: www.usg.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 - a. Use at all non-conditioned and semi-conditioned interior spaces such as:
 - 1) Sprinkler, Demark, Dry, and PCB Storage
 - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 4. Water-Resistant Gypsum Board: At all toilet rooms, restrooms, mechanical rooms, kitchen, and boiler rooms.
 - 5. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 - 6. Glass Mat Faced Products:
 - a. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough.

- C. Impact Resistant Wallboard:
 - 1. Application: Lower 4 feet in corridors, hallways, and all rooms without secondary wall finish (FRP, plywood, PLAM, etc.):
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Type: Fire-resistance-rated Type X, UL or WH listed. Refer to Drawings for rating requirements.
 - 4. Thickness: 5/8 inch (16 mm).
 - 5. Edges: Tapered.
 - 6. Paper-Faced Products:
 - 7. Basis of Design: Georgia Pacific; DensArmor Plus: www.buildgp.com
- D. Backing Board For Wet Areas:
 - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and sinks.
 - 2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type: Thickness 5/8 inch (16 mm).
 - b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch (16 mm). Refer to Drawings for rating requirements.
- E. Exterior Sheathing Board: See Section 06 10 00.

2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: full stud depth.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: Low profile, for 90 degree outside corners.
 - 2. Splayed Corner Beads with Paper Face: Reinforced with metal strips.
 - 3. L-Trim: Sized to fit 5/8 inch (- mm) thick gypsum wallboard.
 - 4. Expansion Joints:
 - a. Type: V-shaped metal with factory-installed protective tape.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Topping Compound: Powder-type vinyl-based joint compound.
 - 5. Taping and Prefilling: Chemical hardening type compound.
 - 6. Joint Compound: Setting type, field-mixed.
- E. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as []
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
- C. Studs: Space studs [] maximum.
 - 1. Extend partition framing to structure in all locations, unless noted in Drawings otherwise.
 - 2. Partitions Terminating at Ceiling: Extend walls 6-inches minimum above ceiling, provide diagonal bracing as required by the stud design engineer.
 - 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track. Install metal and foam flute closures when wall is perpendicular to deck flutes.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using heavier or double studs at jambs, as required by the stud design engineer.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- F. Blocking: Install mechanically fastened steel channel blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall-mounted door hardware.
 - 7. As indicated in Drawings.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

- D. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Expansion Joints: Place expansion joints consistent with lines of building spaces and as follows:
 - 1. Not more than 50 feet apart on walls and ceilings.
 - 2. Coordinate location prior to installation with Owner and Architect.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls to receive specialty graphic as indicated in Drawings.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- E. Where level 4 finish is required, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for wall applications.
- B. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.
- B. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2021.
- C. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- E. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- F. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.
- G. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than 10 of each type.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: As indicated in Drawings.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Open edges of wall tile.
 - b. Wall corners, outside and inside.
 - c. Floor to wall joints.
 - 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. LATICRETE International, Inc: www.laticrete.com/#sle.
- C. Hybrid Polymer-Based Adhesive: One-part, non-sag, polymer-based adhesive suitable for setting gauged porcelain tiles, panels, and slabs.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align wall joints.
- C. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- D. Form internal angles square and external angles bullnosed.
- E. Install non-ceramic trim in accordance with manufacturer's instructions.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - WALL TILE

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.05 CLEANING

- A. Clean tile and grout surfaces.

3.06 PROTECTION

- A. Seal grout immediately after curing and cleaning, or as required by manufacturer recommendations.

3.07 SCHEDULE

- A. Refer to Drawings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.
- B. Section 07 92 00 - Joint Sealants: Acoustical sealant.
- C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wall board for ceiling applications.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- G. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6x6 inch (- mm) in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches (- mm) long, of suspension system main runner, cross runner, and perimeter molding.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's qualification statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 1 percent of total installed, but not less than two boxes.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category as indicated in Structural Notes and complying with the following:
 - 1. Local authorities having jurisdiction.

2.03 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels, Type CL2: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Size: 24 by 48 inches (610 by 1219 mm).
 - 3. Thickness: 15/16 inch (- mm).
 - 4. Panel Edge: Beveled Tegral.
 - 5. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 9/16 inch (- mm) face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
- C. Concealed Suspension System: Hot-dip galvanized steel grid and cap.
 - 1. Application(s): Suspended gypsum ceilings Type CL1.
 - 2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Profile: Tee; 15/16 inch (24 mm) face width.

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- E. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions and specified Seismic Design Category.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system as indicated in Drawings. If not indicated, balance grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Seismic Design: Follow manufacturer's installation requirements for seismic category and jurisdictional requirements.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.

- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips as required for seismic category and jurisdictional requirements.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- E. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2018 (Reapproved 2023).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 by 12 inch (- by - mm) in size illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 100 square feet (- square meters) of each type and color.
 - 3. Extra Wall Base: 50 linear feet (- linear meters) of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store all materials off of the floor in an acclimatized, weather-tight space.

- B. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Linoleum Tile: - Type V1 Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
 - 1. Manufacturer:
 - a. Forbo Flooring, Inc: www.forboflooringna.com/#sle.
 - 2. Minimum Requirements: Comply with ASTM F2195, Type corresponding to type specified.
 - 3. Backing: Synthetic fabric.
 - 4. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
 - 5. Color: As indicated on drawings.

2.02 RESILIENT BASE

- A. Resilient Base - Type ____: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
 - 1. Manufacturer:
 - a. Roppe Corporation: www.roppe.com.
 - 2. Height: 4 inch (100 mm).
 - 3. Thickness: 0.125 inch (3.2 mm).
 - 4. Finish: Satin.
 - 5. Length: Roll, 120' length.
 - 6. Color: As indicated on drawings.

2.03 ACCESSORIES

- A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- B. Moldings, Transition and Edge Strips: As indicated in Drawings.
 - 1. Manufacturer:
 - a. Roppe Corporation: www.roppe.com.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Clean substrate.

- C. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Accessory Samples: Submit two 6 inch (- mm) long samples of edge strip.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: 1 Box of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting: As indicated in Drawings.

2.02 MATERIALS

- A. Tile Carpeting, Type C1 and C2: Fusion bonded, manufactured in one color dye lot.
 - 1. Tile Size: 24 by 24 inch (- mm), nominal.

2.03 ACCESSORIES

- A. Edge Strips: As indicated in Drawings, color as selected by Architect.
- B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- C. Clean and vacuum carpet surfaces.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.
- C. Section 09 97 23 - Concrete and Masonry Coatings: Finish paint system for exposed CMU.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- F. SSPC-SP 1 - Solvent Cleaning; 2015.
- G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- H. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 1. Where sheen is specified, submit samples in only that sheen.
 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding, primed wood, and primed metal.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 3. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- C. Paint ME-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. Semi-gloss: Two coats of latex enamel.
- D. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.
 2. Semi-gloss: Two coats of alkyd enamel.
- E. Paint E-Pav - Pavement Marking Paint:
1. Yellow: One coat, with reflective particles; Where indicated in Drawings.
 2. White: One coat, with reflective particles.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali-Resistant Water-Based Primer.
 2. Interior/Exterior Latex Block Filler; MPI #4.
 3. Water Based Primer for Galvanized Metal; MPI #134.
 4. Rust-Inhibitive Water Based Primer; MPI #107.
 5. Latex Primer for Exterior Wood; MPI #6.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Fiber Cement Siding: 12 percent.
 - 2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.
- I. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

- D. Apply each coat to uniform appearance.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Materials for backpriming woodwork.
- D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - a. Ensure fire treated label is visible and inspected.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 9. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015.
- E. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- F. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.

- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Alkyd; MPI #47, 48, 81, or 96.
 - 3. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
 - 1. Shop primer by others.
 - 2. One top coat _____.
 - 3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
 - 4. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
- E. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
 - 1. One coat of latex primer sealer.

2. Semi-gloss: Two coats of latex enamel.
- F. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
 1. One coat of latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- G. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
 1. Touch-up with latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- H. Paint Mgl-OP-3L - Galvanized Metals, Latex, 3 Coat:
 1. One coat galvanize primer.
 2. Semi-gloss: Two coats of latex enamel.
- I. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
 1. One coat of alkyd primer sealer.
 2. Semi-gloss: Two coats of latex enamel.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Alkali Resistant Water Based Primer; MPI #3.
 2. Interior Latex Primer Sealer; MPI #50.
 3. Interior Drywall Primer Sealer.
 4. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
 5. Interior Water Based Primer for Galvanized Metal; MPI #134 or #134 X-Green.
 6. Latex Primer for Interior Wood; MPI #39.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces:
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.
- H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Moisture resistant smooth concrete and masonry coatings for trash enclosure and Control House.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- B. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).
- C. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints; 2002 (Reapproved 2017).
- D. ASTM D1653 - Standard Test Methods for Water Vapor Transmission of Organic Coating Films; 2013 (Reapproved 2021).
- E. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings; 2020.
- F. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry; 2003 (Reapproved 2022).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.
- I. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- J. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- K. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data indicating coating materials and _____.
- C. Samples: Submit two samples 8.5 by 11 inch (- by - mm) in size illustrating colors available for selection.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

- B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- C. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 CONCRETE AND MASONRY COATINGS

- A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
 - 1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
 - 2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
 - 3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.02 MATERIALS

- A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.
- B. High Build, Water Based Textured Coating System for Masonry: Water based styrene-acrylic resin primer; acrylic terpolymer (elastomeric) top coat and graded sand aggregate.
 - 1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
 - 2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
 - 3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
 - 4. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
 - 5. Color: To be selected by Architect from manufacturer's standard range.
 - 6. Texture: Smooth.
 - 7. Manufacturers:
 - a. Tex-Cote LLC; XL 70 W: www.texcote.com/#sle.
 - b. Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- C. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

- A. Protect finished work from damage.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-code required building and information signs.
- B. Room and door signs required by code.
- C. Emergency evacuation maps.
- D. Building identification signs.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking when required.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs:
 - 1. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
- B. Dimensional Letter Signs:
 - 1. Cosco Industries; Cast Aluminum and Vinyl: www.coscoarchitecturalsigns.com/#sle.
 - 2. Location: As indicated in Drawings.
 - 3. Size: As indicated in Drawings.
 - 4. Font/Style: As indicated in Drawings
 - 5. Cast Aluminum Color: Clear Anodized.
 - 6. Vinyl Color: Black.
- C. Other Signs - Exterior Signage:
 - 1. Type: Stainless steel building signage..
 - 2. Location: As indicated in Drawings.
 - 3. Size: As indicated in Drawings.
 - 4. Finish: Powder coated, color(s) to be selected by Owner and Architect from full range, including custom colors.
 - 5. Hardware:
 - a. Stanchions, standoffs, fasteners, and mounting plates.
 - b. Stainless steel.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs:
 - 1. Provide at the following locations:
 - a. Restrooms
 - b. Fire sprinkler rooms
 - c. Electrical rooms
 - d. Elevator machine room
 - e. Mechanical rooms
 - 2. Sign Type: Flat signs with engraved panel media as specified.
 - 3. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
 - 4. Character Height: 1 inch (25 mm).
 - 5. Sign Height: 3 inches (75 mm), unless otherwise indicated.
 - 6. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 7. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Emergency Evacuation Maps:
 - 1. Allow for one map per elevator lobby.
 - 2. Map content to be provided by Owner.
 - 3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.
- D. Building Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Bevelled.
 - 2. Corners: Radiused.
 - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: To be selected from full range of colors..
 - 4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 - 1. Total Thickness: 1/16 inch (1.6 mm).

2.05 NON-TACTILE SIGNAGE MEDIA

- A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
 - 1. Sign Color: Clear.
 - 2. Total Thickness: 1/8 inch (3 mm).

2.06 EXTERIOR SIGNAGE

- A. Metal Signage:
 - 1. Metal: Stainless Steel sheet, flat, powder coated.
 - 2. Metal Sheet Thickness: 1/4 inch (____ mm), minimum.

2.07 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Metal: Aluminum casting.
 - 2. Finish: Clear Anodized.
 - 3. Mounting: Concealed screws.
- B. Plastic Letters:
 - 1. Material: Vinyl sheet, flat cutout.
 - 2. Color: Black.
 - 3. Mounting: Tape adhesive.

2.08 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs where indicated:

1. Room and Door Signs: Locate on wall at latch side of door with braille centered 48 inches above finish floor.
 2. If no location is indicated obtain Owner's instructions.
 3. Review locations prior to installation.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plastic laminate toilet compartments.
- B. Urinal screens.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Concealed steel support members.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Concealed blocking.
- C. Section 05 50 00 - Metal Fabrications: Concealed steel support members.
- D. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- E. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.
- F. Section 09 21 16 - Gypsum Board Assemblies: Blocking and supports.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- D. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 12 by 12 inch (____x____ mm) in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Laminate Toilet Compartments:
 - 1. General Partitions Mfg. Corp; Plastic Laminate, Series 40:
www.generalpartitions.com/#sle.
 - 2. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Particleboard for Core: ANSI A208.1; composed of wood chips, sawdust or flakes, made with waterproof resin binder; of grade to suit application; sanded faces.
- B. Plastic Laminate: NEMA LD 3, HGS.

2.03 COMPONENTS

- A. Toilet Compartments: Plastic laminate finished, floor-mounted headrail-braced.

- B. Doors, Panels, and Pilasters: Plastic laminate adhesive and pressure bonded to faces and edges of particleboard core, with beveled corners and edges; edges of cut-outs sealed.
 - 1. Reinforce pilasters and panels with steel plate sandwiched in particleboard core at attachment points. Router cut openings as required.
 - 2. Plastic Laminate Color: L5, textured, low gloss finish.
- C. Door and Panel Dimensions:
 - 1. Thickness: 1 inch (25 mm).
 - 2. Door Width: 24 inch (610 mm).
 - 3. Door Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - 4. Door Height: 58 inch (1 473 mm).
 - 5. Pilaster Height: 82 inch.
 - 6. Thickness of Pilasters: 1-1/4 inch (32 mm).
- D. Urinal Screens: Wall mounted with two continuous panel bracket. For screens over 18" wide, provide vertical upright mounted to floor.

2.04 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 6 inches (-mm) high, concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch (25 x 41 mm) size, with anti-grip strips and cast socket wall brackets.
- C. Pilaster Brackets: Polished stainless steel.
- D. Wall Brackets: Continuous type, polished stainless steel.
- E. Attachments, Screws, and Bolts: Stainless steel.
- F. Hardware: Polished stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Nylon bearings.
 - 3. Thumb turn door latch with exterior emergency access feature.
 - 4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 5. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 6. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets.

- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Top-supported folding panel partitions, horizontal opening.
- B. Ceiling track and operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Steel support for track assembly.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking and track support shimming.
- C. Section 09 21 16 - Gypsum Board Assemblies: Adjacent soffit framing and ceiling finish.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- F. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- G. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).
- H. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 1996 (Reapproved 2016).
- I. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.
- J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, track switching components, and colors and finishes available.
- C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.
- D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.
- E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches (300 by 300 mm) size, illustrating quality, colors selected, texture, and weight.
- F. Manufacturer's Instructions: Indicate special procedures.
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of this section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within five year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Folding Panel Partitions - Horizontal Opening:
 - 1. Modernfold, a DORMA Group Company; Acoustiseal Legacy Paired Panel (932): www.modernfold.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

- A. Folding Panel Partitions: Side opening; paired panels; center stacking; manually operated.
- B. Panel Construction:
 - 1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
 - 2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
 - 3. Panel Properties:
 - a. Thickness Without Finish: 3 inches (75 mm).
 - b. Width: Up to 48 inches (1219 mm).
- C. Panel Finishes:
 - 1. Facing: Vinyl coated fabric.
- D. Panel Seals:
 - 1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
 - 2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.
 - 3. Lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 250 lbs. seal force against the adjacent wall for optimum sound control.
 - a. Provide two additional levers per door.
- E. Suspension System:
 - 1. Track: Extruded aluminum; 1-5/8 by 1-5/8 inch (41 by 41 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
 - 2. Carriers: Steel, ball bearing wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- F. Performance:
 - 1. Acoustic Performance:
 - a. Sound Transmission Class (STC): 48 to 52 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).

2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
 3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- G. Accessories:
1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments, and intermediate meeting posts.

2.03 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Vinyl Coated Fabric: ASTM F793/F793M, Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.
- C. Particleboard: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
- D. Markerboard: Porcelain enamel on steel, laminated to core. Color to be selected by Architect from full range of color options.
- E. Acoustic Insulation:
 1. Type: As required for acoustic performance indicated.
 2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch (6.4 mm) of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.
- D. Verify wall plumbness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

3.02 INSTALLATION

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Lubricate moving components.
- C. Install acoustic sealant to achieve required acoustic performance.
- D. Coordinate electrical connections.

3.03 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

- A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of partition and identify potential operational problems.
- B. Provide Owner with additional operating levers.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.
- B. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of corner guard, 12 inch (____ mm) long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- E. Locations: Identify location of guards for confirmation with Architect.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wall and Corner Guards:
 - 1. Inpro: www.inprocorp.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

- A. Corner Guards - Surface Mounted:
 - 1. Basis of Design: In-Pro, Type 430 Stainless Steel.
 - 2. Material: Type 304 stainless steel, No. 4 finish, 18 gage, 18 inch (____ mm) thick.
 - 3. Width of Wings: 1.5 inches (- mm).
 - 4. Corner: Square.
 - 5. Preformed end caps.
 - 6. Length: One piece, as indicated in Drawings.
 - 7. Location: All outside corners and partitions end walls unless otherwise indicated in Drawings.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify with Architect locations of guards.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

- B. Position corner guard 4 inches (____ mm) above finished floor to 52 inches (____ mm) high.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch (6 mm).
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Accessories for toilet rooms, showers, and utility rooms.
- D. Utility room accessories.
- E. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.
- B. Section 10 21 13.16 - Plastic-Laminate-Clad Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Bobrick; www.bobrick.com.
- B. Provide products of each category type by single manufacturer.
 - 1. Products and Model Numbers: As indicated in Drawings.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.

- 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Products and Model Numbers: As indicated in Drawings.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Products and Model Numbers: As indicated in Drawings.
- B. Folding Shower Seat: Wall-mounted recessed; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand and L-shaped, left hand seat.
 - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
 - 2. Size: ADA Standards compliant.
- C. Towel Pin: Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
- D. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.06 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch (6 mm) diameter.
 - 2. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.

- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: As indicated on drawings.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnishing, Delivery and installation of fall protection anchor point and related appurtenances as indicated in Drawings.

1.02 RELATED SECTIONS:

- A. Section 05 50 00 – Metal Fabrications: Miscellaneous metals
- B. Section 06 10 00 – Rough Framing: Required blocking and support
- C. Section 07 54 00 – Thermoplastic Membrane Roofing: Flashing

1.03 REFERENCES

- A. Occupational Safety and Health Administration (OSHA).
- B. Part 1910 Occupational Safety and Health Standards.
- C. Part 1926 Safety and Health Regulations for Construction.
- D. American Society for Testing and Materials (ASTM).
- E. American National Standards Institute, Inc. (ANSI).
 - 1. A 10.14 Safety Belts, Harnesses, Lanyards, Lifelines and Drop Lines for Construction and Industrial Use.
 - 2. Z 359.1-1992: Safety Requirements for Personal Fall Arrest systems, subsystems and components.

1.04 CODE COMPLIANCE

- A. Comply with all local, state, and federal safety standards including WISHA.

1.05 SYSTEM DESCRIPTION

- A. The fall protection system shall allow the user to walk uninterrupted the entire length of the system and provide secure anchorage to arrest a fall by the user. All essential components shall be included as part of the above referenced system, though not specifically stated in the following Specifications, so as to provide a complete and fully operational system.

1.06 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
 - 1. Product Data: Manufacturer's data and product information for manufactured materials and products.
 - 2. Shop Drawings: For fabrication and erection. Include plans, member profiles, sizes, elevations and details for anchorages and connections.
 - 3. Operations and Maintenance Manual: Indicating parts list and maintenance requirements for all equipment indicating proper procedures and equipment for safe operations of the system.
 - 4. Experience Information: Including type of fall projection system, location and date of installation and Owner's name and address.
 - 5. Test Certificate: Indicating completion of proof load testing on installed system.
 - 6. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
 - 7. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
 - 8. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience and approved by manufacturer.

1.07 QUALITY ASSURANCE

- A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single source. The equipment supplier shall, in addition to the contractor, assume the responsibility for proper design and complete installation.
- B. No equipment shall be supplied by any manufacturer not regularly engaged in the manufacturing and production of fall protection systems. The manufacturer must have installed and had in satisfactory use for a period of not less than two (2) years a minimum of ten (10) installations of the size and type comparable to the unit specified. Bids from manufacturers lacking the experience requirements of the specification, can be considered if the manufacturer provides a satisfactory two (2) year maintenance bond in lieu of evidence of experience and operation.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened protective packing.
- B. Store materials in original protective packing. Prevent soiling, physical damage or wetting.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Perform prior to preparation of Shop Drawings and fabrication drawings to ensure required fit and dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Guardian Metal Products, Kent, WA.

2.02 MATERIALS

- A. Type: CB Series anchors system.
- B. All materials shall be new, and the complete fall projection system, except for accessory equipment, shall be essentially the product of one manufacturer regularly engaged in the production of such equipment.
- C. Plates and Bars: ASTM A570.
- D. Steel pipe: ASTM A53.
- E. Cable: Stainless steel.
- F. Finish: Hot-Dipped galvanized after fabrication per ASTM A153.
- G. Fasteners
 - 1. The fall protection system shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the fall protection system of 2 times the maximum design load without failure.
 - 2. Where through bolting is not possible, practical or desirable the listed fastening systems may be approved:
 - a. Hilti Fastening Systems
 - b. Lindapter Connection Systems
 - c. S5 Clamps for use with standing seam metal roofing.

2.03 FABRICATION

- A. General
 - 1. System components shall be of the same material unless otherwise indicated.
 - 2. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges.

3. Coordinate anchorage system with supporting structure. Fabricate and locate anchoring devices as recommended by manufacturer to provide adequate support for intended use.
4. Fabricate joints in a manner to discourage water accumulation. Provide weep holes to drain any water which could accumulate the exposed joints.

2.04 SYSTEM DESIGN

- A. The fall protection system shall be designed to allow users to walk uninterrupted without having to unhook from the system. The system shall be designed to support 2 users for fall arrest and fall restraint. All components shall be designed by the Fall Protection System supplier and shall meet the applicable requirements of ANSI A10. 14.
- B. Lanyard: Provide (2) two adjustable length, tear out shock absorbing or self-retracting lanyards, nylon lanyards with double locking snap assemblies at each end meeting OSHA 1926.500 and ANSI A10, 14 and as recommended by the fall protection system supplier.
- C. Support Harness: Provide (2) two nylon Class III full body harnesses with back "D" ring.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturer's instructions.
- B. Fall protection system shall be installed under the direction of manufacturer's authorized trained personnel.
- C. Install anchorages and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.
 1. Do not load or stress fall protection system until all materials and fasteners are properly installed and ready for service.

3.02 FIELD QUALITY CONTROL

- A. After the safety system is installed and properly tensioned, the safety system manufacturer's approved authorized representative shall inspect and operate the system and shall make all final adjustments for proper operation.
- B. After the system has been placed into operation, the manufacturer's authorized representative shall perform proof testing and issue a certificate attesting to the system's ability to withstand the proof load.

3.03 OPERATOR TRAINING

- A. Provide operator training after the system has been installed and proof tested. Training is to take the form of a single class conducted at the installation site.

3.04 CLEANING

- A. Remove all loose materials, crating and packing material from premises.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This work includes but is not necessarily limited to the following:
 - 1. Furnish and installation of pedestrian security gates, and miscellaneous site construction items assembled and installed with all hardware.
 - 2. Bidder designed and engineered post footings including stamped drawings.

1.2 SUBMITTALS

- A. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware.
- B. Shop Drawings: Indicate plan layout, spacing of components, hardware anchorage, and schedule of components.
- C. Post footing, Concrete Mix, and post spacing shop drawings: Stamped engineered drawings by an Engineer licensed in the State of Washington. See project manual to reference Geotechnical information, and fence and gate manufacturers for wind load data.
- D. Fence Installer Qualification Statement.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

1.4 WARRANTY

- A. Correct defective Work by installer within a five year period after Date of Substantial Completion.
- B. Provide a warranty for products against defects in material and workmanship for a period of one (1) year from the date of invoicing. The warranty shall cover defects in materials and workmanship.

1.5 PROTECTION

- A. Protect all work installed under this section from any cause whatsoever, including subsequent construction activities and vandalism until final acceptance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store products of this section in manufacturer's unopened packaging until installation.
- B. Store off ground, under cover, protected from weather and construction activities.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturer: Hayward Turnstiles Inc., or equal.

Hayward Turnstiles Inc.
160-A Wampus Lane, Milford, CT USA 06460
Phone: 203-644-9147 Fax: 203-200-7866 Email: sales@haywardts.com
www.haywardturnstiles.com

2.2 PRODUCT

- A. HTSG Full Height Security Gate: no substitutions. Features of this gate shall include an entrance pull handle, keyed entrance, rim exit device, infill mesh, heavy duty hydraulic closer, electric strike and a 38" passageway.

2.3 CONSTRUCTION

- A. Gate Frame: The HTSG Full Height Security Gate frame is a fully welded assembly consisting of 3" x 3" x 11ga. steel tubing with tensile strength of 50,000 pounds.
- B. Gate: Interior Gate is a fully welded assembly consisting of 2" x 2" x 11 ga. square tubing with tensile strength of 50,000 pounds.
- C. Infill Mesh: Gate infill should be constructed of 3/8" 9-gauge diamond expanded metal infill material with an independent frame of 1" flat steel bracing welded to both faces around the exterior of the expanded metal material.
- D. A security overlap of 1/4" x 4" flat stock shall be welded to the full length of the gate's vertical member that protects the gate's security hardware and prevents tampering, forced entry, and provides a positive stop against over-swing.

2.4 EQUIPMENT

- A. General: The gate shall provide electronic controlled passage in one direction
- B. Electric Locking Mechanism: Trine electric Strike. Can be configured to unlock on power loss (Fail Safe).
- C. Connects to access control system
- D. LCN Heavy Duty 4040XP Hydraulic Closer: Heavy duty hydraulic self-closing closer.
- E. Detex V40 Rim Exit Device: Full length panic bar. Depressing the panic bar will unlock gate for egress regardless of latch state.
- F. Barbed Wire: The gate shall have 4 pt class 3.80 galvanized 12 1/2 ga. barbed wire between the uprights overtop gate frame.
- G. ADDED OPTIONS
 - 1. Card Reader Mounting Plate: Allows for mounting of reader devices directly to gate frame.
 - 2. Kick Plate: Steel kickplate can be added to interior side of gate
 - 3. Mag Lock Option #1: 600 lb. mag lock welded into gate

2.5 FACTORY TESTING

- A. Product shall be tested at the factory prior to shipment
- B. Inspect product finishes and touch up prior to shipment

2.6 FINISH

- A. Hot-Dip Galvanized: All exterior components are to be hot-dip galvanized

PART 3 EXECUTION

3.1 SITE EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris and grading has been done.

- B. Inspection: Installer must examine the installation location and advise the Contractor of any site conditions inconsistent with proper installation of the product. Gate must be installed on a level concrete pad.

3.2 PREPARATION

- A. Project Site Conditions: Install the gate on a level concrete pad, per Civil drawings, and secure both sides to adjacent wall, turnstile, fencing or other anchored structure, refer to manufacturer's instructions.
- B. Grading per Civil drawings and specifications.
- C. Remove obstructions or debris.

3.3 INSTALLATION

- A. Installation: Install gates in accordance with manufacturer's instructions.
- B. Install post footings per approved shop drawings. Install post footings per approved footing submittal 1.2, C, this section.
- C. Adjustment: Installer shall adjust gates for proper performance after installation.
- D. Do not attach the hinged side of gate to building wall; provide gate posts.
- E. Peen all bolts upon installation.
- F. Perform three random field inspections confirming proper installation.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Do not infringe on adjacent property lines.

3.5 FIELD QUALITY CONTROL

- A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- B. Inspect against submittal drawings for:
 - 1. Post Hole diameter.
 - 2. Post Hole depth.
 - 3. Post Hole spacing.
 - 4. gate height
 - 5. spacing of barb wire.
- C. Gates: Inspect for level, plumb, and alignment.
- D. Workmanship: Verify neat installation free of defects.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured custom casework, with cabinet hardware.
- B. Manufactured open shelving and associated wall mounted standard and bracket system.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and nailers for anchoring casework.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- C. Section 09 21 16 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.
- D. Section 09 65 00 - Resilient Flooring: Resilient wall base.
- E. Section 12 36 00 - Countertops: Additional requirements for countertops.
- F. Division 22: Plumbing requirements.
- G. Division 26: Electrical requirements.

1.03 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.04 REFERENCE STANDARDS

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- G. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
- H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.
- I. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.
- J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances and clearances required.
- D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches (51 mm by 75 mm).
 - 1. Plastic laminate samples, for color, texture, and finish selection.
 - 2. Solid phenolic samples, for color, texture, and finish selection.
- E. Casework Samples: Representative of types in the project.
 - 1. Base Cabinet: Cabinet with drawer and door and specified hardware. Type indicated on drawings.
- F. Manufacturer's Installation Instructions.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- 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.
 - 2. Spare Parts: Two of each kind of drawer slide, hinge, and pull.
 - 3. Tools: One each of every special tool required for maintenance of casework hardware.
- K. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- B. Quality Certification: Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 - 5. Replace, repair, or rework all work for which certification is refused.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed

and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:

1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 1. Ruptured, cracked, or stained finish coating.
 2. Discoloration or lack of finish integrity.
 3. Cracking or peeling of finish.
 4. Delamination of components.
 5. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Laminate Casework:
 1. Case Systems: www.casesystems.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom Grade.

2.03 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Structural Performance: Safely support the following minimum loads:
 1. Drawers: 125 pounds (57 kg), minimum.
 2. Hanging Wall Cases: 300 pounds (135 kg).
 3. Shelves: 100 pounds (45 kg), minimum.
 - a. Wall mounted open shelving 200 pounds, minimum.
- D. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- E. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- F. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
- G. Fixed panels at backs of open spaces between base cabinets.
 1. Provide cutouts for power receptacles where indicated on drawings.
 2. Treat sides and back panel as "exposed".
- H. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- I. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

- J. Apron Frames: Construction similar to other cabinets, with modifications.
 - 1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.
- K. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch (38 mm) in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

2.04 PLASTIC-LAMINATE-CLAD CASEWORK AND OPEN SHELVING

- A. Plastic-Laminate-Clad Casework and Open Shelving: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
 - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 - a. Base Cabinets: 22 inches (559 mm).
 - b. Tall Cabinets: 22 inches (559 mm).
 - c. Wall Cabinets: 16 inches (406 mm).
 - 3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
 - a. Finish: Matte or suede, gloss rating of 5 to 20.
 - b. Surface Color and Pattern Orientation: As indicated on drawings.
 - c. Exposed Interior Surfaces: Thermally fused laminate.
 - 1) Color: To be selected from Manufacturer's full range of laminate options..
 - d. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - e. Cap exposed plastic laminate finish edges with plastic trim.
 - 4. Open Shelving:
 - a. Size as indicated in Drawings
 - b. Shelves to be 1 inch thick with plastic laminate applied to top and bottom faces, and cap edges with plastic trim.

2.05 COUNTERTOPS

- A. Countertops: See Section 12 36 00.

2.06 CABINET HARDWARE

- A. Comply with BHMA A156.9 requirements.
 - 1. Acceptable base materials for plated finishes include steel.
- B. Shelves in Cabinets:
 - 1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
- C. Open Shelving:
 - 1. Shelf Standard and Bracket System: Heavy-duty, vertical standards with adjustable horizontal brackets.
- D. Swinging Doors: Hinges, pulls, and catches.
 - 1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
 - a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
 - 1) European-Style Hinges for Overlay Doors: 110 degree opening angle.

2. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
3. Catches: Magnetic.
- E. Sliding Doors: Pulls and track assemblies.
 1. Pulls: Steel, recessed circular design.
 - a. Steel Finish: Bright chromium plated over nickel.
 2. Track Assembly: Nylon track with solid bearing followers.
- F. Drawers: Pulls and slides.
 1. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
 2. Slides: Steel, full extension arms, ball bearings; soft- self-closing; capacity as recommended by manufacturer for drawer height and width.

2.07 MATERIALS

- A. Wood-Based Materials:
 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
- B. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
- C. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.
- D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.
- E. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- F. Hardboard: ANSI A135.4, Class 1, tempered.
- G. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.
- H. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
- I. Stainless Steel Sheet: ASTM A666 Type 304.

2.08 ACCESSORIES

- A. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: As selected by Architect from manufacturer's full range.
 2. Use at all exposed and semi-exposed edges.
- B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- C. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.
- D. Grommets: Standard painted metal grommets for cut-outs, in color to match adjacent surface.
- E. Sealant for Use in Casework Installation:
 1. Manufacturer's recommended type.

PART 3 EXECUTION

3.01 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

- A. Site Verification of Environmental Conditions:
 - 1. Do not deliver casework until the following conditions have been met:
 - a. Building has been enclosed (windows and doors sealed and weather-tight).
 - b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
 - c. Ceiling, overhead ductwork, piping, and lighting have been installed.
 - d. Installation areas do not require further wet work construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch (13 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
 - 1. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.
- D. Verify adequacy of support framing and anchors.
- E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
 - 2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch (3 mm) in 10 feet (3 m).
 - 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
 - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
 - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).
- F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - 1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches (610 mm) on center, and at sides of cabinets with not less than two fasteners per side.
- G. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.
- H. Install hardware uniformly and precisely.
- I. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- J. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
- B. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.
- B. Wall-hung counters and vanity tops.
- C. Plastic laminate for window sills.

1.02 RELATED REQUIREMENTS

- A. Section 12 32 00 - Manufactured Casework.
- B. Division 22 - Plumbing fixtures and requirements.

1.03 REFERENCE STANDARDS

- A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.
- B. ANSI A208.1 - American National Standard for Particleboard; 2009.
- C. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- I. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Installation Instructions: Manufacturer's installation instructions and recommendations.
- I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS).
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Formica Corporation: www.formica.com/#sle.
 - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - c. Color and Pattern: As indicated on drawings.
 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
 6. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

- A. Fixed Top-Mounted Countertop Support Brackets: See Section 06 20 00.

- B. Aluminum Edge Trim: Extruded flat shape; smooth surface finish; self locking serrated tongue or counter-sunk for screw attachment; clear anodized finish.
 - 1. Location: Plastic laminate sills as indicated in Drawings.
 - 2. Basis of Design: Eagle-Aluminum, Aluminum Face Nosing E-24.

2.04 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and splashes up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.
 - 1. Unless noted otherwise in Drawings, provide brackets to support 300 lbs per linear foot.
 - a. Color to be selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Design and fabrication of continuous angle frame bleacher units.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- F. 2021 IBC – International Building code.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Sealed drawings by licensed professional.
- C. Fabricator Qualifications.
- D. Manufacturer Qualifications
- E. Provide manufacturer's standard workmanship warranty for a period of five (5) years.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualification Statement: Provide documentation showing manufacturer has a minimum of ten years of experience in design and manufacture of bleacher systems. Fabrication Welders shall be AWS certified.
- B. Bleacher system to be design by licensed professional in WA state.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Basis of Design: American Aluminum Seating, Inc.; 5-Row Bleacher: www.bleacherseating.com

2.02 STANDARD BLEACHER

- A. Design Parameters:
 - 1. Vertical Rise Per Row - 8 Inches. (Options available)
 - 2. Horizontal Depth Per Row - 24 Inches. (Options available)

3. Seat Height - 17 to 17 1/2 Inches above its respective tread or walking surface.
4. Framework - Welded angle frames located at a maximum distance of 6 feet and connected by angle cross braces.
5. Seats - Nominal 2 x 10 anodized aluminum (4)-leg plank. (9.5 x 1.50 x .102)
6. Treads - Nominal 2 x 10 mill finish (4)-leg plank. (9.5 x 1.50 x .102)
7. Semi-closed.
8. End Caps - Anodized aluminum channel caps.
9. Risers - 8 Inch
10. Joint Sleeve Assemblies for larger bleachers
11. Steps - Custom designed welded frames using 2 x 12 mill finish plank.
12. Security Guard rail Systems - Two-line rail system which incorporates the use of chain link fence (aluminized) for maximum safety.
13. Elevated walkways from 30" and up in 6" increments.

B. Materials and Finishes.

1. Framework - Aluminum Alloy 6061-t6 structural materials with mill finish. Last row vertical member is heavy aluminum channel for added strength. All welding is seal welded to eliminate moisture infiltration.
2. Extruded aluminum - Planks are aluminum alloy 6063t6. Seats are anodized 204R1.
3. Joint sleeves - Aluminum alloy 6063t6.
4. End Caps - Aluminum alloy 6063t6 and anodized.
5. Hold-down Clips - 4-Way adjustable aluminum alloy 6063t6
6. Hardware - Cadmium or zinc plated, grade 5 or better. Serrated locking flange nuts.
7. Guardrail Pipe - 1.900 o.d. anodized.
8. Fence Fabric - 9 Ga. Wire, Aluminized finish after galvanizing.

C. Design Loads:

1. Live Load - 100 PSF gross horizontal projection.
2. Lateral Sway Load - 24 PLF seat plank.
3. Perpendicular Sway Load - 10 PLF seat plank.
4. Wind Load - 30 PSF vertical projection.
5. Live Load of seat and foot plank - 120 PLF.
6. Guardrail system – to meet vertical and horizontal load.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Contractor shall install the bleacher unit in accordance with the manufacturer's detailed installation procedures.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chain Hoist: Furnishing and installation.

1.02 RELATED REQUIREMENTS

- A. Section 01 33 00 - Submittal Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 01 77 00 - Closeout Procedures: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- C. Section 05 12 00 - Structural Steel Framing.

1.03 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators; 2014.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of crane with size, location and installation of service utilities.
 - 1. Hydronic piping within slab.
 - 2. Additional slab reinforcement

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide electrical and installation requirements.
- C. Shop Drawings: Indicate layout, slab reinforcement requirements, structural loads imposed on the building..
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Specimen Warranty..

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver chain hoist to project site in protective wrapping.

1.08 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for crane and all components.

PART 2 PRODUCTS

2.01 ACCESSORIES

- A. Electric Chain Hoist:
 - 1. Hook Mounted.
 - 2. Three phase electric connection.
 - 3. Two (2) ton lifting capacity
 - 4. 20 feet of lift.
 - 5. Basis of Design: Harrington, Model NER020L-20.
- B. Vinyl lettering listing crane's hoist capacity.
 - 1. 3 inch tall letters in red or contrasting color from crane.
 - 2. Install on beam and two posts.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that site conditions match approved shop drawings..

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust chain hoist for smooth operation.

3.04 CLOSEOUT ACTIVITIES

- A. See Section 01 77 00 - Closeout Procedures, for closeout submittals.
- B. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of on site training.
 - 3. Instructor: Manufacturer's training personnel.
 - 4. Location: At project site.

END OF SECTION

SECTION 23 0000 – BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

- 1.1 Project plumbing scope are intended for design/build and installation by MacDonald-Miller Facility Solutions. Installation by any other contractor will be at the responsibility of said contractor. MacDonald-Miller Facility Solutions shall be held harmless from work performed by any other plumbing contractor and shall not be responsible for unresolved or missing information.
- 1.2 Any further reference plumbing contractor within this document shall be implied to mean MacDonald-Miller Facility Solutions.
- 1.3 The plumbing contractor shall provide the work shown on the drawings and specified for their individual sections of work.
- 1.4 The word “provide” shall mean furnish and install, make all final connections, and leave in an approved complete operating condition.
- 1.5 All work shall be done in accordance with the editions adopted at time of Permitting of the applicable building codes, Washington State Mechanical Code (WSMC), 2018 Uniform Plumbing Code (UPC) with Washington State Amendments, 2018 Washington State Energy Code, National Electric Codes (NEC) and all other applicable Federal, State, and local regulations.
- 1.6 The plumbing contractor shall carefully examine all contract documents. They shall coordinate their work with all other trades including, but not limited to, the contract documents, shop drawings, etc. For all general construction, structural, mechanical, electrical and specialty contractor work.
- 1.7 Drawings are diagrammatic and schematic in nature, and indicate the type, size, arrangement and location of materials and equipment. Work includes certain components, appurtenances and related specialties that may not be shown. Plumbing contractor shall provide all necessary items to complete the work according to industry standards. It is the intent of the drawings and specifications to call out for finished work, tested and ready for operation. Do not scale drawings. Arrangement of equipment and routing of pipes and ductwork, etc. Indicated on drawings shall be routed plumb and at right angles to building construction and may require modification due to unforeseen conditions and require on site revisions during construction.

- 1.8 All work required for identical items shown on the drawings shall be provided, although each specific identical item may not be shown in detail.
- 1.9 All substitutions shall be submitted to the engineer for consideration prior to bidding. The owner's representative shall preapprove any proposed substitution in writing. The plumbing contractor shall be responsible for coordinating all requirements associated with substituted equipment or materials with other building trades, including all electrical, structural, or architectural elements. The plumbing contractor shall identify and annotate all revised requirements on the drawings.
- 1.10 All design parameters shall be as listed on plumbing drawings.
- 1.11 Upon completion of construction, the plumbing contractor shall supply the owner with as-built documents as required by section 5.4 of Appendix 5 of the Owner's Technical Appendices.
- 1.12 All materials and workmanship shall be guaranteed as specified by the project documents.
- 1.13 Plumbing Contractor shall check and verify all sizes, dimensions, and conditions before starting any work. Any deviations or problems shall be transmitted to the engineer for review.
- 1.14 Motor starters and disconnects to be furnished by electrical contractor. Electrical contractor to install the aforementioned items and furnish all power wiring. All low voltage control and interlocking wiring shall be furnished and installed by controls contractor.
- 1.15 All work shown is new unless noted otherwise.
- 1.16 Maintain occupancy and fire wall separation integrity as required. Refer to architectural plans for locations of all occupancy/firewall separations and specific details for construction. Provide all necessary fire and fire smoke dampers, duct access doors, caulking, etc. For approved installation.

PART 2 - PRODUCTS

- 2.1 PIPING
 - A. Piping materials shall be as specified or scheduled on design drawings and installed using industry standards and manufacturer's recommendations.
 - B. Pipe insulation shall be as scheduled on plumbing drawings and installed per manufacturer's recommendations.
 - C. Condensate drain piping materials shall be as specified or scheduled on mechanical design drawings and installed using industry standards and manufacturer's recommendations.

2.2 PLUMBING EQUIPMENT

- A. Provide plumbing equipment as specified and/or scheduled in plumbing drawings and in accordance with manufacturer's published installation instructions. Equipment shall operate according to the manufacturer's "owner's operating and maintenance manual" conforming to the project warrantee requirements.
- B. AIR COMPRESSOR PACKAGED SYSTEM - ROTARY SCREW
 - 1. AC-1 Packaged system.
 - a. Air Compressor(s): Single-stage, oil-free, rotary-screw type with nonlubricated helical screws and lubricated gearbox, and of construction that prohibits oil from entering compression chamber.
 - b. Cooling/lubrication system. The compressor unit shall incorporate two fans. One will be installed on the lubricant cooler and the second independent fan on the aftercooler. The fans shall draw air through the coolers and discharge the air vertically to maximize heat transfer across the coolers and reduce noise.
 - 1) Oil Cooler
 - a) The compressor unit shall incorporate a VFD controlled fan on the lubricant cooler to maintain a consistent lubricant temperature in all operating environments.
 - 2) After-Cooler
 - a) The aftercooler core section shall have a fixed speed fan.
 - c. Air filter.
 - 1) The air inlet filter/silencer shall be heavy-duty, dry type and shall have a service indicator based on differential pressure switch. Air filter service indication solely based on time is strictly prohibited.
 - d. Air/coolant receiver and separation system.
 - 1) The unit shall be equipped with a combination air receiver/lubricant separator assembly which carries an ASME stamp and national board number. It shall incorporate a means of observing the lubricant level while the compressor is operating, an ASME code safety valve of adequate size and a pressure gage. The separator will incorporate multiple stages of separation including a tangential inlet and skirt for initial separation and a single lubricant separator element to limit to 2PPM/W, lubricant consumption. The elements should be designed for 8000-hour minimum life under normal operating conditions.
 - e. Air Inlet Filter/Silencer

- 1) The air inlet filter/silencer shall be heavy-duty, dry type and shall have a service indicator based on differential pressure switch. Air filter service indication solely based on time is strictly prohibited.

f. Lubricant Circuit, Filter and Change Intervals

- 1) The lubricant filter shall have a 12 micron rating (maximum) and be of a full flow type having a bypass valve to assure lubricant flow. It shall have spin-on cartridge elements capable of at least 1000-hour operation between changes. Lubricant change intervals shall be 8000 hours under normal operating conditions. The entire lubricant circuit shall incorporate hard tubing or stainless-braided hoses, o-rings and SAE threads to minimize leaks. The use of hoses in the hydraulic circuit that are not stainless steel braided is not acceptable. NPT threads are not acceptable on any line larger than 1/2".
- 2) The compressor will include a minimum pressure check valve in the package.
- 3) Use of any electrically controlled stop valves or check valves in the oil flow circuit (which provide a stoppage of flow) are strictly prohibited.

g. Sound attenuation enclosure.

- 1) Each air compressor will be equipped with a sound reducing enclosure to limit sound to 85 dB maximum. The sound enclosure is ventilated by the compressor cooling fan(s) and exhausts vertically.

h. Electrical

- 1) CSA/US listed panel and UL listed components shall be used. Use of unlisted electrical components is prohibited. An E-stop button must be provided for immediate shutdown of compressor.

i. Controls

- 1) The compressor package will have the ability to operate in load/unload and in Low Unloaded Horsepower (LUHP). LUHP allows the user to set the unload point of the compressor based upon the ratio of the demand of the system to the compressor's capacity (percentage capacity). The unloading setpoint can be tuned to minimize compressor cycling and maximize power savings considering the system's available storage. A time delay shutdown feature will automatically turn the compressor off when operating unloaded for a user adjustable amount of time and will restart on demand.
- 2) Compressors which turn on and off the main motor without unloading will be prohibited.

C. AC-2 RECIPROCATING PISTON AIR COMPRESSOR

1. Splash-lubricated two-stage compressor with integral receiver tank.

D. COMPRESSED AIR DRYERS – DESICCANT

- a. Twin-tower unit with purge system, mufflers, and capability to deliver -40 deg F 150 psig air at dew point. Include dew point controlled purge, step-down transformers, disconnect switches, inlet and outlet pressure gauges, thermometers, automatic controls, and filters.

E. COMMERCIAL ELECTRIC STORAGE DOMESTIC WATER HEATERS

1. EWH-1

- a. Standard: UL 1453.
- b. Storage-Tank Construction: [Non-]ASME-code, steel [horizontal] [vertical] arrangement.
- c. Pressure Rating: 150 psig.
- d. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
- e. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Drain Valve: Corrosion-resistant metal with hose-end connection.
 - 3) Insulation: Comply with ASHRAE/IES 90.1.
 - 4) Jacket: Steel with enameled finish or high-impact composite material.
 - 5) Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - 8) Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- f.

2.3 PLUMBING PRODUCTS

- A. Domestic water piping materials shall be as specified or scheduled on plumbing design drawings and installed using industry standards and manufacturer's recommendations.
- B. Domestic waste & vent piping materials shall be as specified or scheduled on plumbing design drawings and installed using industry standards and manufacturer's recommendations.

- C. Pipe insulation shall be as scheduled on plumbing drawings and installed per manufacturer's recommendations.
- D. Heat trace: ray chem, xl-trace system (or equal), installed per manufacturer's recommendations.

2.4 ELECTRIC MOTORS

- A. All electric motor driven equipment shall be selected as non-overloading.
- B. All motors driven by variable frequency drives shall contain the following:
 - 1. < 25hp shall be equipped with a shaft grounding device.
 - 2. 25 hp and larger shall be equipped with insulated motor bearings or be an electrostatic shielded induction motor.

2.5 TEST AND BALANCE REPORT (TAB)

- A. Balance all ducts, diffusers, and grilles to obtain the air quantities as shown on plans. Test and balance work shall be performed by a certified AABC or NEBB contractor.
- B. The Test and Air Balance (TAB) report shall be provided in accordance with Appendix 7E (Commissioning Plan) of the Owner's Technical Appendices.

2.6 NOTES

- A. Dielectric fittings shall be used wherever dissimilar metals are joined.
- B. Unless noted otherwise, general contractor to provide access panels in ceilings and walls necessary to access equipment, volume dampers, valves, etc.. Where required. Min access door shall be 18"x18".
- C. Fire and fire smoke dampers shall meet UL 555 and UL 555s and fire dampers shall have blades out of air stream in open position.
- D. Plumbing fixtures: provide chrome plated angle stops with escutcheon plates at plumbing fixtures. All plumbing fixtures shall comply with local regulations and adopted water conservation codes.
- E. When required, disinfect all potable water systems in accordance with all local jurisdictional requirements, codes, plumbing code and/or, AWWA standard. Provide written confirmation to owner's representative that this work has been completed.

PART 3 - EXECUTION

- 3.1 Install the work in accordance with Owner's Technical Appendices, specifications, Drawings, and manufacturer's instructions. Where these conflict, the more stringent requirements govern.

- 3.2 The contractor shall provide all sleeves, openings, necessary for the installation of the work. Cutting and patching shall be done by general contractor utilizing workmen skilled in the trades required.
- 3.3 The plumbing contractor shall provide handling of materials and equipment, and the necessary protection for materials and equipment as defined in the plumbing scope of work.
- 3.4 The plumbing contractor will protect their work and material against dirt, damage, or injury until accepted by Project Company. All work shall be turned over clean and in like new condition.
- 3.5 Pipes and/or conduits passing through wall, floors and partitions shall be provided with sleeves. Sleeves passing through water proofing or damp proofing shall be water tight. Sleeves passing through fire rated construction shall be fire proofed with material approved for the fire rating of the separation area and U.L. listed.
- 3.6 Each contractor shall provide all hangers, and supports for all equipment supplied and/or installed under their scope of work. Equipment shall be provided with vibration isolation and flexible connections to piping and or ductwork if defined as a project requirement.
- 3.7 Where pipes or conduits pass through walls, floors, or ceilings in finished areas, they shall be furnished with escutcheon plates (color per architect and/or interior designer).
- 3.8 At the conclusion of the job, each piece of equipment, valve, switch, starter, panel, pipeline, conduit, duct, etc., shall be clearly identified whether exposed or concealed, covered or uncovered, in accordance with OSHA and ANSI regulations. Identify pipes near each valve with "Brandy-Perma" code pipe tape" or t. & b. Westline "Tel-a-Pipe" indicating direction of flow, service, zone, and size. Tape shall be applied to pipe, conduit, or covering. Valves, controls, and dampers shall be identified by 2-inch lacquered brass tags with stamped letters fastened with "s" hooks or chains. Equipment is to be identified as to function and purpose by means of permanently attached laminated engraved phenolic nameplates with beveled edges, and white letters on black background. (no adhesive labels allowed).
- 3.9 At the conclusion of the work, all equipment and systems shall be balanced, adjusted, and tested to provide a quiet-operating, stable, and safely operating system(s). Demonstrate operation of all systems to the owner's designated representative. The test and balance work shall be performed in accordance with NEBB or AABC standards, by independent, approved, and certified test and balance personnel.
- 3.10 The plumbing contractor is responsible for retaining and paying for the design services of a structural engineer to create the design and installation drawings for plumbing systems seismic restraint support, per the project's applicable building code. Prior to construction, the plumbing contractor shall submit plumbing systems shop drawings based upon multi discipline coordination. Included with the shop drawing submission shall be seismic restraint drawings noting where seismic support is required. For each area noted needing seismic support for the plumbing systems, there shall be a seismic drawing detailing the required support. The seismic support drawings shall be signed and sealed by a registered structural engineer in the same state as the project. Building structural engineer of record is responsible for reviewing and approving any attachment to the building structure. In addition to the project design team review, the seismic support drawings will be issued to the local building department for review as part of a deferred submittal for the building documents.

- 3.11 Water proofing and flashing of pipe penetrations through exterior wall and roof shall be in accordance with design documents. Plumbing contractor shall coordinate locations and methods with general contractor prior to construction of roof deck.
- 3.12 Plumbing contractor shall coordinate with the architect the exact location of equipment, plumbing fixtures, floor drains and any other apparatus specified in these drawings.
- 3.13 Provide clean outs in sanitary, waste and drain lines as shown and as required by local code. All cleanouts shall be readily accessible.
- 3.14 Provide pressure reducing valve in system as required.
- 3.15 Provide a non-vented trap on all indirect waste piping five (5) to fifteen (15) feet in developed length. Indirect waste piping with angles and changes of direction shall be provided with cleanouts.

End of Section 23 0000

SECTION 23 0000 – BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

- 1.1 Project mechanical scope are intended for design/build and installation by MacDonald-Miller Facility Solutions. Installation by any other contractor will be at the responsibility of said contractor. MacDonald-Miller Facility Solutions shall be held harmless from work performed by any other mechanical contractor and shall not be responsible for unresolved or missing information.
- 1.2 Any further reference to mechanical contractor within this document shall be implied to mean MacDonald-Miller Facility Solutions.
- 1.3 The mechanical contractor shall provide the work shown on the drawings and specified for their individual sections of work.
- 1.4 The word “provide” shall mean furnish and install, make all final connections, and leave in an approved complete operating condition.
- 1.5 All work shall be done in accordance with the editions adopted at time of Permitting of the applicable building codes, Washington State Mechanical Code (WSMC), Uniform Plumbing Code (UPC) with Washington State Amendments, National Electric Codes (NEC) and all other applicable Federal, State, and local regulations.
- 1.6 The mechanical contractor shall carefully examine all contract documents. They shall coordinate their work with all other trades including, but not limited to, the contract documents, shop drawings, etc. For all general construction, structural, mechanical, electrical and specialty contractor work.
- 1.7 Drawings are diagrammatic and schematic in nature, and indicate the type, size, arrangement and location of materials and equipment. Work includes certain components, appurtenances and related specialties that may not be shown. Mechanical contractor shall provide all necessary items to complete the work according to industry standards. It is the intent of the drawings and specifications to call out for finished work, tested and ready for operation. Do not scale drawings. Arrangement of equipment and routing of pipes and ductwork, etc. Indicated on drawings shall be routed plumb and at right angles to building construction and may require modification due to unforeseen conditions and require on site revisions during construction.

- 1.8 All work required for identical items shown on the drawings shall be provided, although each specific identical item may not be shown in detail.
- 1.9 All substitutions shall be submitted to the engineer for consideration prior to bidding. The owner's representative shall preapprove any proposed substitution in writing. The mechanical contractor shall be responsible for coordinating all requirements associated with substituted equipment or materials with other building trades, including all electrical, structural, or architectural elements. The mechanical contractor shall identify and annotate all revised requirements on the drawings.
- 1.10 All design parameters shall be as listed on mechanical drawings.
- 1.11 Upon completion of construction, the mechanical contractor shall supply the owner with as-built documents as required by section 5.4 of Appendix 5 of the Owner's Technical Appendices.
- 1.12 All materials and workmanship shall be guaranteed as specified by the project documents.
- 1.13 Mechanical Contractor shall check and verify all sizes, dimensions, and conditions before starting any work. Any deviations or problems shall be transmitted to the engineer for review.
- 1.14 Motor starters and disconnects to be furnished by electrical contractor. Electrical contractor to install the aforementioned items and furnish all power wiring. All low voltage control and interlocking wiring shall be furnished and installed by controls contractor.
- 1.15 All work shown is new unless noted otherwise.
- 1.16 Maintain occupancy and fire wall separation integrity as required. Refer to architectural plans for locations of all occupancy/firewall separations and specific details for construction. Provide all necessary fire and fire smoke dampers, duct access doors, caulking, etc. For approved installation.
- 1.17 Shaft walls constructed to support air movement for stair pressurization systems shall be constructed to the following standards by the General Contractor:
 - A. Shafts (rated for maximum 2" wc) shall be constructed to withstand 15 psf loading with a deflection of 1/360 (uno).
 - B. Shafts shall be sealed substantially air-tight using the criteria from the international building code:
 - 1. Section 715.6 fire resistant joint systems in smoke barriers: leakage shall not exceed 5 cfm per linear foot of joint at 0.3" wc.

2. Section 909.5 smoke barrier construction for interior exit stairways and exit passageways: maximum allowable leakage area per shaft shall not exceed (0.00035 sf) (gross shaft wall area).
3. Stair and elevator pressurization shafts shall be pressure tested during commissioning. General Contractor shall make modifications to installation until shafts are in compliance.

PART 2 - PRODUCTS

2.1 HVAC EQUIPMENT

- A. Provide HVAC equipment as specified and/or scheduled in mechanical drawings and in accordance with manufacturer's published installation instructions. Equipment shall operate according to the manufacturer's "Owner's Operating and Maintenance Manual" prior to starting test and balance (tab) work.

2.2 DUCTWORK

- A. Ductwork shall meet all local code requirements as well as current SMACNA and industry standards.
- B. Provide manual volume dampers with locking quadrants and identifying ribbons at damper handles for air balancing each branch duct take-off or piece of air distribution equipment.
- C. Seal all duct penetrations through walls, floor and roof in accordance with design documents. Seal all transverse duct seams with approved mastic. Duct tapes shall not be allowed for rigid ductwork. Supply and return ductwork shall be insulated as described on mechanical drawings and in accordance with local codes.
- D. All ductwork size annotations represent the actual outside dimensions of the sheet metal. This does not account for any insulation on the interior or exterior of the ductwork. When determining actual duct free area, interior insulation will need to be accounted for.
- E. Flexible ductwork where indicated on the drawings shall be insulated, with plastic vapor barrier at interior and exterior, steel wire coil reinforced. Joints shall be band-clamped and tape sealed to maintain integrity of vapor barrier. Flexible installation shall be supported to eliminate sags. Flexible glass fiber insulation shall have a maximum 0.23 k value at 75 °F.
- F. Duct detectors shall be furnished by others and installed by mechanical contractor as documented on all relevant trade's permit documents to meet all applicable code and project requirements.

2.3 PIPING

- A. Piping materials shall be as specified or scheduled on design drawings and installed using industry standards and manufacturer's recommendations.

- B. Pipe insulation shall be as scheduled on mechanical drawings and installed per manufacturer's recommendations.
- C. Condensate drain piping materials shall be as specified or scheduled on mechanical design drawings and installed using industry standards and manufacturer's recommendations.

2.4 ELECTRIC MOTORS

- A. All electric motor driven equipment shall be selected as non-overloading.
- B. All motors driven by variable frequency drives shall contain the following:
 - 1. < 25hp shall be equipped with a shaft grounding device.
 - 2. 25 hp and larger shall be equipped with insulated motor bearings or be an electrostatic shielded induction motor.

2.5 TEST AND BALANCE REPORT (TAB)

- A. Balance all ducts, diffusers, and grilles to obtain the air quantities as shown on plans. Test and balance work shall be performed by a certified AABC or NEBB contractor.
- B. The Test and Air Balance (TAB) report shall be provided in accordance with Appendix 7E (Commissioning Plan) of the Owner's Technical Appendices.

2.6 NOTES

- A. Dielectric fittings shall be used wherever dissimilar metals are joined.
- B. Unless noted otherwise, general contractor to provide access panels in ceilings and walls necessary to access equipment, volume dampers, valves, etc.. Where required. Min access door shall be 18"x18".

PART 3 - EXECUTION

- 3.1 Install the work in accordance with Owner's Technical Appendices, specifications, Drawings, and manufacturer's instructions. Where these conflict, the more stringent requirements govern.
- 3.2 The contractor shall provide all sleeves, openings, necessary for the installation of the work. Cutting and patching shall be done by general contractor utilizing workmen skilled in the trades required.
- 3.3 The mechanical contractor shall provide handling of materials and equipment, and the necessary protection for materials and equipment as defined in mechanical scope of work.
- 3.4 The mechanical contractor will protect their work and material against dirt, damage, or injury until accepted by Project Company. All work shall be turned over clean and in like new condition.

- 3.5 Pipes and/or conduits passing through wall, floors and partitions shall be provided with sleeves. Sleeves passing through water proofing or damp proofing shall be water tight. Sleeves passing through fire rated construction shall be fire proofed with material approved for the fire rating of the separation area and U.L. listed.
- 3.6 Each contractor shall provide all hangers, and supports for all equipment supplied and/or installed under their scope of work. Equipment shall be provided with vibration isolation and flexible connections to piping and or ductwork if defined as a project requirement.
- 3.7 Where pipes or conduits pass through walls, floors, or ceilings in finished areas, they shall be furnished with escutcheon plates (color per architect and/or interior designer).
- 3.8 At the conclusion of the job, each piece of equipment, valve, switch, starter, panel, pipeline, conduit, duct, etc., shall be clearly identified whether exposed or concealed, covered or uncovered, in accordance with OSHA and ANSI regulations. Identify pipes near each valve with "Brandy-Perma' code pipe tape" or t. & b. Westline "Tel-a-Pipe" indicating direction of flow, service, zone, and size. Tape shall be applied to pipe, conduit, or covering. Valves, controls, and dampers shall be identified by 2-inch lacquered brass tags with stamped letters fastened with "s" hooks or chains. Equipment is to be identified as to function and purpose by means of permanently attached laminated engraved phenolic nameplates with beveled edges, and white letters on black background. (no adhesive labels allowed).
- 3.9 At the conclusion of the work, all equipment and systems shall be balanced, adjusted, and tested to provide a quiet-operating, stable, and safely operating system(s). Demonstrate operation of all systems to the owner's designated representative. The test and balance work shall be performed in accordance with NEBB or AABC standards, by independent, approved, and certified test and balance personnel.
- 3.10 The mechanical contractor is responsible for retaining and paying for the design services of a structural engineer to create the design and installation drawings for mechanical systems seismic restraint support, per the project's applicable building code. Prior to construction, the mechanical contractor shall submit mechanical systems shop drawings based upon multi discipline coordination. Included with the shop drawing submission shall be seismic restraint drawings noting where seismic support is required. For each area noted needing seismic support for the mechanical systems, there shall be a seismic drawing detailing the required support. The seismic support drawings shall be signed and sealed by a registered structural engineer in the same state as the project. Building structural engineer of record is responsible for reviewing and approving any attachment to the building structure. In addition to the project design team review, the seismic support drawings will be issued to the local building department for review as part of a deferred submittal for the building documents.
- 3.11 Mechanical contractor shall refer to the architectural reflected ceiling plan for exact location of grilles, registers and diffusers and point out any unresolved discrepancies to the architect.
- 3.12 Water proofing and flashing of pipe penetrations through exterior wall and roof shall be in accordance with design documents. Mechanical contractor shall coordinate locations and methods with general contractor prior to construction of roof deck.

End of Section 23 0000

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 specification sections apply to this section.

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
 - 1. International Electrical Testing Association (NETA) ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, Latest Edition.

1.03 RELATED SECTIONS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables
- B. Section 260526 - Grounding and Bonding
- C. Section 260573 - Overcurrent Protective Device Coordination Study
- D. Section 260800 - Commissioning of Electrical Systems
- E. Section 260943 - Network Lighting Controls
- F. Section 262200 - Low-Voltage Transformers
- G. Section 262413 - Switchboards
- H. Section 262416 - Panelboards
- I. Section 262726 - Wiring Devices
- J. Section 262816 - Enclosed Switches and Circuit Breakers
- K. Section 262913 - Enclosed Controllers
- L. Section 263213 - Engine Generators
- M. Section 263600 - Transfer Switches
- N. Division 27 - Communications
- O. Division 28 - Electric Safety and Security

1.04 SUMMARY

- A. Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph entitled "Maintenance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment.
- B. Perform all equipment and device testing after installation and prior to substantial completion or owner occupancy, allowing enough time for corrective action of all deficiencies.
- C. Review manufacturer's installation instruction and confirm that equipment is installed in accordance with manufacturer's instructions.
- D. Prior to performing tests confirm that the equipment is clean and free of construction debris and dust.

1.05 SUBMITTALS

- A. Submit the following for review:
 - 1. Name and qualifications of organization. Organization shall have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA MTS.
 - 2. Name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 3years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.06 QUALITY ASSURANCE

- A. Test Equipment: The testing firm shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA ATS. Provide a complete list of test equipment utilized in all of the testing. Include manufacturer, model number, current calibration date, next calibration date and age of equipment.
- B. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute in Engineering Technologies with a minimum of five years of experience testing, calibrating electrical distribution and generation equipment, systems, and devices.

1.07 CLOSEOUT

- A. Testing Performed by an Independent Testing Company.
 - 1. Include certified copies of inspection reports and test reports in the O&M manual. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record.
 - 2. The testing company shall install test stamps or stickers on all tested equipment. Indicate testing company name, testing date and expiration date.
- B. Testing Performed by the Division 26 Contractor: Submit a letter listing the equipment/systems tested and a certification stating that all testing has been completed per NETA ATS. Include certification letter in the O&M Manual.
- C. Testing Performed by the Equipment Supplier: Include a copy of the equipment Suppliers test report for each system in the O&M Manual.

PART 2 PRODUCTS

2.01 TESTING COMPANY

- A. Retain the services of an independent testing company that is qualified to test electrical equipment and is a state approved testing company.
- B. The testing company shall perform acceptance tests and inspections for all equipment listed in Paragraph 3.1A. Test methods, procedures, and test values shall be performed and evaluated in accordance with NFPA 70B, NETA ATS, the manufacturer's recommendations, and as required by each applicable specification section. Equipment shall be placed in service only after completion of required tests and evaluation of the test results has been completed.

2.02 TEST EQUIPMENT

- A. The testing firm shall provide all apparatus and material required for testing. The testing firm shall use installation tools and test equipment which are designed for the specific task and shall use this equipment per the manufacturer's instructions. All test equipment shall have current calibration certification by a third-party calibration laboratory and shall have a signed and dated calibration sticker affixed to the device. Calibration shall be traceable to the National Bureau of Standards and be less than 6 months since last calibration. Defective test equipment and installation tools shall not be used. Installation tools such as torque wrenches shall be calibration certified.

PART 3 EXECUTION

3.01 ACCEPTANCE TESTS AND INSPECTIONS

- A. The following testing shall be performed by the Independent Testing Company:
 - 1. Grounding and Bonding for Electrical Systems
 - 2. Overcurrent Protective Device and Coordination Study
 - 3. Switchboards
 - 4. Low-Voltage Transformers
 - 5. Panelboards
 - 6. Enclosed Switches and Circuit Breakers
 - 7. Enclosed Controllers
- B. The following testing shall be performed by the Division 26 Contractor:
 - 1. Low-Voltage Electrical Power and Conductors and Cables
 - 2. Wiring Devices
- C. The following testing shall be performed by the equipment supplier:
 - 1. Lighting Controls
 - 2. Engine Generator
 - 3. Automatic Transfer Switches
 - 4. Each Communications System specified in Division 27.
 - 5. Each Electronic Safety and Security System as specified in Division 28.

3.02 SCHEDULE

- A. Perform all testing after installation and before energizing. All primary systems shall pass tests prior to placing them in service. Notify Engineer and Owner's representative 10 working days prior to performance of any test.
- B. Insert a copy of each test report in the operation and maintenance manuals.

3.03 LABELS

- A. Upon completion of the tests, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the testing company.

3.04 FINAL ACCEPTANCE

- A. Final acceptance is contingent upon satisfactory completion of acceptance tests and inspections.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. The work under this division includes furnishing all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all electrical work for this project as shown on the electrical drawings specified herein.
- B. Related Work Described Elsewhere: Where other divisions require electrical materials or installations, comply with all applicable requirements herein. Provide all electrical materials and installation work required to connect, test and operate equipment required by other divisions. Electrical installations required by other divisions but not shown on the electrical drawings shall be provided.
- C. Warranty: The Contractor shall guarantee all work installed under this specification and make good, repair or replace at his own expense any defective work, materials or parts. Incandescent lamps are not warranted but all shall be operating at time of final acceptance.

1.03 REGULATIONS

- A. Codes and Ordinances: Comply with all applicable codes, ordinances and regulations including the National Electrical Code, the Washington Administrative Code, National Electrical Safety Code, WISHA, NFPA and all other national, state and local codes and ordinances. Notify the Engineer of any noncompliance in contract documents to applicable codes and regulations prior to installation of the work. Changes in the work after initial installation due to requirements of code enforcing agencies shall be at no additional cost to the Owner.
- B. Permits: Provide and pay for all permits and fees required for this project. In addition to paying for all permits and fees, the Contractor shall be responsible for contacting the various Approving Authorities, arranging for review of shop drawings where appropriate, scheduling inspections in a timely manner, and making necessary corrections as required by the Approving Authorities.
- C. Approving Authority: It is the Contractor's responsibility to ascertain and contact the appropriate "Approving Authorities" for this project. Approving Authorities will include, but not be limited to the electrical inspector and the Fire Marshal having jurisdiction.
- D. Certificate of Inspection: Obtain a Certificate of Electrical Inspection indicating final acceptance from the local inspecting authority.
- E. Safety Measures To Be Taken: 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 solely and completely responsible for conditions of the job site, 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 Engineer 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.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Intent: The electrical drawings and specifications are intended to include all labor and materials necessary to provide a complete operating facility. Any materials shown and called for on the drawings but not mentioned in the specifications, or vice versa, which are necessary for the proper completion of the installation or operation of the equipment, shall be furnished the same as if

specifically called for in both. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the contract documents, existing site conditions, and has determined that these documents and conditions do sufficiently describe the scope of construction work required under this contract. Any questions regarding interpretation of the contract documents shall be made in writing in a timely manner prior to the bid date to allow reasonable time for resolution of the questions.

- B. Diagrammatic Drawings: The electrical drawings are diagrammatic and do not show exact or complete raceway and wiring configurations, routing, rating or the necessary number and types of raceway fittings or pull boxes. Provide all labor and materials required to execute the work.

1.05 SUBMITTALS AND SHOP DRAWINGS

- A. It is the Contractor's responsibility to thoroughly review vendor-assembled shop drawings, catalog cuts, etc. to ensure that these documents are complete and comply with the specifications.
- B. All submittals and shop drawings must be stamped by the Electrical Contractor and the General Contractor confirming they have been reviewed and comply with the contract documents. Submittals which are not stamped will be returned unreviewed.
- C. Submittal Format:
 - 1. General: The submittals must include all specified material. Multiple submittals will not be accepted.
 - 2. Electronic submittals can be submitted. However, bound hard copies of the distribution equipment (switchboards, transformers, distribution panels and panelboards) and lighting must be provided.
 - 3. Shop Drawings: Only one hard copy shall be provided for review. One electronic copy (PDF) will be returned.
- D. Review: The review of a manufacturer's name or product does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the contract documents. The contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer's review.

1.06 OPERATIONS AND MAINTENANCE MANUALS

- A. Prepare operations and maintenance manuals for all electrical equipment installed on this project.
- B. Provide a table of contents at front of manual indicating general content of each section. Provide an index for each section of the manual with complete equipment catalog item or identification.
- C. The information and diagrams included must be on the specific equipment installed for this project. General "product line" information is not acceptable. The equipment model and catalog numbers with appropriate prefixes and suffixes must be clearly indicated on the data sheets. Manuals shall contain shop drawings, schematic and wiring diagrams (showing all external connections), parts lists, operating and maintenance information. Any modifications to equipment in the field shall be updated on the drawings, diagrams, etc. to reflect the "as-built" conditions.
- D. Bind with three-screw post-type binder with heavy-duty hardboard cover and cloth backing. Imprint the edge of volume with name of the project, year of completion and the words "Electrical Equipment." The front of the manual shall be imprinted with the words "Electrical Equipment," the name of the project, the name of the Owner, year completed, and name of the Architect, Engineer, and Contractor. All printed in gold lettering. If the thickness of the manual exceeds approximately two inches, provide separate volumes, each being a maximum of two inches thick. Each volume shall be imprinted as described above and include the volume number.
- E. Submit 2 CD-ROM copies of the operations and maintenance manual. Disk data is to be in Adobe Acrobat v11.0 or later. Arrange information and materials in the same order and categories as is

typical of printed hard copy O&M manuals as described in this section. Disk PDF file shall include electronic "bookmarks" for each category, specification section and subsection.

- F. One preliminary copy shall be submitted to the Engineer for review 30 days prior to completion of the project. Preliminary copy shall include proposed wording for cover and back edge of the manual. Submit final bound copies for distribution as required in Division 01.

1.07 RECORD DRAWINGS

- A. A record shall be made during the progress of the project indicating the work as actually installed. Corrections and changes shall be always kept up to date on a separate set of record drawings kept at the job site for review. Mark-ups may be schematic as related to interior raceway systems; however, all raceways shall be shown in proper relationship with junction boxes, panelboards, devices, and equipment. Raceways installed below grade shall be shown with both horizontal and vertical dimensions with an accuracy of $\pm$ six inches.
- B. Project Closeout: The Contractor shall provide as-built drawings at completion of the project indicating work as revised, detailed, and installed.
- C. Additional Record Drawings: Refer to Division 27 and 28 sections for additional record drawing requirements. AutoCAD production requirements also apply to all special system drawings.

1.08 DEFINITIONS

- A. Provide: To furnish and install.
- B. Wiring: Raceway, conductors and connections.
- C. Exposed: Visible from occupied areas.
- D. Install: To set in position and make it fully operational.
- E. Furnish: Purchase and deliver to the job site.
- F. Required: As required by code, authority having jurisdiction or contract documents for the system and/or installation to be fully operational.

1.09 COORDINATION

- A. UTILITIES SERVICES
 - 1. It shall be the Contractor's responsibility to contact all utility companies, including but not limited to the power company, telephone company and cable television company, and verify the extent of work to be performed by the utility companies. All other labor and necessary materials, provided by the utility companies shall be provided by the Contractor.
 - 2. Coordination and scheduling new services with the various utility companies is the sole responsibility of the Contractor.
 - 3. In general, the Contractor shall be responsible for providing the following:
 - a. Trenching, backfill and compaction.
 - b. Raceways.
 - c. Manholes and vaults (including grounding).
 - d. Concrete encasement of raceways (where called out on the drawings or specified).
 - e. Obtaining all necessary permits.
 - 4. Service Charges: All utility service charges will be paid by the Owner.
 - 5. Applications for Services: It shall be the contractor's responsibility to complete and submit all required applications for service with the various utility companies.
- B. Work of Other Trades: The electrical drawings do not show complete details of the building construction. Refer to the Architectural, Structural, Civil, Landscape, Mechanical and Kitchen Drawings for details which may affect the execution of this work. Specific locations of construction

features shall be obtained from the reference drawings, field measurements, or the trade providing the material or equipment. No extra payments will be allowed for failure to obtain this information.

- C. The Contractor will not be paid for work requiring reinstallation due to lack of coordination prior to installation such as removing and replacing, relocating, cutting, patching, or finishing. Special attention is called to the following items and all conflicts shall be coordinated prior to installation:
 - 1. Light switches will be located on the "strike" side of the door.
 - 2. All electrical outlets, lighting fixtures and other electrical outlets and equipment are installed to avoid conflict with grilles, pipes, sprinkler heads, ducts, and other mechanical equipment.
 - 3. Electrical outlets, lighting fixtures and equipment are to be installed in proper relation to cabinets, counters, doors, and other architectural appurtenances.
 - 4. Electrical characteristics (HP, kVA, voltage, phase, fusing, overload protection) of actual equipment furnished under other divisions being different from that shown on the electrical drawings.
- D. Provide access panels for electrical items that are behind finished surfaces or otherwise concealed.
- E. Provide all required firestopping for electrical work.

PART 2 PRODUCTS

2.01 STANDARD OF QUALITY

- A. General: Whenever any material or equipment is specified by patent or proprietary name or by the name of the manufacturer, such specification shall establish the minimum standard of quality in that field of manufacture. The engineer shall be the sole and final judge as to quality and acceptability of substitutions, no exceptions.

2.02 PRODUCT LISTING AND LABELING

- A. All electrical equipment shall be Underwriters Laboratories listed and labeled. Equipment in compliance with UL standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory, the necessary inspection and acceptance by the testing facility shall be performed in the field at no additional cost to the Owner, and be acceptable to the Authority Having Jurisdiction.

2.03 ELECTRICAL DISTRIBUTION EQUIPMENT

- A. Scope: Provide the equipment for the various primary and secondary voltage distribution systems including switchgear, service transformer, service switchboards, distribution switchboards, panelboard equipment, motor control centers, dry-type transformers, and all miscellaneous equipment.
- B. Type: The distribution equipment shall provide a quality system with the highest degree of safety, protection, and integrity.
- C. Space for Future Circuit Breakers and Fused Switches: Provide as indicated on drawings; shall be completely equipped for the future addition of a circuit breaker or fused switch, including all connections. Each switchboard or panelboard section shall be fully bussed with spaces available the entire height of the equipment.
- D. Finish: Finish of all distribution equipment and other associated equipment shall match and unless specified otherwise shall be manufacturer's standard light gray.
- E. Phasing:
 - 1. Phase arrangement for all bussing and terminations in switchboards, panelboards, motor starter centers, transformers, etc. shall be as follows when viewed from the front:

Phase A	Front	Left	Top
Phase B	Center	Center	Center

- Phase C Rear Right Bottom
2. Lugs for switchboards, panelboards, transformers and other distribution equipment connections shall be hydraulically set compression lugs.

- F. Manufacturer: The number of manufacturers shall be kept to a minimum to maintain close control and coordinate the various components of the distribution systems. All electrical distribution equipment shall be provided by the same manufacturer. Dimensions are critical. Each manufacturer shall verify that the equipment proposed will fit within the spaces provided with adequate working clearances.

PART 3 EXECUTION

3.01 GENERAL

- A. All materials shall be new, free from defects and arrive at the job site in their original unopened containers.
- B. Comply with NECA 1. Where a conflict exists between NECA 1 and the contract documents, the most restrictive/expense shall govern.

3.02 MATERIAL STORAGE

- A. Make all necessary provisions for storing materials and equipment at the site to insure the quality and fitness of the items to be incorporated in the work. Equipment shall be stored to prevent damage and corrosion.

3.03 TEMPORARY ELECTRICAL SERVICES

- A. Construction will occur in numerous phases. Provide design-build temporary electrical services and obtain the required permits to accommodate construction sequencing and phasing.
- B. Refer to the Division 1 Specifications and the Architectural, Civil, Mechanical and Electrical Drawings for Sequencing and Phasing requirements.

3.04 PHASED CONSTRUCTION

- A. Each low-voltage system, including lighting in controls, shall be tested and the equipment programmed at the completion of each phase.
- B. Prior to substantial completion of the entire project, all low-voltage systems, including lighting controls shall be completely retested.
- C. All fluorescent and HID lamps used during the project shall be replaced prior to substantial completion for the entire project.

3.05 INTERRUPTION OF EXISTING ELECTRICAL SERVICE

- 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 providing temporary electrical services.
1. Notify the Owner no fewer than 48 hours in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without the Owner's written permission.

3.06 EXISTING CONDITIONS

- A. General: Specific scope of demolition work and operating conditions to be encountered shall be verified by on-site review prior to submitting bid. Demolition work, in general, is noted or shown on the documents based upon available "drawings of record" and may not show the actual conditions as they presently exist. The Contractor shall be responsible for removing or modifying the existing electrical installation as required by the building alterations. The Contractor shall be responsible for

protection of existing equipment and wiring to be retained or reinstalled and shall replace any equipment damaged during the process of removal and reinstallation.

- B. Owner Retained Equipment: The Owner may wish to retain certain specific items scheduled for demolition. The Contractor shall carefully remove these items, provide protection and packaging as may be required to protect the equipment and turnover said equipment to the Owner at a place designated on the jobsite. Any equipment that the Owner does not desire to retain shall become the property of the Contractor and be removed from the site.
- C. Existing Raceways and Wiring:
 - 1. No existing raceways or wiring shall be reused unless specifically shown on the drawings.
 - 2. Unused Raceways and Wiring: All unused conductors in existing buildings shall be removed. All unused raceway shall be removed except where located in or above existing construction which is not being altered and would require removal and replacement of the existing construction.
 - 3. Continuity of Service To and In Existing Building: The Contractor shall reroute existing raceways, wiring and equipment which is in conflict with building alterations. The Contractor's bid shall include intercepting and relocating existing raceways in ten different locations throughout the project. These locations are in addition to those shown on the drawings. Each location shall be assumed to have four 3/4" EMT raceways that are each 100-lineal feet in length and each containing seven #12 AWG conductors which must be intercepted and relocated.
 - 4. Ceiling Panels: Remove and reinstall all necessary panels in existing accessible ceilings, as required for the installation of electrical work. Where existing ceiling panels are damaged, they shall be replaced with new units. After ceiling removal and reinstallation is complete, the ceiling system appearance shall match adjacent similar ceilings that have not been removed.
 - 5. Work Caused by Removal and Reinstallation of Existing Material: Existing electrical work which is to be removed and reinstalled as a result of the installation of work by other trades shall be performed by the Electrical Contractor at no additional expense to the Owner.
 - 6. Existing fluorescent fixture ballasts to be removed shall be assumed to contain PCBs/Mercury and are to be treated as hazardous materials. Removal and disposal of these fixtures are to comply with all local, state and federal agency requirements. Provide documentation as required by all regulating agencies as proof of proper disposal.
 - 7. Openings in walls and floors resulting from removal of conduits and/or devices are to be patched with materials equivalent to adjacent surfaces. Materials used for patching shall maintain the fire rating of the existing area.
 - 8. Existing raceways and exposed cabling above existing suspended ceilings shall be supported from the building structure.

3.07 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

3.08 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. General:
 - 1. Provide sleeves for all penetrations unless core-drilled holes or formed openings are used.
 - 2. Extend sleeves installed in floors two inches above finished floor level.
 - 3. Size sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
 - 4. Seal space outside of sleeves with grout for penetration of concrete and masonry. Pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

- B. Interior Penetrations of Non-Fire-Rated Walls and Floors: Provide EMT sleeves. Seal space between sleeve and wall or floor, using joint sealant appropriate for size, depth and location of joint.
- C. Fire-Rated Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations.
 - 1. Penetrations at Walls, Partition and Ceilings: Provide STI "EZ Path" assemblies.
 - 2. Floors: Provide EMT sleeves. Seal pathway and cable penetration with firestop materials.
- D. Roof Penetration Sleeves: Provide a four-pound lead-plumbing vent flashing. Provide counter flashing attached above with a stainless-steel draw band clamp.
- E. Aboveground, Exterior-Wall Penetrations: Provide steel pipe sleeves. Select sleeve size to allow for one-inch annular clear space between pipe and seal penetration utilizing mechanical sleeve seals.
- F. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for one-inch annular clear space between raceway or cable and sleeve. Seal penetration utilizing mechanical sleeve seals.

3.09 FIRESTOPPING

- A. Provide firestopping to penetrations of fire-rated floor, wall and ceiling assemblies for electrical installations to restore original fire-resistance rating of the assembly.

3.010 CUTTING AND PATCHING

- A. Provide all required cutting, demolition and patching required for the installation of the electrical work. Penetrations through structural walls, ceiling or floor slabs shall be core drilled. In no case shall structural members be penetrated without prior approval of the structural engineer.

3.011 PAINTING

- A. Touch up electrical equipment with factory-finished surfaces as required using factory-furnished paint. Do not paint screw heads, hinges, nameplates, hardware, etc. All surface-mounted raceways in finished areas shall be painted to match adjacent surfaces.

3.012 CLEANING

- A. Promptly remove waste material and rubbish resulting from electrical work.
- B. Prior to energizing equipment, remove all dirt and debris. Vacuum and wipe down all surfaces.
- C. Clean all equipment and fixtures at completion of the project.

3.013 CONSTRUCTION OBSERVATION AND FINAL ACCEPTANCE

- A. Site Review: On-site meetings or reviews of construction by the Engineer shall not be construed as acceptance by these parties as related to quantities, rough-in locations and compliance with code enforcing authorities.
- B. Testing: The Contractor shall test all wiring and all electrical equipment to verify absence of grounds and short circuits and verify proper operation, rotation, and phase relationship. The contractor will be responsible for scheduling tests and demonstrations at times mutually acceptable to the Owner. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations. Operate every device manually and automatically in accordance with its purpose. Tests shall be performed in the presence of the Owner or his designated representative. All instruments and personnel required to conduct the test shall be provided by the Contractor. Any test not witnessed by the Owner shall be waived by written document. All such documents must become the property of the Owner upon completion of construction.

3.014 INSTRUCTION FOR OWNER'S PERSONNEL

- A. Scope: Following initial operation of all electrical equipment and prior to acceptance of the electrical work, conduct demonstrations of equipment operation and instruction periods for the Owner's representatives.
- B. Instruction Periods: Shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings, followed by tours of equipment spaces explaining maintenance requirements, access methods, servicing and maintenance procedures, settings and available system and equipment adjustments.
- C. Contractor's representatives, in general, who conduct these instructions and demonstrations shall be qualified foremen or superintendents acquainted with this project and from the trade involved. The representative shall be the manufacturer's representative with operating experience and substantial design experience on this project for major equipment. Their qualifications shall be submitted to the Architect and Engineer before conducting the instruction period.
- D. Minimum Duration of Instruction Periods:
 1. Electrical Distribution System: Four hours.
 2. Low-Voltage Systems: Four hours each unless noted otherwise.
 3. Refer to other sections of the specification for additional testing requirements.
- E. Scheduling of Instruction Periods: Provide notice of contractor's readiness to conduct such instruction and demonstration periods to the Owner at least two weeks prior to each instruction period and reach agreement on the date of each instruction period.
- F. Prepare a written statement of acceptance for the Owner's signature. The statement shall be substantially as follows:

"I (the Contractor), the associated factory representatives and the subcontractor, have thoroughly tested each of the following systems and have proved their normal operation to the Owner's representative and have instructed him in the operation and maintenance thereof."

Owner's System	Demonstrator	Representative	Date
Electrical Distribution & Lighting			
Communications Systems			
(List each system specified)			
Safety and Security Systems			
(List each system specified)			

Owner's Representative	Date

Electrical Contractor	Date

- G. Send copies of this acceptance to the Architect and the Engineer and place one copy in each maintenance manual.
- H. Completion of Work: When requesting final inspection, provide ten-day notice. Submit written certifications that the work has been fully completed in strict accordance with the plans and specifications.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. The Contractor shall visit the site and review the existing conditions prior to bid to confirm the general scope of demolition work. Any damage to existing systems to remain resulting from performance of work under this contract shall be repaired at no increase in contract cost. Any existing wiring serving devices to remain in service, and which is interrupted by work performed under this contract shall be rerouted to maintain circuit continuity. The contractor is responsible for maintaining all existing systems except relocation of wiring #2 AWG and above shall be considered an additional cost if not shown on the drawings to be relocated. If such wiring is found the Contractor shall notify Engineer of wiring location and the reason it must be removed.
- B. The drawings show portions of the electrical systems to remain, to be removed or to be modified as part of the Contractor's work. Features of the existing systems are derived from record drawings, and the Engineer's best judgment of the configuration, but no guarantee is made as to their correctness.
- C. All demolition work required under this contract is not shown in the drawings. The Contractor shall remove all electrical equipment in the area being remodeled which is no longer in service presently or because of this contract.
- D. Premium time shall be included in the Base Bid for electrical system outages and for other work as required by the schedule, phasing and as shown in the drawings and as noted in other Divisions of the specifications.
- E. Should the Contractor assume a salvage value for any existing equipment or materials such as conductors, he shall do so at his own risk. Existing materials to be removed are based on the record drawings and have not been verified.

1.03 TEMPORARY SERVICES

- A. The Contractor shall provide design-build temporary line and low voltage services and equipment as required to accommodate project phasing. All systems shall be always operational during construction.
- B. Any information in the construction documents related to temporary work is provided to assist the contractor but does not relieve the contractor of his responsibility to always keep all systems operational during construction.
- C. The contractor shall obtain all required permits for temporary work
- D. All temporary work shall be completely removed at the completion of construction.

1.04 CONFLICTS

- A. When a conflict between existing equipment to remain and new work is identified, the contractor shall notify the Engineer immediately to obtain resolution and direction on how to resolve such conflict.

PART 2 MATERIALS

2.01 GENERAL

- A. Existing materials and equipment removed as part of this work may not be reinstalled unless specifically noted on the drawings.

- B. Some existing materials may be directed by the Owner to be salvaged. Contractor to coordinate with Owner prior to demolition work.
- C. The Contractor may reuse existing raceway systems if no other systems occupy the raceway system and if raceways and enclosures are electrically and mechanically continuous and new wiring is provided. Provide new raceway support systems for all existing reused raceways above suspended ceilings, which were supported by the existing ceiling or ceiling supports.

PART 3 EXECUTION

3.01 DEMOLITION

- A. Areas of demolition are outlined in the drawings. Electrical devices and associated wiring located within the demolition area but not shown to be reused shall be removed.
- B. Prior to demolition work, trace out and identify each branch circuit and feeder using an electronic circuit tracer.
- C. Where "all electrical Systems" are noted to be removed from an area all equipment, devices, luminaires and associated raceways and wiring shall be removed.
- D. Provide raceways and wiring as required to maintain circuit continuity when existing equipment, device, luminaires are removed.
- E. Provide raceway, equipment and cabling as required to maintain low voltage systems in operation where existing devices are removed.
- F. The Contractor shall update the switchboard, distribution panel and disconnect labels to reflect the loads that are removed.
- G. The Contractor shall post updated circuit directories in all panels to reflect loads that are removed.

3.02 POWER OUTAGES

- A. Schedule electrical system outages with the Owner. Refer to Section 260500, Common Work Results.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cerro Wire
 - 2. CME Wire and Cable
 - 3. Encore Wire Corp.
 - 4. Republic Wire
 - 5. Southwire/General Cable
- B. Conductors: Stranded copper.
- C. Conductor Insulation: Type THHN-THWN.

2.02 MULTICONDUCTOR ARMORED CABLE (MC)

- A. NFPA 70, Type MC with copper conductors, Type TFN/THHN conductor insulation and copper sheath drain wire.

2.03 FIRE-RATED CABLE

- A. NFPA 70, Type MI (Mineral Insulated) with copper conductors, copper sheath, two-hour fire-resistive rating, UL listed.

2.04 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. O-Z/Gedney
 - 2. 3M
 - 3. Tyco
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Stranded copper.
- B. Branch Circuits: Stranded copper.

3.02 CONDUCTOR INSULATION AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN single conductors in raceway.
- B. Feeders: Type THHN-THWN single conductors in raceway.
- C. Branch Circuits: Type THHN-THWN single conductors in raceway.
- D. Fire Pump and Control Wiring Installed within Buildings: Two-hour, fire-rated cable.

- E. Minimum Conductor Size:
 - 1. Neutral: #10 AWG (#12 AWG minimum for dedicated neutrals and lighting circuits).
 - 2. Ground: #12 AWG.
 - 3. Phase Conductors (more than six in a raceway): #10 AWG.
 - 4. Phase Conductors (six or less in a raceway): #12 AWG.
 - 5. Branch Circuit Homeruns (longer than 75 feet): #10 AWG.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.
- G. Class 1 Control Circuits: Type THHN-THWN in raceway.
- H. Class 2 Control Circuits: Type THHN-THWN in raceway.
- I. Multiconductor Armored Cable (MC): Provide only where specifically called out on the drawings.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Wiring from separate systems shall not be intermixed in a common junction box.
- C. Wiring shown in separate raceways shall not be combined.
- D. Feeders: Make no splices unless shown on the plans.
- E. Branch Circuits: Homeruns longer than 75 feet to the first outlet shall be #10 AWG minimum for the entire length of the circuit. Make no splices in homeruns.

3.04 CONNECTIONS

- A. General: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Feeder Splices: Make splices with hydraulically set long barrel connections insulated with heat shrink tubing.
- C. Lighting and Receptacle Branch Circuit Splices: Insulated screw-on type connectors.
- D. Wiring at Outlets: Install conductor at each outlet with at least six inches of slack.
- E. Below-Grade Splices: Make splices in handholes and insulate with epoxy resin-type splicing kits. 3M or equal.
- F. Termination at Busses (Panel, Switchboard, Transformers, ATS, etc.): Hydraulically set compression lugs.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. Telecommunications Room: MDF (MER) or IDF (TR or TC)

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

PART 2 PRODUCTS

2.01 CONDUCTORS

- A. Insulated Conductors: Stranded copper wire or cable insulated for 600 volts.
- B. Bare Copper Conductors: Stranded copper wire or cable.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 x 2 x 12" in cross section unless otherwise indicated; with insulators.

2.02 CONNECTORS

- A. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type with at least two bolts.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad, 3/4 inch by 10 feet.

PART 3 EXECUTION

3.01 APPLICATIONS

- A. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection with alternating bands of green and yellow tape using at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telecommunications equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on one inch (minimum) insulated spacers six inches above finished floor, unless otherwise indicated.
 - 2. Provide No. 2/0 AWG from each ground bus to building grounding electrode system.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connections.
 - 2. Underground Connections: Exothermic welded connections.
 - 3. Connections to Structural Steel: Exothermic welded connections.
 - 4. Connections to Ground Rods: Exothermic welded connections.

5. Ground Buses: Two-hole long barrel compression lugs.

3.02 BONDING

- A. Insulated grounding bushings shall be installed to bond all feeder conduits to the switchboard ground bus or panel ground bus at both ends of feeder raceways. Insulated grounding bushings shall also be installed in all the feeder pull boxes to bond all conduits together. Jumpers or bonds shall be copper and sized in accordance with Table 250-95 of the National Electrical Code.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Grounding Vaults and Manholes: Install a driven ground rod through vault or manhole floor, close to wall, and set rod depth so four inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from two inches above to six inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- B. Grounding Connections to Vault and Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each vault or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Arrange the conductors to be level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- C. Pad-Mounted Transformers and Switches: Install two ground rods and a ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items by connecting them to the grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury the ground ring not less than six inches from the foundation.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- C. Signal and Communication Equipment: Provide No. 4 AWG minimum insulated grounding conductor in raceway from building grounding electrode system to each ER (MDF), and TR (IDF) Room, and control panel terminal cabinet.
1. MER (MDF) and TR or TC (IDF) Rooms: Terminate grounding conductor on a 1/4 x 2 x 12" grounding bus.
 2. Control Panel Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.05 INSTALLATION

- A. Grounding Conductors: Route along the shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Ground Rods: Drive rods until the tops are two inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. Grounding electrode system: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes and connect to the service grounding electrode conductor.
 - 3. Utilize exothermic welded connections to connect grounding electrode conductor to ground rod.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations to connect grounding electrode conductor to ground rod.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit from building's main service equipment or grounding bus to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector, or by bolting a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart. Install tinned-copper conductor not less than No. 2/0 AWG between ground rods to form a ground ring. Bond columns to ground ring with No. 2/0 AWG and for taps to building steel.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70 using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to the reinforced steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding electrode system.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.03 SUBMITTALS

- A. Product Data: Submit for each of the products provided.

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line
 - b. Thomas & Betts
 - c. Unistrut
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating.
 - 4. Painted Coatings: Manufacturer's standard painted coating.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- D. Mounting, Anchoring and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened Portland cement concrete, steel, or wood with tension, shear and pullout capacities appropriate for supported loads and building materials where used. Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. Hilti
 - b. ITW Ramset/Red Head
 - c. Simpson Strong-Tie
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel for use in hardened Portland cement concrete with tension, shear and pullout capacities appropriate for supported loads and building materials in which used. Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. Cooper B-Line
 - b. Hilti
 - c. ITW Ramset/Red Head

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 Type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 EXECUTION

3.01 APPLICATION

- A. Conduit Crossing Structural Separation: Conduit that crosses structural or seismic separations between building units shall be installed with flexible connections suitable to accommodate longitudinal and transverse displacements. Secure raceways on each side of joint and provide minimum of 36 inches length flexible conduit between building units.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space support for EMT, IMC and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.
- B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. Wood: Fasten with lag screws or through bolts.
 2. New Concrete: Bolt to concrete inserts.
 3. Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. Existing Concrete: Expansion anchor fasteners. In lieu of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete four inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than four inches thick.
 5. Steel: Beam clamps.
 6. Light Steel: Sheet metal screws.
 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers and other devices on slotted-channel racks attached to substrate.
- C. Drill holes for the expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 CONCRETE BASES

- A. Provide four-inch-high concrete pads with chamfered edges for all floor-mounted equipment including switchboards, distribution panels, transformers, motor control centers and unit substations.
- B. Construct concrete bases of dimension indicated but not less than four inches larger in both directions than supported unit, and so anchors will be a minimum of 10-bolt diameters from edge of the base.
- C. Use 3000-psi, 28-day compressive-strength concrete.
- D. Anchor equipment to concrete bases.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing
- B. FMC: Flexible metal conduit
- C. LFMC: Liquidtight flexible metal conduit
- D. RMC: Rigid metal conduit
- E. RNC: Rigid nonmetallic conduit
- F. SMR: Surface Metal Raceway

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable
 - 2. Allied Tube
 - 3. Electri-Flex
- B. Rigid Metal Conduit (RMC):
 - 1. General: Comply with ANSI C80.1.
 - 2. Fittings:
 - a. Couplings: Threaded metallic type of the same material as the conduit.
 - b. Locknuts: Steel up to two inches, malleable iron for 2-1/2 inches and larger.
 - c. Bushings: Bakelite or plastic up to two inches, malleable iron with insulating collar for 2-1/2 inches and larger.
 - d. Unions: Zinc-plated malleable iron, three piece coupling.
 - e. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, including flexible external bonding jumper.
- C. Electrical Metallic Tubing (EMT):
 - 1. General: Comply with ANSI C80.3.
 - 2. Fittings:
 - a. Fittings: Steel, set-screw-type containing dual setscrews on each side of coupling.
 - b. Exterior: UL-Listed, raintight, steel, compression-type with silicon rubber internal sealing rings.
 - c. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- D. Flexible Metallic Conduit (FMC):
 - 1. General: Zinc-coated steel.
 - 2. Fittings: Steel, one- or two-screw clamp type.
- E. Liquid-Tight Flexible Metallic Conduit (LFMC):
 - 1. General: Flexible steel conduit with PVC jacket.
 - 2. Fittings: Galvanized steel, compression type.

2.02 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable
 - 2. Anamet
 - 3. Electri-Flex
 - 4. Carlon
- B. Rigid Nonmetallic Conduit (RNC):
 - 1. General: Comply with NEMA TC 2, Type EPC-40-PVC.
 - 2. Fittings: Comply with NEMA TC 3; same material as the conduit.
 - 3. Expansion Fittings: PVC to match conduit type, complying with UL 651, rated for environmental conditions where installed.

2.03 SURFACE METAL RACEWAYS (SMR)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thomas & Betts
 - 2. Wiremold
- B. Color: Ivory
- C. Single-Channel Raceway: Two-piece raceway with a single compartment and snap cover. Provide raceways with nominal dimensions as follows:
 - 1. Raceway fill shall not exceed 40%.
 - 2. Power Conductors:
 - a. Up to Three #12 AWG Conductors: 21/32" x 3/4".
 - b. Up to Six #12AWG Conductors: 1-9/32" x 3/4".
 - 3. UTP Cables:
 - a. Up to Two Cables: 1-9/32" x 3/4".
 - b. Up to (15) Cables: 2-3/4" x 1-7/16".
 - c. More than 15 Cables: Provide multiple raceways.
 - 4. Other Low-Voltage Cables:
 - a. One Cable: 21/32" x 3/4".
 - b. More Than One Cable: Size raceway for 40% full. Maximum raceway size shall be 2-3/4" x 1-7/16".
- D. Two-Channel Raceway:
 - 1. The raceway fill shall not exceed 40 percent.
 - 2. Provide where shown in the drawings.
 - 3. Raceway: Two-piece raceway with divider and snap cover. Nominal dimensions shall be 4-3/4" x 1-3/4".
 - 4. Device-Mounting Brackets: High-impact plastic bracket with trim plate. Trim plates shall overlap the raceway cover for a seamless transition between cover fittings. Provide insert for each device installed. Provide blank insert where only one device is provided.

2.04 TELECOMMUNICATIONS OUTLET BOXES

- A. Manufacturer: Randl Industries.
- B. Description: 5" square width x 2.875" deep one piece pressed steel, electrogalvanized with cable management. Randl Industries #T-55057.

2.05 BOXES, ENCLOSURES AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds
 - 2. EGS/Appleton Electric
 - 3. Hoffman

4. Hubbell
 5. RACO
 6. Thomas & Betts
 7. Wiremold
- B. Small Sheet Metal Pull and Junction Boxes: Comply with NEMA OS 1.
- C. Hinged-Cover Enclosures: NEMA 250, Type 1, steel, continuous-hinge cover with flush latch, finished inside and out with manufacturer's standard enamel.
- D. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.

2.06 FLOOR BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Systemone (General Purpose)
 2. Brownsfield Manufacturing (Heavy Duty)
- B. General Purpose:
1. Recessed, 4-gang, 16-gauge, galvanized sheet metal floor box with all required accessories to mount the receptacles and low-voltage devices as shown on the drawings.
 2. The floor box shall be listed as follows:
 - a. UL 514A
 - b. UL scrub water compliant
 3. Provide black powder-coated ADA compliant cover as follows:
 - a. Carpet, Tile, VCT or Wood Floors: Surface style cover.
 - b. Tile, Concrete or Terrazzo Floors: Flush style cover.
 4. Provide box with fusion-bonded green epoxy paint for slab on grade installations.
- C. Heavy Duty:
1. Custom manufactured, recessed, heavy-duty, stainless-steel floor box with all required accessories to mount the receptacles and low-voltage devices as shown on the drawings.
 2. The floor box shall be listed as follows:
 - a. UL Listed and Labeled.
 - b. UL scrub water compliant.
 3. Provide H-20 rated, aircraft aluminum, fully-gasketed cover as follows:
 - a. Carpet, Tile and VCT Floors: Provide recess in cover to accommodate the floor covering in the room.
 - b. Tile, Concrete and Terrazzo Floors: Provide standard cover.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: RMC.
 2. Concealed Conduit, Above Ground: RMC.
 3. Underground Conduit: RNC with RMC elbows.
 4. Connection to Vibrating Equipment (Including Transformers and Motor-Driven equipment): LFMC.
 5. Boxes and Enclosures, Above Ground: NEMA 250, Type 3R.

- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed and Subject to Physical Damage: RMC. Includes raceways in the following locations:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts and pallet-handling units.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Existing Walls in Finished Areas: SMR.
 - 5. Connection to Vibrating Equipment (Including Transformers and Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: RMC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R, in damp or wet locations.
- C. Minimum Raceway Size:
 - 1. General: 3/4 inches unless otherwise indicated.
 - 2. Raceways with no more than three No. 12 AWG conductors shall be 1/2 inches unless otherwise indicated.

3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Raceways shall be concealed in finished areas. Where existing wall surfaces are inaccessible, surface metal raceways shall be provided. Raceways may be surface mounted in unfinished equipment spaces such as mechanical rooms, electrical rooms, elevator machine rooms and attic spaces.
- C. Floor Boxes:
 - 1. Coat boxes mounted in floor slabs with bitumstic coal, tar epoxy sealant, Carboline 300M series or equal.
 - 2. The floor box shall flush with the top of the finished floor slab.
- D. Surface Metal Raceway:
 - 1. Provide two-compartment SMR where shown on the drawings.
 - 2. Conduits serving SMR shall be fully concealed in wall construction or above the suspended ceiling.
 - 3. Provide a separate, continuous, unbroken ground conductor in all SMR containing power circuits.
- E. Branch circuit raceways in telecommunication rooms shall be concealed within the wall.
- F. Install exposed raceways as high as possible, above ductwork, parallel or at right angles to building lines.
- G. Expansion and Seismic Joints:
 - 1. Raceways shall not be installed in concrete slab or wall construction when passing through an expansion or seismic joints.
 - 2. Raceways shall be installed in furred or suspended ceiling spaces with a minimum of 36 inches of flexible conduit crossing the expansion or seismic joints. Secure raceways on each side of joint.
- H. Raceways shall be installed parallel or at right angles to the building construction. This applies to all exposed raceways as well as all raceways above suspended ceiling.
- I. Raceways shall not be run in floor slabs, under heavy equipment, footings or other structural elements that might adversely affect the integrity of the raceways system or building structure.

Raceways installed above suspended ceilings shall be a minimum of six inches clear above the top of ceiling system.

- J. Raceways shall not be installed in floor slabs or structural columns.
- K. Underground Metallic Raceways or Metallic Raceways in Contact with Concrete: Wrap raceway with .010-inch-thick pipe-wrapping plastic tape applied with a 50 percent overlap (3M Scotchrap Tape 50).
- L. Pullboxes with Covers: Provided as shown on the drawings and as required by the NEC. All pullboxes shall be accessible.
- M. Exterior Walls: Conduits passing through exterior walls below grade and/or bridging an area which was previously excavated and backfilled shall be rigidly supported by a structurally reinforced concrete duct bank spanning between the building wall and a bearing surface on undisturbed earth.
- N. Cleaning of Raceways: The interior and exterior of all conduits and other raceways shall be thoroughly cleaned of all material. All conduits shall be capped or plugged after installation.
- O. Keep raceways at least six inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- P. Complete raceway installation before starting conductor installation.
- Q. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- R. Install no more than the equivalent of three 90-degrees bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- S. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints.
- T. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- U. Provide pull strings in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- V. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compounds. Install each fitting for concealed raceways in a flush steel box with a blank cover plate having a finish like that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- W. Thermal Expansion Fittings
 - 1. RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30°F and that has straight-run length that exceeds 25 feet. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change.
 - 2. EMT and RMC: Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100°F and that has straight-run length that exceeds 100 feet. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree Fahrenheit of temperature change for metal conduits.
 - 3. Install expansion-joint fittings for each of the following locations and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.

- c. Indoor Spaces: Connected with the outdoors without physical separation; 125 degrees F temperature change.
 - d. Attics: 135 degrees F temperature change.
 - e. Utility Tunnels: 155 degrees F temperature change.
- 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 the time of installation.
- X. Flexible Conduit Connections: Use maximum of eight feet of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Y. 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.
- Z. Set metal floor boxes level and flush with finished floor surface.

3.03 RACEWAYS AND CABLE INSTALLATION PATHWAYS FOR LOW-VOLTAGE SYSTEMS

- A. Installation of Raceways/Pathways for low-voltage systems shall be in accordance with the applicable portions of ANSI/TIA-569-D, *Telecommunications Pathways and Spaces*.
- B. Conduits above lay-in ceilings: Do not install cables in conduits that are supported from the ceiling suspension system. All conduits shall be supported independently of the ceiling support system.
- C. Conduit fill shall not exceed 40 percent.
- D. Bend radii for conduits shall meet the following requirements:
 - 1. If the conduit has an internal diameter of two inches or less, the bend radius must be at least six times the internal conduit diameter.
 - 2. If the conduit has an internal diameter of more than two inches, the bend radius must be at least 10 times the internal conduit diameter.
- E. There shall be no more than two 90-degree bends between pull points in conduit, without derating the conduit capacity. The conduit capacity shall be derated by 15 percent for each additional 90-degree bend. Increase conduit size as required to meet conduit fill requirements of this section and account for the derated capacity. Provide pull boxes to eliminate 90-degree bends as necessary to avoid having to derate conduit. Offsets shall be considered as equivalent to a 90-degree bend. Pull boxes added to conduit runs as of result of this requirement shall be in accordance with this section.
- F. Conduits which are terminated at cable trays shall be supported from structure with a maximum distance of 24 inches from the tray. Conduits terminated at cable trays shall be bonded to the tray.
- G. Exterior conduit shall be four inches Schedule 40 PVC with GRC elbows transitioning to four inches GRS for Service Entrances. The interior conduit for vertical riser cable shall be GRC, sized according to ANSI/TIA-569-D or as indicated on the Contract Drawings. Interior conduit for horizontal cable shall be EMT, sized according to ANSI/TIA-569-D standards or as indicated on the Contract Drawings.
- H. Flexible conduit for telecommunications shall only be used in lengths not exceeding four feet, without prior written approval. If used, flexible metal conduit shall be increased by one trade size for the application used.
- I. Conduits entering telecommunication rooms through the floor shall be terminated four inches above the finished floor. Conduits entering the rooms from above shall be terminated four inches below

the finished ceiling. In no case shall the conduits terminate greater than 12 inches above the cable tray or distribution frame.

- J. Conduits and cut-out openings between floors shall be sealed with removable and reusable firestopping material, to accommodate adds, moves and changes in the cabling system.
- K. Conduits used for routing of low voltage cables shall have bushings at all stubouts.

3.04 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit.
 - 2. Backfill shall be imported structure fill or imported gravel borrow according to WSDOT standards.
 - 3. After installing conduit, backfill and compact. Start at tie-in point and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
 - 4. Elbows: All elbows shall be RMC.
 - a. Wrapped elbows with 3M Scotchrap Tape 50.
 - b. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with three inches of concrete.
 - c. Extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation for stub-ups at equipment mounted on outdoor concrete bases.
 - d. Install insulated grounding bushings on terminations at equipment.

3.05 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install them in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.06 FIRESTOPPING

- A. Provide firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 SOUND CONTROL

- A. General: The installation of the outlet boxes and conduit shall utilize installation methods which minimize sound transmission from one room to adjacent room or areas boxes shall not be located within 24 inches of each other or within the same study cavity.
- B. Installation:
 - 1. Boxes mounted in a common wall shall be offset horizontally whenever possible so that they are not mounted back-to-back. Connect offset boxes with flexible conduit not to exceed 24 inches in length.
 - 2. Boxes may be mounted back-to-back (with permission) where it is not practical to offset, with a minimum clearance of ¼" inch between boxes. Wrap both boxes with STI putty pads. Connect boxes with flexible conduit. Do not nipple boxes that are mounted back-to-back.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITION

- A. RNC: Rigid nonmetallic conduit.
- B. RSC: Rigid Steel Conduit.

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.04 COORDINATION

- A. Coordinate layout and installation of ducts, vaults, handholes and boxes with final arrangement of other utilities, site grading and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into vaults, handholes and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes.

PART 2 PRODUCTS

2.01 UNDERGROUND DUCTS

- A. Rigid Steel Conduit (RSC): Galvanized. Comply with ANSI C80.1.
- B. Rigid Nonmetallic Conduit (RNC): TC2, Type EPC-40 PCV, unless otherwise indicated.

2.02 DUCT SEPARATORS

- A. Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing's indicated while supporting ducts during concreting or backfilling.

2.03 WARNING TAPE

- A. Underground-line warning tape specified in Division 26, Section 260553, "Identification"

2.04 INNERDUCT

- A. Manufacturer: MaxCell "Detectable" series
- B. Description: Three 1.25-inch ducts with integral 18-gauge solid copper core tracer wire.

2.05 PRECAST CONCRETE VAULTS/MANHOLES/HANDHOLES

- A. Manufacturer: Utility Vault Co.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. The frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- D. Frame and Cover: Weatherproof steel frame with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - 1. Cover Hinges: Concealed with hold-open ratchet assembly.

- 2. Cover Handle: Recessed.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Provide welded steel nameplate identifying the system within as follows:
 - 1. Power: "POWER"
 - 2. Lighting: "LIGHTING"
 - 3. Telephone: "TELEPHONE"
 - 4. Cable Television: "CABLE"
 - 5. All other low-voltage systems: "SIGNAL"
- G. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
- H. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - 1. Windows shall be located no less than six inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - 2. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie into concrete envelopes of duct banks.
 - 3. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
- I. Duct Entrances in Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - 1. Type and size shall match fittings to duct or conduit to be terminated.
 - 2. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

2.06 HANDHOLES (OTHER THAN PRECAST CONCRETE)

- A. Manufacturer: Hubbell "Quazite" series.
- B. Description: Fiberglass handles and boxes with polymer concrete frame and cover shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
- C. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- E. Cover Finish: Nonskid finish.
- F. Cover Legend: Molded lettering describing the system contained within as follows:
 - 1. Power: "POWER"
 - 2. Lighting: "LIGHTING"
 - 3. Telephone: "TELEPHONE"
 - 4. Cable Television: "CABLE"
 - 5. All other low-voltage systems: "SIGNAL"

2.07 SEALING PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Duct Plugs: Tyco Electronics, "Jackmoon" plugs.
 - 2. Foam Sealant: TODAL Products Duo Dill 400.

2.08 TAMPERPROOF HARDWARE

- A. Provide stainless steel tamperproof bolts to secure all vault, manhole and handhole covers. Verify bolt type with Owner.

2.09 ELBOWS

- A. RSC: C Wrapped with 3M Scotchrap Tape 50

PART 3 EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 Volt and Less: RNC, NEMA Type EPC-40-PVC, direct-buried, unless otherwise indicated. Provide RSCelbows.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, direct-buried unless otherwise indicated.
- C. Ducts for Low-Voltage Cabling: RNC, NEMA Type EPC-40-PVC, direct-buried unless otherwise indicated. Provide RSCelbows.

3.02 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
- B. Precast Concrete Vaults/Manholes: H-20 structural load rating according to AASHTO HB 17.

3.03 EARTHWORK

- A. Backfill: Utilize imported structural fill or gravel borrow per WSDOT standards.
- B. Compact backfill but do not use heavy-duty, hydraulic-operated, compaction equipment.
- C. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging and mulching.
- E. Cut and patch existing pavement.

3.04 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use five-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- D. Duct Entrances to Vaults and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for five-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- F. Pulling Cord: Install 100lb-ft test nylon cord in ducts, including spares.
- G. Concrete-Encased Ducts:
 - 1. Support ducts on separators coordinated with duct size, duct spacing and outdoor temperature.
 - 2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately six inches between tiers. Tie the entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 3. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 - 4. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to the center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 - 5. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 6. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - 7. Minimum Space between Ducts: Three inches between ducts and exterior envelope wall, two inches between ducts for like services, and four inches between power and signal ducts.
 - 8. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
 - 9. Stub-Ups: Use manufactured rigid-steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with three inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

H. Direct-Buried Duct Banks:

1. Support ducts on separators coordinated with duct size, duct spacing and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger separators approximately six inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank.
4. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to four inches over ducts and hand tamp. Firmly hand tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.
5. Install ducts with a minimum of three inches between ducts for like services and six inches between power and signal ducts.
6. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
7. Set elevation of bottom of duct bank below the frost line.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with three inches of concrete.
 - b. Stub-Ups to Equipment: Extend steel conduit horizontally a minimum of 60 inches from edge of base, for equipment mounted on outdoor concrete bases. Install insulated grounding bushings on terminations at equipment.
- I. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within three inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.
- J. Innerduct: Provide Maxcell innerduct (three 1.25" innerducts) in every 4" duct being used for low-voltage cabling.

3.05 INSTALLATION OF PRECAST CONCRETE VAULTS, MANHOLES AND HANDHOLES

A. General:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install vaults level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from one-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames one inch above finished grade.

3. Install vaults with bottom below the frost line below grade.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes one inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Waterproofing: Apply waterproofing to exterior surfaces.

3.06 INSTALLATION OF HANDHOLES (OTHER THAN PRECAST CONCRETE)

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes one inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line below grade.
- E. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut the wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.07 GROUNDING

- A. Ground underground ducts, vaults, manholes, handholes and utility structures according to Division 26, Section 260526, "Grounding and Bonding."

3.08 SEALING

- A. Vaults and Manholes:
 1. Provide blank duct plugs in all space ducts.
 2. Provide "Jack Moon" plugs for ducts that have cables installed.
- B. Handholes: Seal all ducts with two-part urethane foam sealant.
- C. Ducts terminating within Building: Seal all ducts with two-part urethane foam sealant.

3.09 DRAINS

- A. Provide two-inch drainline from each vault and manhole to nearest catch basin which is at a lower elevation than the bottom of the vault. Slope drain to catch basin.

3.010 ACCEPTANCE TESTING

- A. Comply with Section 260126, Acceptance Testing of Electrical Systems.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide complete seismic anchorage and bracing for all electrical raceways, cable trays, fixtures and equipment as required by the International Building Code (IBC) Section 1621.
- B. Retain the services of a professional licensed structural engineer to design the required seismic anchorage and bracing.
- C. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: B
 - a. Component Importance Factor: 1.5 for essential systems, 1.0 for nonessential systems.
 - b. Component Response Modification Factor: 5.0.
 - c. Component Amplification Factor: 2.5.
 - 3. Design Spectral Response Acceleration at 1.0-Second Period.
 - 4. Essential Systems:
 - a. The following electrical equipment, raceways and spaces are considered essential for the continued operation of the facility:
 - 1) All electrical, generator and communications rooms.
 - 2) All life-safety distribution equipment, feeders, and raceways.
 - 3) All equipment and feeders that are rated 225 amperes and above.
 - 4) All cable trays.
 - 5) All fire alarm system equipment and raceways.
 - 6) All communication system equipment and raceways.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Isolation Technology, Inc.
 - 2. Vibration Isolation
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
- C. Resilient Material: Oil and water-resistant neoprene.
- D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Restraint: Seismic or limit-stop as required for equipment and Authorities Having Jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.02 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line
 2. Hilti Inc.
 3. TOLCO Incorporated
 4. Unistrut
- B. General Requirements for Restraint Components: Rated strengths, features and application requirements shall be as defined in reports by an agency acceptable to Authorities Having Jurisdiction.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchors and studs.
- G. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 EXECUTION

3.01 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze members with clamps approved for application by an agency acceptable to Authorities Having Jurisdiction.

- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.02 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to Authorities Having Jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify the position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeves fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.04 ADJUSTING

- A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

PART 2 PRODUCTS

2.01 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Lighting and Power Circuits: White letters on a black field.
 - 2. Fire Alarm: White letter on a red field.
 - 3. Other Low-Voltage Systems: White letters on a black field.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant two inches wide and compounded for outdoor use.

2.02 FASTENERS FOR LABELS AND SIGNS

- A. Stainless steel machine screws with nuts and flat and lock washers in outdoor locations, and contact-type permanent self adhesive in indoor locations.

2.03 CONTROL AND COMMUNICATIONS CABLING AND CONDUCTORS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than three mils thick by one to two inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Write-On Tags: Polyester tag, 0.015 inch thick with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable. Uses permanent, waterproof, black ink marker recommended by tag manufacturer.

2.04 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed polyethylene tape.
 - 1. Compounded for permanent direct-burial service.
 - 2. Embedded continuous metallic strip or core.
 - 3. Printed legend shall indicate type of underground line.

2.05 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels configured for display on front cover, door or other access to equipment, unless otherwise indicated.

2.06 EQUIPMENT NAMEPLATES

- A. General: Nameplates shall be 1/16" thick laminated plastic with engraved letters.
- B. Color for Nameplates:
 - 1. Lighting and Power: White letters on a black field.
 - 2. Fire Alarm: White letters on a red field.
 - 3. Emergency Systems (NEC Article 700): White letters on an orange field.
 - 4. Other Low-Voltage Systems: White letters on a black field.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: - 40 to +185 degrees Fahrenheit.
 - 4. Color: Black, except where used for color-coding.

PART 3 EXECUTION

3.01 APPLICATION

- A. Equipment with Multiple Power Sources: Provide label that reads: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
- B. Accessible Raceways More Than 600 Volt: Identify with "DANGER: HIGH-VOLTAGE" in black letters at least two inches high with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.
- C. Power-Circuit Conductor Identification: Use color-coding conductor tape for conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, vaults and handholes. Identify source and circuit number of each set of conductors. Identify phase in addition to the above for single conductor cables.
- D. Branch-Circuit Conductor Identification: Use marker tape where there are conductors for more than three branch circuits in the same junction or pull box. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify all control and low-voltage systems wiring as follows:
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with manufacturer's shop drawings.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Equipment Identification Labels:
 - 1. Switchboards and Distribution Panelboards: Provide nameplate that identifies the switchboard/distribution panel and the source panel. (Example: Distribution Panel No. 1/Fed from Main Service Switchboard - Bkr. No. 1.) Provide a nameplate at each overcurrent device that identifies the device number and the load served. (Example: Bkr. No. 1/Panel A)

2. Panelboards: Provide a nameplate on the front of the panel cover that identifies the panel. (Example: Panel A.) Provide a nameplate concealed behind the door which identifies the panel and the source panel. (Example: Panel A, fed from Distribution Panel 1-Bkr. No. 2)
 3. Transformers: Provide nameplate identifying the transformer, the source panel and the panel served. (Example: Transformer T1/fed from Distribution Panel 1, Bkr. No. 1/Serves Panel A)
 4. Disconnect Switches and Enclosed Controllers: Provide nameplate that identifies the source panel and load served. (Example: Panel A-1, 3, 5/Exhaust Fan No.1)
 5. Variable Frequency Drives: Provide nameplate which identifies the source panel and load served. (Example: Panel A-1, 3, 5/Exhaust Fan No. 1)
- I. Device Plates: Laser-engrave according to Division 26, Section 262726, "Wiring Devices."
- J. Junction and Pull Box Identification: Mark the cover of all junction boxes and pull boxes to identify the system, circuits, or feeders contained within the box. Circuits shall be identified by the panel and specific circuit numbers contained within the box.
1. Boxes containing fire alarm conductors shall be painted red.
 2. Boxes containing emergency system conductors shall be painted orange.
- K. Color-Coding for Phase and Voltage Level Identification, 600 Volt and Less: Use the colors listed below for ungrounded conductors:
1. Colors for 208/120-Volt Circuits:
 - a. Phase A: Black
 - b. Phase B: Red
 - c. Phase C: Blue
 - d. Neutral: White
 - e. Ground: Green
 - f. Travelers: Yellow
 2. Colors for 480/277-Volt Circuits:
 - a. Phase A: Brown
 - b. Phase B: Orange
 - c. Phase C: Yellow
 - d. Neutral: Gray
 - e. Ground: Green
 - f. Travelers: Lavender
 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of six inches from terminal points and in boxes where splices or taps are made. Apply the last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- L. Arc Flash Hazard Labels:
1. Provide labels on all distribution equipment that designates the appropriate PPE (Personal Protective Equipment) required for the hazard present. Labels to comply with the NEC and NFPA 70E. Submit sample of label to Engineer for review.
 2. Refer to Division 26, Section 260573, "Overcurrent Protective Device Coordination Study."

3.02 INSTALLATION

- A. Verify the identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application using materials and methods recommended by manufacturer of identification device.

- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at six to eight inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. This section includes computer-based, fault-current and overcurrent protective device coordination studies for all new and existing devices. Protective devices shall be set based on results of the protective device coordination study.
- B. This study also includes:
 - 1. An arc flash hazard analysis.
 - 2. Providing self-adhesive arc flash hazard labels.
- C. Provide an initial study and submit with the electrical gear submittals.
- D. Provide a final study prior to substantial completion. The final study shall include all changes made during construction.

1.03 SUBMITTALS

- A. Product Data: Submit for computer software program to be used for studies.
- B. Product Certificates: Submit for coordination-study and fault-current-study computer software programs to certify compliance with IEEE 399.
- C. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.

1.04 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with the requirements of standards and guides specified in this section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices. A professional engineer, licensed in the state where the project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of a qualified engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:
 - 1. Power Analytics
 - 2. EDSA Micro Corporation
 - 3. ESA Inc.
 - 4. Operation Technology, Inc.

5. SKM Systems Analysis, Inc.

2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. The computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. The computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 EXECUTION

3.01 GENERAL

- A. Examine project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.
- B. Existing Devices: Field verify data for all existing devices.
- C. Existing Feeders: Field verify conductor and raceway data for all existing feeders.

3.02 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 - 1. Product data for overcurrent protective devices specified in other Division 26 sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, size, voltage, and source impedance.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity and impedance.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
 - 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices indicated to be coordinated.

- h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.03 FAULT-CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Switchgear and switchboard bus
 - 2. Motor-control center
 - 3. Distribution panelboard
 - 4. Branch circuit panelboard
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties based on maximum available fault current. Show interrupting (five-cycle) and time-delayed currents (six cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.
- D. Equipment Evaluation Report:
 - 1. 600-Volt Overcurrent Protective Devices: Ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 2. Devices and Equipment Rated for Asymmetrical Fault Current: Apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 - 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.04 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 - 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 - 2. Calculate the maximum and minimum interrupting duty (five cycles to two seconds) short-circuit currents.
 - 3. Calculate the maximum and minimum ground-fault currents.
- B. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00 for fault currents.
- C. Motors served by voltages more than 600 volt shall be protected according to IEEE 620.

- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 - 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of overcurrent protective devices.

3.05 ARC FLASH HAZARD ANALYSIS

- A. Calculate the arc flash hazard category, the incident energy level and the flash hazard boundary for all electrical equipment.
- B. Provide self-adhesive labels complying with ANSI Standards Z535.4-1998.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 specification sections apply to this section.

1.02 RELATED SECTIONS

- A. Section 01900, Commissioning
- B. Division 22, Plumbing
- C. Division 23, Mechanical
- D. Section 260126, Acceptance Testing of Electrical Systems
- E. Division 27, Communications
- F. Division 28, Electronic Safety and Security

1.03 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
 - 1. International Electrical Testing Association (NETA) ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, Latest Edition

1.04 SUMMARY

- A. The purpose of this section is to specify the Contractor's responsibilities relative to Division 26 and participation in the commissioning process. See Division 1, Section 019100, "Commissioning," for Contractor-related commissioning requirements.
- B. Organization of the commissioning program is primarily the responsibility of the Commissioning Authority. Execution of the program is primarily the responsibility of the Contractor with support from the Division 26 for the following:
 - 1. Testing and start-up of the electrical equipment.
 - 2. Completion and endorsement of prefunctional test checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operational and ready for functional testing.
 - 3. Providing qualified personnel to assist the Commissioning Authority with functional testing to verify equipment/system performance.
 - 4. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
 - 5. Providing training for the systems specified in Division 26 with coordination of Owner by the Commissioning Authority.
- C. Division 26 shall cooperate with the Commissioning Authority in the following manner:
 - 1. Complete all acceptance testing specified in Section 260126, "Acceptance Testing of Electrical Systems" prior to the start of commissioning.
 - 2. Allow sufficient time before final completion dates so that electrical testing, lighting control checkout, and functional testing can be accomplished.
 - 3. Provide labor and material to make corrections when required without undue delay.
 - 4. Put all electrical systems and equipment into full operation and continue the operation of the same during each working day of commissioning.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Standard certified test equipment for commissioning will be provided by the Commissioning Authority.
- B. Proprietary test equipment required by the manufacturer shall be provided by the manufacturer of the equipment. The manufacturer shall provide the test equipment, demonstrate its use and assist the commissioning authority in the commissioning process fuse applications.

PART 3 EXECUTION

3.01 WORK PRIOR TO COMMISSIONING

- A. Specific precommissioning responsibilities of Division 26 are as follows:
 - 1. Normal startup services are required to bring each system into a fully operational state.
 - 2. Complete all testing specified in other Division 26 sections.
 - 3. Complete all testing specified in Section 260126, Acceptance Testing of Electrical Systems.

3.02 PARTICIPATION IN COMMISSIONING

- A. The Division 26 Contractor shall provide skilled technicians to start up and trouble shoot all systems within the Division 26 work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. The contractor will ensure the qualified technician(s) are available and present during the agreed upon schedules, and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or subsystem. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for the purposes of this work.

3.03 ELECTRICAL SYSTEM TESTING

- A. Electrical system testing as required in other sections of this specification shall be coordinated with the Commissioning Authority. The Commissioning Authority may witness testing performed by the Division 26 Contractor.
- B. All testing documentation related to Division 26 equipment and systems, as specified in other sections of this specification, will be provided to the Commissioning Authority for use and review.

3.04 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. All equipment and systems will be tested and commissioned in the peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.
- B. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and

commissioned at the minimum, and at peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.05 TRAINING

- A. The Division 26 Contractor shall participate in the training of the Owner's engineering and maintenance staff for each electrical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with specific equipment. The type of training will be per the Owner's option.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.04 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 OCCUPANCY SENSORS

- A. Manufacturer: Subject to compliance with requirements, provide products by Wattstopper.
- B. General Description: Wall- or ceiling-mounted, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of one to 15 minutes.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-volt ac, for 13-A tungsten at 120-volt ac, and for one hp at 120-volt ac. The power supply to sensor shall be 24-volt dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - 6. Bypass Switch: Override the on function in case of sensor failure.
- C. Dual-Technology Type: Provide with separately wired power pack and isolated relay output.
- D. Ultra-Sonic Type: Provide with separately wired power pack and isolated relay output.
- E. Occupancy Sensor Switches: Provide separate switches for each zone.
- F. Emergency Lighting Control Unit: Dry contacts rated for 20A ballast load at 120- and 277- volt AC for 13A tungsten at 120-volt AC, and for one HP at 120-volt AC. Power supply to sensor shall be 24-volt DC, 150 mA, Class 2 power source as defined by NFPA 70. UL 924 listed for use in emergency circuits.

2.02 WALL-BOX DIMMERS

- A. Manufacturer: Subject to compliance with requirements, provide products by Wattstopper.

- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches with audible frequency and EMI/RFI suppression filters.
- C. Control: Continuously adjustable slider for each zone. Comply with UL 1472.

2.03 TIME CLOCKS

- A. Manufacturers: Subject to compliance with requirements, provide products by Intermatic.
- B. Electronic Time Clocks: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
 - 1. Contact Rating: 30-A inductive or resistive, 240-volt ac.
 - 2. Program: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
 - 3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 - 4. Astronomic Time: All channels.
 - 5. Battery backup is required for schedules and time clock.

2.04 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D
 - 2. Siemens
 - 3. General Electric
 - 4. Eaton
- B. Description: Electrically operated and electrically held.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, 30-amp minimum, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide control power transformer, red pilot light and H-O-A switch matching the NEMA type specified for the enclosure.

2.05 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26, Section 260519, "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26, Section 260519, "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26, Section 260519, "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 DIMMER INSTALLATION

- A. Install dimmers within terms of their listing.
- B. Install unshared neutral conductors on the line and load side of dimmers according to manufacturer's device listing conditions in the written instructions.

3.03 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26, Section 260519, "Low-Voltage Electrical Power Conductors and Cables."
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 EMERGENCY (LIFE SAFETY) CIRCUITS

- A. Provide UL 924 listed lighting control unit where emergency (Life Safety) circuits are controlled.

3.05 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26, Section 260553, "Identification." Provide phenolic nameplate on the cover of each lighting contactor enclosure that identifies the circuits controlled and areas served.

3.06 COMMISSIONING OF LIGHTING CONTROL DEVICES

- A. All lighting controls shall be commissioned to ensure they operate according to the manufacturer's specifications. Prior to commissioning, conduct a precommissioning meeting with the Owner and the Engineer to establish the settings for the devices. Provide a commissioning report that provides the following for each room:
 - 1. Lighting control device type and part number.
 - 2. Device settings.
- B. Confirmation that devices operate according to the specifications.

3.07 Installed Spare Devices

- A. Provide the following spare occupancy sensors including associated raceways and wiring:

<u>Item</u>	<u>Quantity</u>
Dual Technology	4
Ultrasonic	2
Occupancy Sensor Switches	4
Timer Switches	2

- B. Spare devices shall include 75 feet of conduit, faceplates, all require wire, cutting, patching, and painting for a complete installation. The location of these units is to be determined by the Owner's representative at the site. The Contractor shall assume that these devices will be installed after all other work is completed. Installation shall occur on an accelerated (night/weekend) schedule. Unused devices are to be turned over to the Owner.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 DEFINITIONS

- A. BAS: Building Automation System.
- B. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control, signaling and power-limited circuits.
- D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- E. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.
- F. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.03 SUBMITTALS

- A. Product Data: Submit for each type of product provided.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this project.
 - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this section and devices furnished with power distribution system components. Indicate data communication paths and identify repeaters, emergency modules, interface modules, and other devices to be used.
 - 3. Wiring Diagrams: Show all power, signal, and control wiring connections. Coordinate nomenclature and presentation with a block diagram.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. N'Light
 - 2. Wattstopper
 - 3. Lutron
- B. The basis of design for this project is Wattstopper. The type of devices, quantity of devices and wiring shown on the drawings are based on this manufacturer. The other manufacturers listed may have different types and quantities of devices, require different wiring, and require different ballasts. If the basis of design manufacture is not provided, the Contractor is responsible to provide all additional labor and material necessary for a complete and operational system that meets functionality of the basis of design system.

2.02 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Performance Requirements: Manual switch operation sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.
- C. Control Module Description: Comply with UL 508 (CSA C22.2, No. 14); microprocessor-based, programmable, control unit; mounted in preassembled, modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays shall be prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays. Control units shall be capable of receiving inputs from sensors and other sources. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable.

2.03 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
 - 1. Cabinet: Steel with hinged, locking door.
 - a. Barriers separate low-voltage and line-voltage components.
 - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
 - 2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
 - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - b. Rated Capacity (Mounted in Relay Panel): 20 ampere, 125-volt ac for tungsten filaments; 20 ampere, 277 volt ac for ballasts.
 - c. Endurance: 50,000 cycles at rated capacity.
 - d. Mounting: Provision for easy removal and installation in relay cabinet.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-volt ac, solid-state control panels.

2.04 REPEATERS

- A. Provide as required.

2.05 EMERGENCY MODULES

- A. Provide as required to automatically turn on all emergency lighting in the event of a power failure.

2.06 INTERFACE MODULES

- A. Provide quantity as required to interface with dry-contact closures from the building automation system.

2.07 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary-contact, low-voltage type. Match color specified in Division 26, "Wiring Devices."

- B. Wall Plates: Single and multigang plates as specified in Division 26, "Wiring Devices."
- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.08 CABLING

- A. Provide per manufacturer's request.

2.09 IDENTIFICATION DEVICES

- A. Label each control panel with an engraved laminated plastic nameplate as specified in Division 26, "Identification." Name each to provide the following information:
 - 1. Panel name.
 - 2. Circuit number.
 - 3. Areas controlled.
- B. Provide a directory inside each panel that lists the circuit number and area controlled for each relay.

PART 3 EXECUTION

3.01 WIRING INSTALLATION

- A. Wiring Method: Install wiring in raceways except where installed in accessible ceilings and gypsum board partitions. Comply with Division 26, "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
- F. Identify components and power and control wiring according to Division 26, "Identification."

3.02 COMMISSIONING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing and programming.
- B. Provide the following on-site support during construction:
 - 1. Preinstallation conference with the Contractor.
 - 2. Postinstallation inspection to ensure the system is installed according to the manufacturer's requirements prior to programming.
 - 3. Programming of all panels to accomplish the functions shown on the drawings and as specified herein.
 - 4. Commissioning to verify the system operates as specified.
 - 5. Initial Owner training (four hours minimum).
 - 6. Final Owner training to be conducted approximately six months after substantial completion (four hours minimum).
 - 7. 12 months after the date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to project during other than normal occupancy hours for this purpose.

- C. Provide a written certification signed by the manufacturer stating the system has been commissioned.

3.03 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls as described under "Commissioning."

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of transformer provided.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton
- B. The basis of design manufacturer for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the Basis of Design.
 - 3. The equipment dimensions are equal to or smaller than the Basis of Design.

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26, "Vibration and Seismic Controls."
- C. Core: One leg per phase.
- D. Enclosure: Ventilated, NEMA 250, Type 2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Taps for Transformers Smaller Than 3 kVA: One five percent tap above normal full capacity.
- F. Taps for Transformers 7.5 to 24 kVA: One five percent tap above, and one five percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5-percent taps above and four 2.5-percent taps below normal full capacity.

- H. Insulation Class: 220 degree C, UL-component-recognized insulation system with a maximum of 150 degree C rise above 40 degree C ambient temperature.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger: Complying with NEMA TP 1, Class 1 efficiency levels.
- J. K-Factor Rating: Transformers indicated to be K-factor rated and comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
- K. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
 - 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- L. Wall Brackets: Manufacturer's standard brackets.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Wall-Mounted Transformers:
 - 1. 30-kVA and Less: Provide manufacturer's standard wall bracket.
 - 2. 45-kVA and Larger: Provide custom-fabricated welded red iron frame.
- B. Ceiling-Hung Transformers:
 - 1. 30-kVA and Less: Support with Unistrut frame suspended with 1/2" diameter all-thread rod.
 - 2. 45-kVA and Larger: Provide custom-fabricated welded red iron frame.
- C. Floor-Mounted Transformers:
 - 1. Mount to concrete base according to Division 26, Section 260529, "Hangers and Supports."
 - 2. Provide vibration pads under transformer according to Division 26, Section 260548, "Vibration and Seismic Controls."

3.02 IDENTIFICATION DEVICES

- A. Label each transformer with an engraved laminated plastic nameplate as specified in Division 26, Section 260553, "Identification."

3.03 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 12 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus three percent at maximum load conditions.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings. Include settings report in Operations and Maintenance Manual.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector and accessory provided.
- B. Overcurrent Protective Device Coordination Study: Submit for review along with product data. Refer to Division 26, Section 260573, "Overcurrent Protective Device Coordination Study."

1.03 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.04 SELECTIVE COORDINATION

- A. The emergency distribution system shall be selectively coordinated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton
- B. The basis of design manufacturer for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the Basis of Design.
 - 3. The equipment dimensions are equal to or smaller than the Basis of Design.

2.02 FABRICATION

- A. General: Fixed, individually mounted main device, panel-mounted branches, and sections rear aligned.
- B. Access: Front only or rear accessible as shown on the drawings.
- C. Alignment: All sections shall align front and rear.
- D. Nominal System Voltage: As shown on one-line diagram.
- E. Main-Bus Continuous: As shown on one-line diagram.
- F. Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26, "Vibration and Seismic Controls."
- G. Enclosure: Steel, NEMA 250, Type 1.
- H. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

- I. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If a separate vertical section is required for utility metering, match and align with basic switchboard.
- J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- K. Buses and Connections: Three phase, four wire, unless otherwise indicated.
 - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
 - 2. Load Terminals: Insulated, rigidly braced, silver-plated, copper runback bus extensions equipped with pressure connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full ampere rating of circuit-breaker position.
 - 3. Ground Bus: 1/4 x 2 inch (minimum-size), hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. Extend insulated equipment grounding cable to busway ground connection support cable at intervals in vertical run for busway feeders.
 - 4. Contact Surfaces of Buses: Silver plated.
 - 5. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
 - 7. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.
- L. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.03 SHORT-CIRCUIT RATING

- A. Fully rated to interrupt the symmetrical short circuit available at the terminals.

2.04 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sinewave tracking suppression and filtering modules.
- B. Minimum single-impulse current rating shall be as follows:
 - 1. Line-to-Neutral: 100,000.
 - 2. Line-to-Ground: 100,000.
 - 3. Neutral-to-Ground: 50,000.
- C. Protection modes shall be as follows:
 - 1. Line-to-Neutral
 - 2. Line-to-Ground
 - 3. Neutral-to-Ground
- D. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
- E. Maximum Category C combination wave clamping voltage shall not exceed:
 - 1. 600-volt, Line-to-Neutral and Line-to-Ground on 120/208-volt systems.
 - 2. 1000-volt, Line to Neutral and Line to Ground on 277/480-volt systems.
- F. Maximum UL 1449 clamping levels shall not exceed:
 - 1. 400-volt, Line-to-Neutral and Line-to-Ground on 120/208-volt systems.
 - 2. 800-volt, Line-to-Neutral and Line-to-Ground on 277/480-volt systems.
- G. Withstand Capabilities: 3000 Category C surges with less than five percent change in clamping voltage.

H. Accessories:

1. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
2. Audible alarm activated on failure of any surge diversion module.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers Rated 800 Amps or More: Provide electronic trip unit with adjustable Long-Time, Short-Time and Instantaneous trip functions. Provide ground fault protection (G) where called out on the one-line drawing.
- B. Circuit Breakers Rated 1200 Amps or More: Provide trip unit with a maintenance mode switch with LED indicator lights that overrides the trip settings in order to minimize the arc flash hazard during maintenance.

2.06 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
 1. Potential Transformers: Secondary voltage rating of 120 volt and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3kV.
 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.
- B. Main Bus:
 1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.
- C. Each Feeder:
 1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.
 - d. KWH, revenue-grade, nonresetable. KWH meter to have pulsed output, same as utility meter.

2.07 CONTROL POWER

- A. Control Circuits: 120 volt, supplied through secondary disconnecting devices from control-power transformer.
- B. Control-Power Fuses: Primary and secondary fuses for current limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, conductors across hinges, and conductors for interconnections between shipping units.

2.08 CURRENT AND POTENTIAL TRANSFORMERS OR USE BY CONTROLS CONTRACTOR

- A. Potential Transformer: Provide three single-phase potential transformers (24 VAC secondaries) on the main bus (Phase A, B, C). Wire secondary to a terminal strip for use by the building controls contractor.

- B. Current Transformers: Provide three current transformers with a 0-5 amp output on the main bus (Phase A, B, C). Wire secondaries to a terminal strip for use by the building controls contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install switchboards on four-inch-high concrete bases. Secure switchboards to anchor bolts installed in concrete bases.

3.02 CURRENT AND POTENTIAL TRANSFORMERS FOR USE BY BUILDING CONTROLS CONTRACTOR

- A. The secondaries of all current and potential transformers provided for use by the building controls contractor shall be wired to a terminal strip in a barriered compartment within the switchboard.

3.03 TESTING

- A. After all wiring is complete, all feeder circuit terminations shall be checked with a torque wrench. Torque levels shall be in accordance with NETA Standard ATS unless otherwise specified by the manufacturer. A test report, which gives the following information for each panelboard, shall be submitted to the Engineer two weeks prior to final inspection:
 - 1. Size and insulation type of the phase, neutral and ground conductors.
 - 2. Phase-to-phase and phase-to-neutral operating load voltage.
 - 3. Operating load current (each phase, neutral and ground).
- B. Phase-to-phase and phase-to-neutral conductor insulation resistance. Test shall be made with a DC "Megger" (500 volt minimum) type tester. If tests indicate faulty insulation (less than 8 megohms), the conductors shall be replaced and retested.
- C. A copy of the test report shall be included in the Operations and Maintenance Manual.

3.04 IDENTIFICATION DEVICES

- A. Label switchboard and each overcurrent device with an engraved laminated plastic nameplate as specified in Division 26, "Identification."

3.05 ADJUSTING AND TESTING

- A. Set ground fault relay and each overcurrent device according to Division 26, "Overcurrent Protective Device Coordination Study."
- B. Test all ground fault relays according to the requirements of the WAC.

3.06 ACCEPTANCE TESTING

- A. Comply with Section 260126, Acceptance Testing of Electrical Systems.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of panelboard, overcurrent protective device, transient voltage suppression device and accessory provided.
- B. Overcurrent Protective Device Coordination Study: Submit for review along with product data. Refer to Division 26, "Overcurrent Protective Device Coordination Study."

1.03 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.04 SELECTIVE COORDINATION

- A. The emergency distribution system shall be selectively coordinated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards and Overcurrent Protective Devices:
 - a. Square D
 - b. General Electric
 - c. Siemens
 - d. Eaton
 - 2. Transient Voltage Suppression Panelboards:
 - a. Square D
 - b. General Electric
 - c. Siemens
 - d. Eaton
- B. The basis of design manufacturer for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the Basis of Design.
 - 3. The equipment dimensions are equal to or smaller than the Basis of Design.

2.02 FABRICATION

- A. Enclosures:
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor, Wet or Damp Locations: NEMA 250, Type 3R.
 - 2. Doors: Door-within-door type.
 - 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 4. Directory Card: Provide transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.

- 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Compression type.
 - 2. Ground Lugs and Bus Configured Terminators: Compression type.
 - 3. Feed-Through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.03 SHORT-CIRCUIT RATING

- A. Fully rated to interrupt the symmetrical short-circuit current available at the terminals.

2.04 DISTRIBUTION PANELBOARDS

- A. Branch Overcurrent Protective Devices:
 - 1. Circuit-Breaker Frame Sizes 125 Ampere and Smaller: Bolt-on circuit breakers.
 - 2. Circuit-Breaker Frame Sizes Larger Than 125 Ampere: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- B. Doors: Door-within-door type secured with vault-type latch with tumbler lock; keyed alike.

2.05 PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Door-within-door type, concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.06 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- B. Doors: Door-within-door type, concealed hinges; secured with vault-type latch with tumbler lock; keyed alike.
- C. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sinewave tracking suppression and filtering modules.
 - 1. Minimum Single-Impulse Current Ratings:
 - a. Line-to-Neutral: 100,000 ampere.
 - b. Line-to-Ground: 100,000 ampere.
 - c. Neutral-to-Ground: 50,000 ampere.
 - 2. Protection modes shall be as follows:
 - a. Line-to-neutral.
 - b. Line-to-ground.
 - c. Neutral-to-ground.
 - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
 - 4. Maximum Category C Combination Wave Clamping Voltage: 600 volt, line-to-neutral and line-to-ground on 120/208-volt systems.
 - 5. Maximum UL 1449 Clamping Levels:
 - a. 400-volt, line-to-neutral and line-to-ground on 120/208 volt.
 - b. 800-volt, line-to-neutral and line-to-ground on 277/480-volt systems.

6. Withstand Capabilities: 3000 Category C surges with less than five percent change in clamping voltage.

2.07 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-case circuit breaker with interrupting capacity to meet available fault currents. Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
- B. Circuit Breakers Rated 800 Amps or More: Provide electronic trip unit with adjustable Long-Time, Short-Time and Instantaneous trip functions. Provide ground fault protection (G) where called out on the one-line drawing.
- C. Circuit Breakers Rated 1200 Amps or More: Provide trip unit with a maintenance mode switch with LED indicator lights that overrides the trip settings in order to minimize the arc flash hazard during maintenance.

2.08 SPACE FOR FUTURE CIRCUIT BREAKERS OR FUSED SWITCHES

- A. Provide as indicated on the drawings. Spaces shall be completely equipped for the future addition of a circuit breaker or fused switch, including all mounting hardware and buss connections. Unless otherwise noted, spaces shall be sized to accommodate the following future circuit breaker or fused switch:

<u>Panel Rating</u>	<u>Minimum Space Ampacity</u>
100 Amperes	70 Amperes
225 Amperes	125 Amperes
400 Amperes	225 Amperes
600 Amperes	400 Amperes
800 Amperes	600 Amperes
1200 Amperes	800 Amperes

2.09 INSTRUMENTATION (DISTRIBUTION PANELBOARDS)

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
 - 1. Potential Transformers: Secondary voltage rating of 120 volt and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 - 2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
 - 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3kV.
 - 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.
- B. Main Bus:
 - 1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.
- C. Each Feeder:
 - 1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.

- d. KWH, revenue-grade, nonresetable. KWH meter to have pulsed output, same as utility meter.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount top of trim to be 74 inches above finished floor, unless otherwise indicated.
- B. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- C. Install overcurrent protective devices and controllers. Set field-adjustable switches and circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Stub four one-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four one-inch empty conduits into raised floor space or below slab not on grade.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 DIRECTORY

- A. Provide a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directories. Handwritten directories are not acceptable.

3.03 IDENTIFICATION DEVICES

- A. Label each panelboard with an engraved laminated plastic nameplate as specified in Division 26, "Identification."

3.04 ACCEPTANCE TESTING

- A. After all wiring is complete, all feeder and branch circuit terminations shall be checked with a torque wrench. Torque levels shall be in accordance with NETA Standard ATS unless otherwise specified by the manufacturer. A test report which gives the following information for each panelboard shall be submitted to the Engineer two weeks prior to final inspection:
 - 1. Size and insulation type of the phase, neutral and ground conductors.
 - 2. Phase-to-phase and phase-to-neutral operating load voltage.
 - 3. Operating load current (each phase, neutral and ground).
- B. Phase-to-phase and phase-to-neutral conductor insulation resistance. The test shall be made with a DC "Megger" (500-volt minimum) type tester. If tests indicate faulty insulation (less than 8 megohms), the conductors shall be replaced and retested.
- C. Comply with Section 260126, Acceptance Testing of Electrical Systems.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.03 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 2 PRODUCTS

2.01 GENERAL

- A. Devices with preconnectorized pigtails are not acceptable.

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Specification Grade
 - a. Arrow Hart
 - b. Hubbell
 - c. Leviton
 - d. Pass & Seymour
 - 2. Industrial Extra Duty Grade
 - a. Hubbell. No Substitutions.

2.03 SPECIFICATION-GRADE DEVICES

- A. Straight Blade Receptacles:
 - 1. Convenience Receptacles, 125-volt, 15 ampere, NEMA 5-15R. Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; 5252 (duplex)
 - b. Hubbell; 5252 (duplex)
 - c. Leviton; 5252 (duplex)
 - d. Pass & Seymour; 5252 (duplex)
 - 2. Dedicated Receptacles, 125-volt, 20 ampere, NEMA 5-20R. Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; 5352 (duplex)
 - b. Hubbell; 5352 (duplex)
 - c. Leviton; 5352 (duplex)
 - d. Pass & Seymour; 5352 (duplex)
 - 3. Isolated-Ground, Duplex Convenience Receptacles, 125-volt, 20 ampere, NEMA 5-20R. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; CR5253IG
 - b. Leviton; 5362-IG
 - c. Pass & Seymour; IG6300
 - 4. Tamper-Resistant Convenience Receptacles, 125-volt, 20 ampere, NEMA 5-20R. Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; TR8300
 - b. Hubbell; BR20TR series
 - c. Leviton; TBR20
 - d. Pass & Seymour; 63H

5. Surge Suppression Device (SPD) Receptacles, 125-volt, 20 ampere, NEMA 5-20R. Subject to compliance with requirements, provide one of the following products:
 - a. Pass & Seymour; IG 6362-050
 - b. Hubbell; IG5360SA
- B. GFCI Receptacles:
 1. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
 2. Duplex GFCI Convenience Receptacles, 125-volt, 20 ampere: Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; SGF20
 - b. Hubbell; GFRST20 series
 - c. Pass & Seymour; 2097TRA
 - d. Leviton; GFNT2
- C. USB Receptacles:
 1. General Description: Straight blade. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL1310, Type A, Class 2.0 with LED power indicator light.
 2. Duplex USB Convenience Receptacles, 125-volt, 20 ampere; USB 5V DC 3.8 Ampere: Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; USB20X2. No Substitutions.

2.04 INDUSTRIAL EXTRA-DUTY GRADE DEVICES

- A. Straight Blade Receptacles:
 1. Convenience Receptacles, 125-volt, 15 ampere, NEMA 5-15R with one piece brass mounting strap. Subject to compliance with requirements, provide one of the products:
 - a. Hubbell; HBL5262 (duplex). No substitutions.
 2. Dedicated Receptacles, 125-volt, 20 ampere, NEMA 5-20R with one piece brass mounting strap. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; HBL5362 (duplex). No substitutions.
 3. Isolated-Ground, Duplex Convenience Receptacles, 125-volt, 20 ampere, NEMA 5-20R, with brass mounting strap. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; IG5362 (duplex). No substitutions.
 4. Tamper-Resistant Convenience Receptacles, 125-volt, 20 ampere, NEMA 5-50R, with brass mounting strap. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; HBL5362TR (duplex). No substitutions.
 5. Surge Suppression Device (SPD) Receptacles, 120-volt, 20 ampere, NEMA 5-20R with end of life light and audio alarm. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; HBL5362SA. No substitutions.
- B. GFCI Receptacles:
 1. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped and end of life indicator.
 2. Duplex GFCI Convenience Receptacles, 125-volt, 20 ampere: Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; GFR5362SG. No substitutions.

2.05 TOGGLE SWITCHES

- A. Comply with NEMA WD 1 and UL 20.

- B. Switches, 120/277 Volt, 20 Amperes: Subject to compliance with requirements, provide one of the following products:
 - 1. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way)
 - 2. Hubbell; 1221 (single pole), 1222 (two pole), 1223 (three way), 1224 (four way)
 - Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way)
 - 3. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)
- C. Pilot Light Switches, 20 Ampere: Subject to compliance with requirements, provide one of the following products:
 - 1. Cooper; 2221PL for 120 Volt and 277 Volt
 - 2. Hubbell; HPL1221PL for 120 Volt and 277 Volt
 - 3. Leviton; 1221-PLR for 120 Volt, 1221-7PLR for 277 Volt
 - 4. Pass & Seymour; PS20AC1-PLR for 120 Volt
- D. Key-Operated Switches, 120/277 Volt, 20 Ampere: Subject to compliance with requirements, provide one of the following products:
 - 1. Cooper; 2221L
 - 2. Hubbell; HBL1221L
 - 3. Leviton; 1221-2L
 - 4. Pass & Seymour; PS20AC1-L

2.06 WEATHERPROOF RECEPTACLES

- A. Provide 20A duplex GFCI receptacle with metallic cover that is UL Extra-Duty While-In-Use weatherproof whether or not the attachment plug is inserted.
 - 1. Intermatic WP 1010MC cover.
 - 2. Hubbell WP26E

2.07 DEVICE PLATES

- A. Finished Areas-Surface or Flush-Mounted: 302 stainless steel.
 - 1. Hubbell; SS Series
 - 2. Pass & Seymour
- B. Unfinished Areas-Surface-Mounted Devices: 4/S raised steel.

2.08 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: White.
 - 2. Wiring Devices Connected to Generator: Red.
 - 3. Wiring Devices Connected to UPS: Gray.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 2. Install device boxes in brick or block walls so that the coverplate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors: The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300 without pigtails.

- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than six inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-ampere circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation: Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated mount flush with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

- A. Receptacles: Laser-engraved faceplate with panel and circuit number.
- B. Special Receptacles Other Than 15 or 20 Ampere, 120 Volt: Laser-engrave faceplate with ampere rating, voltage, phase, panel, and circuit number.
- C. Computer Receptacles: Laser-engrave "Computer" in 3/16 inches high letter on the top of the plate. Laser-engrave with panel and circuit number at the bottom of the plate.
- D. Receptacles Installed in a Multi-System Wall Box: Labeled with panel and circuit number utilizing a computer-generated printed self-adhesive label.

3.03 INSTALLED SPARE DEVICES

- A. Provide the following installed spare devices:

<u>Device</u>	<u>Quantity</u>
Dedicated Duplex Receptacle	12
Double Duplex Receptacle	4
Furniture Feed	2

- B. Spare devices shall include 75 feet of conduit, faceplates, all required wire, cutting, patching and painting for a complete installation. Location of these units to be determined by the Owner's representative at the site. The Contractor shall assume that these devices will be installed after all other work is completed. Installation shall occur on an accelerated (night/weekend) schedule. Unused devices are to be (turned over) to the Owner.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.03 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman
 - 2. Ferraz Shawmut
 - 3. Littelfuse

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.03 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: Provide for each size of fuse.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

3.02 FUSE APPLICATIONS

- A. Service Entrance: Class RK1, time delay.
- B. Feeders: Class RK1, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet (if no location is shown, install in the Main Electrical Room).

3.04 SPARE FUSES

- A. Provide one complete set of spare fuses (three fuses to a set) for each size and type shown. Install spare fuses in a spare fuse cabinet in the Main Electrical Room. Any spare fuses utilized during

testing must be replaced to leave the Owner a complete set of spare fuses at completion of the project.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of enclosed switch, circuit breaker and accessory being provided.

1.03 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton
- B. The basis of design for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the basis of design.
 - 3. The equipment dimensions are equal to or smaller than the basis of design.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch-600A and Smaller: NEMA KS 1, Type HD with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Nonfusible Switch-600A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.03 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Molded-Case Circuit Breaker: NEMA AB 1 with interrupting capacity to meet available fault currents. Provide with the following features and accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
- B. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating. Provide with the following features and accessories:
 - 1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

2.04 ENCLOSURES

- A. Rated for environmental conditions at installed locations.
 - 1. Outdoor, wet, or damp locations; NEMA 250, Type 3R.
 - 2. Shop Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other wet or damp indoor locations; NEMA 250, Type 4.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Control Equipment Mounted to Walls: Mount adjacent units at uniform height. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. Provide freestanding racks complying with Division 26, Section 260529, "Hangers and Supports," for controllers not located on walls.
- B. Floor-Mounted Control Equipment: Anchor to concrete base.
- C. Install fuses in each fusible switch.

3.02 IDENTIFICATION DEVICES

- A. Label each switch and circuit breaker on engraved laminated plastic as specified in Division 26, Section 260553, "Identification."

3.03 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.04 ACCEPTANCE TESTING

- A. Comply with Section 260126, Acceptance Testing of Electrical Systems.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of enclosed controller and accessory being provided.

1.03 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
 - 4. Eaton
- B. The basis of design manufacturer for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the Basis of Design.
 - 3. The equipment dimensions are equal to or smaller than the Basis of Design.

2.02 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller:
 - 1. Generator: NEMA ICS 2, general purpose, Class A with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."
 - 2. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
 - 3. Accessories: Pilot light.
- B. Magnetic Controller:
 - 1. Generator: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, NEMA 1 (minimum) unless otherwise indicated.
 - 2. Control Circuit: 120 volt; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
 - 3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 20 30 tripping characteristic and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection with start and run delays to prevent nuisance trip on starting.
 - 4. Accessories: Red pilot light, green pilot light, hand-off-automatic switch, 2-N.O. and 2-N.C. contacts.

- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
 - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
 - 2. Control Circuit, 120 volt: Obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
 - 3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 20 30 tripping characteristic and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection with start and run delays to prevent nuisance trip on starting.
 - 4. Accessories: Red pilot light, green pilot light, hand-off-automatic switch, 2-N.O. and 2-N.C. contacts.

2.03 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition.

2.04 ELEVATOR SERVICE DISCONNECT

- A. Manufacturer: Bussman
- B. General: Provide surface-mounted elevator power module switch located as shown on the drawings. Module switch assembly shall include shunt trip, fire interface relay, control power transformer with fuses, pilot lights and key to rest.
- C. Automatic Service Disconnect:
 - 1. Means shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water in accordance with WAC 296-81-2787 and ANSI A17.1-102.2(C)4.
 - 2. Fixed temperature heat detectors (135 degrees F) shall be provided at the top of the elevator hoistway and within the elevator equipment room to disconnect the main line power of the elevator prior to the application of water from the sprinkler.
 - 3. Heat detectors shall be ceiling mounted and located within 18 inches of each sprinkler head. Heat detectors shall be an auxiliary function of the elevator equipment only, and shall be identified "Elevator Control Only - DO NOT TEST."
 - 4. Power for the automatic disconnect control circuit shall be derived from the load side of the elevator power main disconnecting means. The disconnect control device shall be located in the Elevator Equipment Room and shall be easily identifiable.

2.05 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Shop Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.06 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Control Equipment Mounted to Walls: Mount adjacent units at uniform height. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. Provide freestanding racks complying with Division 26, "Hangers and Supports," for controllers not located on walls.
- B. Floor-Mounted Control Equipment: Anchor to concrete base.
- C. Install fuses in each fusible switch.

3.02 IDENTIFICATION DEVICES

- A. Label each controller with an engraved laminated plastic as specified in Division 26, Section 260553, "Identification."

3.03 ADJUSTING

- A. Set field adjustable overload relays.

3.04 ACCEPTANCE TESTING

- A. Comply with Section 260126, Acceptance Testing of Electrical Systems.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. Related Section: Division 26, "Transfer Switches."

1.02 SUBMITTALS

- A. Product Data: Submit for each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator
 - 2. Time-current characteristic curves for generator protective device
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
 - 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
 - 4. Wiring Diagrams: Show all power, signal, and control wiring connections.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain within 100 miles of project site, a service center capable of providing training, parts and emergency maintenance repairs.
- B. Comply with IFC.
- C. Comply with NFPA 37.
- D. Comply with NFPA 70.
- E. Comply with NFPA 99.
- F. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- G. Comply with UL 2200.
- H. UL field-labeled according to NEC Article 700.
- I. Engine Exhaust Emissions:
 - 1. Comply with EPA Tier 3 requirements.
 - 2. Comply with all state and local requirements.
- J. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- K. Seismic Importance Factor (Ip): 1.5

1.04 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Five to 40 degrees C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Provide products complying with the requirements here within:
 - 1. Caterpillar
 - 2. MTU
 - 3. Cummins

2.02 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated on the one-line diagram.
 - 2. Output Connections: Three phase, four wire as indicated on the one-line diagram.
- D. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: Three percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - 5. Transient Frequency Performance: Less than five percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 - 6. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral shall not exceed five percent total and three percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - 7. Sustained Short-Circuit Current: System shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components for a three-phase, bolted short circuit at system output terminals.
 - 8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 RPM.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 FPM.

- D. Lubrication System: The following items are mounted on engine or skid:
 - 1. Filter and Strainer: Rated to remove 90 percent of particles five micrometers and smaller while passing full flow.
 - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Engine Fuel System:
 - 1. Main Fuel Pump: Mounted on engine, pump ensures adequate primary fuel flow under starting and load conditions.
 - 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. Governor: Mechanically adjustable electronic isochronous with speed sensing.
- H. Cooling System: Closed loop, liquid cooled with radiator factory mounted on engine generator-set mounting frame and integral engine-driven coolant pump.
 - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water with anticorrosion additives as recommended by engine manufacturer.
 - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig maximum working pressure with coolant at 180-degree F, and non-collapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- I. Muffler/Silencer: Critical grade, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
- J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 24-volt electric with negative ground.
 - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions."
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" to provide specified cranking cycle at least three times without recharging.
 - 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - 6. Battery Compartment: Factory fabricated metal with acid-resistant finish and thermal insulation. A thermostatically controlled heater shall be arranged to maintain battery above 10

- degree C regardless of external ambient temperature within range specified in Part 1 "Project Conditions." Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 ampere shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. The unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from -40 degree C to +60 degree C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to ± 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low-battery voltage and close contacts providing low-battery voltage indication on control and monitoring panel. Sense high-battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.04 FUEL OIL STORAGE

- A. Comply with NFPA 30 and the International Fire Code (IFC).
- B. Base-Mounted, Double-Walled Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 1. Tank level indicator
 2. Capacity: Fuel for 24 hours continuous operation at 100 percent rated power output.
 3. Vandal-resistant fill cap
 4. Containment Provisions: Comply with requirements of Authorities Having Jurisdiction and the IFC.

2.05 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When the mode-selector switch is switched to the on position, generator set starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. The mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
 1. AC voltmeter
 2. AC ammeter
 3. AC frequency meter
 4. DC voltmeter (alternator battery charging)
 5. Engine-coolant temperature gage

6. Engine lubricating-oil pressure gage
 7. Running-time meter
 8. Ammeter-voltmeter, phase-selector switch(es)
 9. Generator-voltage adjusting rheostat
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- E. Connection to Data Link: Provide a separate terminal block, factory-wired to Form C dry contacts, for each alarm and status indication.
- F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include the following necessary contacts and terminals in control and monitoring panel:
1. Overcrank shutdown
 2. Coolant low-temperature alarm
 3. Control switch not in auto position
 4. Battery-charger malfunction alarm
 5. Battery low-voltage alarm
- G. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. The silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- H. Remote Emergency-Stop Switch: Flush wall mounted, unless otherwise indicated; and labeled. Pushbutton shall be protected from accidental operation.

2.06 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.
1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.07 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.

- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified. Adjusting rheostat on control and monitoring panel shall provide plus or minus five percent adjustment of output-voltage operating band.

2.08 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.09 ACOUSTICAL ENCLOSURE

- A. Heavy-gauge, weatherproof, reinforced steel sound attenuated enclosure which mounts directly to the generator skid base. Provide hinged doors to allow access to the engine generator and a hinged rear door to provide access to the control panel. The maximum sound level at seven meters shall be 70 dBA with the engine generator operating at rated load.

2.010 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with restrained spring isolators having a minimum deflection of one inch on a four-inch-high concrete base. Secure sets to anchor bolts installed in concrete bases.
- D. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 23.
- E. Electrical Wiring: Install and wire all electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.02 CONNECTIONS

- A. Piping installation requirements shall comply with Division 23 Sections.
- B. Provide vent piping with rain caps. Connect to tank and interstitial vents.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to generator with a ball valve, and union and flexible connector.

- E. Provide required wiring to remote alarm annunciations. Provide required wiring to automatic transfer switches. Provide required wiring to remote emergency stop switches.

3.03 ACCEPTANCE TESTING

- A. Engage a factory-authorized service representative to perform tests and inspections and prepare test reports.
- B. Provide load bank and cables required for testing.
- C. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 - 7. Exhaust Emissions Test: Comply with applicable government test criteria.
 - 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
 - 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 - 10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at two locations on the property line, and compare measured levels with required values.
 - 11. Full Load Test: Run generator at full load for four hours. During all tests, monitor and record fuel consumption, load, voltage, frequency, oil pressure and water temperature. Record all readings prior to the test, every fifteen minutes during the test, and at the completion of the test.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. A copy of the test report shall be included in the Operations and Maintenance Manuals.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.
- B. Coordinate training with that for the transfer switches.

3.05 FUELING

- A. Provide all required fuel for testing.
- B. After the successful completion of all tests and training sessions, change all the filters and fill the tank with No. 2 diesel fuel.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. Related Section: Division 20, "Engine Generators."

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product indicated.
- B. Related Section: Division 26, "Engine Generators."

1.03 QUALITY ASSURANCE

- A. Comply with NEMA ICS 1.
- B. Comply with NFPA 70.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these specifications are stricter.
- F. UL field-labeled according to NEC Article 700.

1.04 LOAD SHED

- A. Provide automatic load-shed system to transfer all standby transfer switches to the neutral position when the load on the generator reaches 90 percent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Same as engine generator.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in project under the fault conditions indicated, based on testing according to UL 1008. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus two percent or better over an operating temperature range of minus 20 to plus 70 degree C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Switch Action: Double throw; mechanically held in both directions.

2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units rated 225 ampere and higher shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Underload with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from one to 30 seconds.
- E. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- F. Automatic Transfer-Switch Features:
 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 2. Adjustable Time Delay: Override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 5. Test Switch: Simulate normal-source failure.
 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 ampere, 240-volt ac.
 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 ampere at 32-volt dc minimum.
 11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
 12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from seven to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for a seven-day exercise cycle, 20-minute running period, and five-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.04 BYPASS/ISOLATION SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
 3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by one person in no more than two operations in 15 seconds or less.
 6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
 7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
- C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

PART 3 EXECUTION

3.01 IDENTIFICATION DEVICES

- A. Identify system components, wiring, cabling, and terminals according to Division 26, "Identification."

3.02 ADJUSTING

- A. Set field-adjustable intervals and delays, relays and engine exerciser clock.

3.03 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup services, programming and final commissioning of the system.
- B. Verify the installation complies with the manufacturer's installation requirements and the contract documents.
- C. Complete all startup checks according to the manufacturer's written instructions.
- D. Provide a written certification stating the system has been commissioned.

- E. A copy of the test reports shall be included in the Operations and Maintenance Manual.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches.
- B. Coordinate this training with generator equipment training.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. Provide Surge Protection Devices (SPD) as shown in the panel schedules on the one-line diagram.

1.03 DEFINITIONS

- A. SPD: Surge Protection Device
- B. TVSS: Transient Voltage Surge Suppressor

1.04 SUBMITTAL

- A. Product Data: Submit for each type of SPD provided.

1.05 WARRANTY

- A. 30-year unlimited free replacement with no exceptions.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Total Protection Solutions
- B. All part numbers refer to total protection solutions to establish minimum standards for quality and performance.

2.02 LISTING

- A. UL 1449, Current Edition.
 - 1. Type 1 and 2 allow for direct buss with no additional overcurrent protection requirements.
 - 2. Nominal Discharge Current (In): 20kA for Main Service and 10kA for all other applications.
 - 3. SCCR: 200KA short circuit current rating with no additional/external overcurrent protection.

2.03 SURGE CURRENT RATINGS

- A. Minimum Single Impulse Rating (Independent testing per NEMA LS1).
 - 1. Main Service: 240KA/Phase (120KA/Mode)
 - 2. Distribution and Branch Panels: 120KA/Phase (60KA/mode)

2.04 MODE OF PROTECTION

- A. Discrete MOV Line-to-Neutral, Line-to-Ground, Neutral-to-Ground with Sinewave Tracking transient filter protection for all modes.

2.05 DURABILITY TESTING

- A. Minimum 5,000 ANSI/IEEE C3 (20KV, 10KA) surges with less than 7% LTV deviation.

2.06 COMPONENT LEVEL FUSING

- A. Balanced array MOV based SPD/TVSS with individual Component Level Fusing (Oxygen Free High Conductivity elements in sand) required for all components.

2.07 MONITORING

- A. Phase Status LEDs, Red Service Required LED, Dry Contacts and Audible Alarm with silence button.

2.08 MAXIMUM CONTINUOUS OPERATING VOLTAGE

- A. 115% above nominal, minimum.

2.09 ENCLOSURES

- A. Heavy-duty steel with appropriate NEMA rating for application.

2.010 MAXIMUM LET THROUGH VOLTAGES

- A. Tested with 6 inch leads and 500-MHz scope from 0 ref per NEMA-LS1 shall be as follows:

MAIN SERVICE APPLICATIONS

Voltage Configuration	Test Waveform	L-N	L-G	L-L	N-G	Phase °
480Y/277V	IEEE C3 – 20 kV/10ka	1187	1540	1950	1500	90°
	UL VPR – 6 kV/3kA	1200	1200	1800	1200	90°
	IEEE A1 – 2kV – 67A	44	77	54	52	180°
208Y/120V	IEEE C3 – 20 kV/10kA	907	1173	1267	1090	90°
	UL VPR – 6 kV/3kA	800	800	1200	800	90°
	IEEE A1 – 2kV – 67A	40	76	54	46	180°

MCC, DISTRIBUTION & BRANCH PANEL APPLICATIONS

Voltage Configuration	Test Waveform	L-N	L-G	L-L	N-G	Phase °
480Y/277V	UL VPR – 6 kV/3kA	1200	1200	2000	1200	90°
	IEEE A3 – 6kV – 200A	71	119	73	67	180°
	IEEE A1 – 2kV – 67A	27	52	39	48	180
208Y/120V	UL VPR – 6 kV/3kA	700	700	1200	700	90°
	IEEE A3 – 6kV – 200A	56	81	88	112	180°
	IEEE A1 – 2kV – 67A	29	46	39	40	180°

2.011 MAIN SERVICE SWITCHBOARD DEVICES

- A. 480Y/277V: Total Protection Solutions No. ST240-3Y480-FL
B. 208Y/120V: Total Protection Solutions No. ST240-3Y208-FL

2.012 DISTRIBUTION PANEL AND PANELBOARD DEVICES

- A. 480Y/277V: Total Protection Solutions No. LP120-3Y480-FL
B. 208Y/277V: Total Protection Solutions No. LP120-3Y208-FL

PART 3 EXECUTION

3.01 PREINSTALLATION TRAINING

- A. Prior to installation, training shall be conducted by the local manufacturer's representative. Contact Power Solutions NW at (206) 930-1980.

3.02 INSTALLATION

- A. Install devices per manufacturer's installation instructions.
- B. Main Service:
 - 1. Provide 30A-3P circuit.
 - 2. Provide #6 AWG conductors from circuit breaker to SPD.
 - 3. Maximum conductor length shall be 24".
- C. Distribution Panels and Panelboards:
 - 1. Provide 30A-3P circuit protector. Install circuit breaker in pole position closest to the neutral bus.
 - 2. Mount SPD directly adjacent to the 30-amp circuit breaker.
 - 3. Make lead lengths as short and straight as possible. Maximum lead length is 16 inches.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. LED: Light Emitting Diode
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting fixture, including lamp, ballast and/or driver, if included.

1.03 SUBMITTALS

- A. Product Data: Provide for each type of product being used on project.
- B. Shop Drawings: Provide as specified on the luminaire schedule.
- C. Special Submittals: Provide special submittals as specified on the Luminaire Schedule.

1.04 CLOSEOUT SUBMITTALS

- A. Provide for all lighting equipment and luminaires including the following:
 - 1. Specification sheets for each type of luminaire, lamp, ballast, and driver.
 - 2. LED Fixtures: Provide a list that gives the driver part number for each luminaire type.

1.05 COORDINATION

- A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Provide ballasts/drivers that match the service voltage being provided to the fixture.
- C. Provide ballasts/drivers as required to accommodate the fixture switching/dimming scheme shown on the drawings.

1.06 EXTERIOR AND DAMP LOCATION FIXTURES

- A. Fixtures installed in the following locations shall be UL listed and labeled for wet locations:
 - 1. Exterior locations
 - 2. Interior wet locations
 - 3. Interior damp locations

1.07 ACCESSORIES

- A. General: Provide all required hardware and accessories for complete installation.
- B. Trims: The Contractor shall coordinate with the architectural drawings and provide the appropriate trim for each recessed fixture.

1.08 MANUFACTURERS' CATALOG NUMBERS

- A. Catalog series numbers specified represent the type and style of luminaire. Complete part numbers shall be based on series numbers and written descriptions in Luminaire Schedule.

1.09 WARRANTY

- A. Special Warranty for LED Luminaires, Drivers, and Controllers for Solid-State Lighting Systems: Provide a five-year warranty against defects in workmanship or material. Warranty shall include labor charges incurred for replacement of inoperative in-warranty equipment.

1.010 LUMINAIRE TYPE SYMBOLS

- A. The luminaire type symbols indicated on the drawings are intended to show the type of luminaire in that general area. If a luminaire-type symbols is missing from a particular room or area, the Contractor shall assume, for the purpose of bidding only, that the luminaire type is HA1.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Refer to Luminaire Schedule on the drawings.
- B. LED Diode:
 - 1. CREE
 - 2. Nichia
 - 3. Osram Opto Semiconductors
 - 4. Philips Lumileds

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- D. Diffusers:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and/or UV radiation.
 - a. Lens Thickness: 0.125 inch minimum.
 - b. UV stabilized.
- E. Linear Luminaires:
 - 1. Linear luminaires are shown in individual four-foot sections on the drawings. Extruded luminaires may be provided in 12-foot sections (maximum) at the Contractor's option. Provide a separate driver for each four-foot luminaire section.
 - 2. LED linear luminaires are shown actual length on the drawings based on increments offered by manufacturer. Driver quantity to be based on manufacturer's recommendation per fixture length.

2.03 GENERAL REQUIREMENTS FOR LEDS

- A. Correlated color temperature (CCT) for phosphor-coated white LEDs must have one of the following designated CCT's and fall within the following binning standards:
 - 1. 2700K defined as 2725 +/- 145K
 - 2. 3000K defined as 3045 +/- 175K

3. 3500K defined as 3465 +/- 245K
 4. 4000K defined as 3985 +/- 275K
 5. 4500K defined as 4503 +/- 243K
 6. 5000K defined as 5028 +/- 283K
 7. 5700K defined as 5665 +/- 355K
 8. 6500K defined as 6530 +/- 510K
- B. Color spatial uniformity shall be limited to variations in chromaticity for different directions (i.e., changes in viewing angle).
- C. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 over the lifetime of the product.
- D. Color Rendering Index:
1. Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
 2. Laboratory tests must be produced using specific module(s)/array(s) and driver combination that will be used in production.
 3. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories.
- E. Lumen Depreciation:
1. Lumen depreciation to be measured using IESNA LM-80-08 standard for IES approved method of measuring lumen maintenance of LED light sources.
 2. Phosphor coated white LED module(s)/array(s) shall deliver at least 70% of initial lumens for a minimum of 35,000 hours when installed in position and operated at 100% output and the maximum specified operating temperature.
 3. Colored LED module(s)/array(s) shall deliver at least 50% of initial lumens for a minimum of 35,000 hours when installed in position and operated at 100% output and the maximum specified operating temperature.
- F. Luminaire Efficacy:
1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid-state lighting products.
 2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include driver, thermal, optical, and luminaire losses.
- G. Thermal Management:
1. Solid-state luminaire shall not exceed LED manufacturer's maximum junction temperature requirements when operated in position at luminaire manufacturer's maximum ambient operating temperature and 100% light output.
 2. Solid-state luminaire shall be thermally protected using one or more of the following thermal management techniques:
 - a. Metal Core Board
 - b. Gap Pad
 - c. Internal Monitoring Firmware
 3. Solid-state luminaire housing shall be designed to transfer heat from the LED board to the outside environment.

2.04 LED DRIVERS

- A. The driver shall have a power factor of 0.90 or greater for primary application.
- B. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%.
- C. Driver shall have a minimum operating temperature of minus 4 degrees Fahrenheit (minus 20 degrees Celsius) or below when used in luminaires intended for outdoor applications.

- D. The driver's output operating frequency to be equal to or greater than 120 Hz.
- E. The driver shall operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
- F. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
- G. Driver output shall be regulated to +/- 5% across the published load range.
- H. The driver shall have a Class A sound rating.
- I. Driver output shall have current limiting protection.
- J. Driver shall operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.

2.05 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, the relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and a flashing red LED.

2.06 EMERGENCY EGRESS LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. The lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Integral Time-Delay Relay: Holds unit on for fixed interval of 90 minutes when power is restored after an outage.
 - 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and a flashing red LED.

2.07 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with Section 260529, "Hangers and Supports for Electrical Systems" for channel- and angle-iron support.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire, unless noted otherwise in Luminaire Schedule.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single luminaire. Finish same as luminaire, unless noted otherwise in Luminaire Schedule.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

2.08 LED LUMINAIRES

- A. All hardwired connections to solid-state luminaires shall be reverse polarity protected and provide high-voltage protection in the event connections are reversed.
- B. Solid-state lighting installations shall be UL listed as a low voltage lighting system, including, but not limited to; luminaire, driver, controller, keypad and wiring.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Luminaires:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamp(s) in each luminaire.
 - 3. Contractors shall not install luminaire lenses, diffusers, or parabolic louvers in luminaires until general construction work is complete, including painting. Dirty lenses, diffusers, or louvers shall be removed, washed, and rinsed as recommended by luminaire manufacturer.
- B. Temporary Lighting: Do not use permanent luminaires for temporary lighting unless approved by the Design Team. If approved to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts/Drivers: Distance between the ballast/driver and luminaire shall not exceed that recommended by ballast/driver manufacturer. Verify maximum distance between ballast/driver and luminaire with ballast/driver manufacturer.
- D. Lay-in Ceiling Luminaire Supports:
 - 1. Do not use ceiling grid as support for fixtures.
 - 2. Install ceiling support system rods or wires independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
 - 3. Support Clips: Fasten to luminaire and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
 - 4. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaire independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 5. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have broken strength of the weight of luminaire at a safety factor of 3.
- E. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 3. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. All pendant-mounted luminaires shall contain horizontal restraints. Provide aircraft cable between luminaire housing and adjacent structure in four directions.
- G. Mounting Heights:
1. Pendant-mounted luminaires shown on plans or in specifications shall be to the bottom of the luminaire.
 2. Wall-mounted luminaires shall be to the center of the outlet box unless otherwise noted.
- H. The contractor shall coordinate the location and mounting heights of the luminaires in mechanical rooms with the available space left between the various ducts and piping.
- I. The contractor shall clean and re-lamp all existing luminaires being reused in remodeled areas and replace any broken or defective parts including noisy ballasts.
- J. All existing luminaires not being reused and not to be retained by the Owner shall become the property of the Contractor and be removed from the site.
- K. Contractors shall remove all ballasts that contain PCB's and dispose of them in accordance with local, state and federal regulations. Provide receipt from governing agency indicating the quantity of ballasts disposed.

3.02 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in "Identification for Electrical Systems."

3.03 INSTALLED SPARE PARTS

- A. Provide the following spare parts:

<u>Device</u>	<u>Quantity</u>
EA1	8
HA1	8
RA1	4
SA1	4
WA1	4

- B. Spare devices shall include 75' of conduit and wiring as required for complete installation. Location of these units to be determined by the Owner's Representative at the site. The Contractor shall assume that these devices will be installed after all other work is completed. Installation shall occur on an accelerated (night/weekend) schedule. Unused units are to be turned over to the Owner.

END OF SECTION

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27 02 00 General Requirements (Structured Cabling Systems and Pathways and Spaces systems for all Voice and Data systems)

27 02 01 Summary

A. The Scope of Work covered by this document is to furnish and install the Structured Cabling Systems and Pathways and Spaces systems for _____. This work will provide for the structured cabling system (SCS) for all Voice and Data systems. Work on this project will commence after the award of the bid to a successful bidder.

B. Contact Information:

1. PSE's Representative:

Name Steve Brooks
Company: Puget Sound Energy
Address: 20000 N. Creek Parkway, Bothell, WA 98011
Phone:

E-Mail: Structured Cabling Designer:

Name:
Company: Puget Sound Energy
Address:
Phone:
E-Mail:

C. Telecommunications system shall include the following systems:

1. Structured Cabling System (SCS) For Telecommunications Systems
2. Pathways for Telecommunications Systems
3. Grounding and Bonding System (GBS) For Telecommunications Systems
4. Firestopping for Telecommunications Systems

27 02 05 Additional Requirements

- A. **Integration:** Responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and suppliers shall rest with Contractor named in construction contract issued by PSE's Representative. Work covered by this division of specifications shall be coordinated with related work indicated on drawings or specified elsewhere under project specifications. Work related to telecommunications system shall be performed under direct supervision of telecommunications system installer in a manner approved by product manufacturer.
- B. **Coordination of work:** Contractor shall be responsible for coordination of work among project specification divisions and contractor/subcontractors involved in this project. This coordination of Work Includes following instructions provided the Construction Manager or General Contractor if project is managed by such. See section 27 02 10 for additional information.
- C. **General compliance requirements:** Provide a complete and operable system in compliance with project drawings, specifications, referenced standards, applicable building codes, and Authority Having Jurisdiction (AHJ) requirements. Scope of this contract includes planning, design, materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on drawings or contained in specifications. Comply with all contract documents, specifications, drawings, manufacturer's instructions, and PSE and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify PSE's representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from PSE's representative. Work includes all items required for complete system whether or not identified in specification or drawings.
- D. Information about general construction and architectural features and finishes shall be derived from structural and architectural drawings and specifications only.
- E. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- F. Work related to telecommunications system shall be installed by an SCS manufacturers authorized or certified trained installer and supervised an SCS manufacturers authorized or certified SCS Engineer. PSE reserves the right to review and approves any personnel assigned to this project in a supervisory or managerial role.
- G. SCS contractor shall have had at least 10 years of comparable experience with telecommunications projects. As part of the proposal, SCS installer shall submit at least three (3) comparable Project reference descriptions with reference contacts. Comparable projects shall equal or exceed size and complexity of work on drawings.
- H. **Complete and usable work:** Refer to and comply with requirements in section 27 02 67 outlined below.

27 02 10 Related Documents and Drawings

- A. **General:** The project drawings and general conditions of Contract shall apply to this section.
- B. **Coordination:** Coordinate with work specified in other sections and divisions of specifications.
- C. **Reference:** Codes and standards as referenced in Section 27 02 20 may define additional specifications or requirements not specifically called out within this division. However, contractor shall adhere to most stringent requirements as defined herein, or as defined by reference within section 27 02 20.
- D. Architectural and Engineering specifications may have additional conditions or requirements that affect the work defined by this division of specifications. Contractor shall be responsible for the coordination of all conditions and other trade requirements that may impact schedule, scope of work, work progress, or other factors that may affect the overall ability for contractor to execute the requirements of this division of specifications.

27 02 20 Codes and Standards

- A. General: All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractor's Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.
- B. Other sections of this document contain References to Codes and Standards that are applicable to the section.

27 02 20.20 Codes

- A. Insulated Cable Engineers Association (ICEA)
 - ANSI/ICEA S-80-576-2002, Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems, 2002.
 - ANSI/ICEA S-84-608-2002, Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, 2002.
 - ANSI/ICEA S-90-661-2002, Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems, 2002.
 - ICEA S-102-700-2004, ICEA Standard for Category 6 Individually Unshielded Twisted-Pair Indoor Cables for Use in LAN Communication Wiring Systems Technical Requirements, 2004
- B. National Fire Protection Association (NFPA)
 - NFPA 70, National Electrical Code® (NEC®), 2008

NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, 2004

NFPA 72, National Fire Alarm Code®, 2007

NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment, 2009

NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities, 2009

NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2009

NFPA 101, Life Safety Code®, 2006

NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, 2006

NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces, 2007

NFPA 780, Standard for the Installation of Lightning Protection Systems, 2004

NFPA 5000™, Building Construction and Safety Code, 2006

27 02 20.40 Reference Standards

A. Telecommunications Industry Association (TIA)

ANSI X3T9.5, Requirements for UTP at 100 Mbps

TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning, 2001

TIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)

TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7

T-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14

TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009

TIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, 2009

TIA-568-C.2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components, 2008

TIA-568-C.3, Optical Fiber Cabling Components Standard, 2008

TIA-569-B, Commercial Building Standards for Telecommunications Pathways and Spaces, 2004

TIA-569-B-1, Commercial Building Standard for Telecommunications Pathways and Space – Addendum 1 – Temperature and Humidity Requirements for Telecommunications Spaces, 2009

ANSI/TIA-598-C, Optical Fiber Cable Color Coding, 2005

ANSI/TIA-604.2-A, FOCIS 2—Fiber Optic Connector Intermateability Standard, 2003

TIA-606, Administration Standard for Commercial Telecommunications Infrastructures, 2008

ANSI J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002

ANSI/TIA-758-A, Customer-owned Outside Plant Telecommunications Infrastructure Standard, 2005

ANSI/TIA-854, A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling, 2001

TIA-862, Building Automation Systems Cabling for Commercial Buildings, 2002

TIA-942, Telecommunications Infrastructure Standard for Data Centers, 2005

ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems, 2006

Category TSB-155, Guidelines for the Assessment and Mitigation of Installed 6 Cabling to Support 10GBASE-T, 2007

B. Other Reference Materials

ANSI/NECA/BICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling

BICSI Outside Plant Design Reference Manual (COOSP), current edition.

BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition

BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition

BICSI Network Design Reference Manual (NDRM), current edition

BICSI Telecommunications Distribution Methods Manual (TDMM), current edition

BICSI Wireless Design Reference Manual (WDRM), current edition

Institute of Electrical and Electronic Engineers (IEEE)

National Electrical Manufacturers Association (NEMA)

Underwriters Laboratories (UL) Cable Certification and Follow Up Program

27 02 25 Abbreviations, Acronyms and Definitions

27 02 25.20 Abbreviations and Acronyms

ACD	Automatic Call Distribution
AFF	Above Finished Floor
AWG	American Wire Gauge
BICSI	Building Industry Consulting Services International

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CAT5	Category 5 Copper Cable
CAT5e	Category 5e Copper Cable
CAT6	Category 6 Copper Cable
CAT6A	Category 6A Copper Cable
CDDI	Copper Distributed Data Interface
CMP	Communications Multipurpose Plenum: cable rating
CMR	Communications Multipurpose Riser: cable rating
EIA	Electronic Industries Association
ELFEXT	Equal-Level Far-End Crosstalk
FEXT	Far End Crosstalk
Gbps	Gigabits per second
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intermediate Distribution Frame - Termination frames, relay racks, and cable management
IEEE	The Institute of Electrical and Electronics Engineers
IM	Information Management
ISDN	Integrated Services Digital Network
LAN	Local Area Network
Mbps	Megabits per second
MDF	Main Distribution Frame, consisting of carrier entrance rooms and head-end
MMF	Multi-mode fiber optics, 50 or 62.5 micron laser optimized core
MUTOA	Multi-User Telecommunications Outlet Assembly
NEXT	Near End Cross Talk
NRTL	Nationally Recognized Testing Laboratories
OSHA	Occupational Safety and Health Act
PBX-	Private Branch Exchange: telephone switch
PDS	Premises Distribution Systems (See SCS.)
PoE	Power over Ethernet (IEEE 802.3af)
POP	Point of Presence
PSACR	Power Sum Attenuation-to-Crosstalk Ratio
PSAFEXT	Power Sum Alien Far-End Crosstalk
PSAELFEXT	Power Sum Alien Equal Level Far-End Crosstalk
PSANEXT	Power Sum Alien Near-End Crosstalk
PSELFEXT	Power Sum Equal Level Far-End Crosstalk
PSNEXT	Power Sum Near-End Crosstalk

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SCC	Security Command Center
SCS	Structured Cabling System, or Structure Connectivity System; a complete cabling system
SFF	Small Form Factor
SMF	Single-mode fiber optics, 8.3 micron core
TC	Telecommunications Closet
TE	Telecommunications Enclosure
TEF	Telecommunications Entrance Facility
TIA	Telecommunications Industry Association
TR	Telecommunications Room
TO	Telecommunications Outlet
TWC	Time Warner Cable - PSE
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WAO	Work Area Outlet
WAN	Wide Area Network

27 02 25.40 Definitions

Access Floor - A floor system that has removable floor panels.

Building Backbone Cabling – Cabling used to connect Floor Distributors (FD) or other local collection points to the Building Distributor (BD). Building backbone cabling typically carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling may include either fiber optic or copper cabling or both.

Building Distributor (BD) – Termination point from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF in Americas, Main Comms Room in EMEA and Communication Room, IT Lab or IT Room in AsiaPac. Referred to as BD in international and European industry standards and Intermediate Cross-connect (IC) in American industry standards. There is one BD for each building and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet). All BD's are linked to the

Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

Campus Distributor (CD) – Termination point from which all campus backbone cabling emanates and highest-level interconnection point for the network backbone. Commonly referred to as NOC in Americas and Main Comms Room in EMEA. Referred to as CD in international and European

industry standards and Main Cross-connect (MC) in American industry standards. On smaller campuses, there is one CD for the campus. On larger campuses there might be several CD's with each CD serving several buildings. Besides linking to each of the BD's it serves, the CD is also the network interconnection point for data center links and links to service providers.

Category 3 (Cat 3) – A category of transmission performance, defined in EIA standards, that specifies electrical properties up to 10 MHz. Cat 3 is the minimum performance grade permissible and is used typically for analog voice distribution.

Category 5e (Cat 5e) / Class D – A category/class of transmission performance that specifies electrical properties up to 155.5 MHz. Capable of supporting copper-based, four-pair Gigabit Ethernet (IEEE 802.3ab 1000BASE-T) applications. Category 5e is defined in TIA/EIA 568B.2 standard. Class D is defined in the ISO 11801 standard.

Category 6 (Cat 6) / Class E – A category/class of transmission performance that specifies electrical properties up to 250 MHz. Refer to the TIA/EIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements. Also refer to CENELEC EN50173.

Category 6A (Cat 6) / Class EA – A category/class of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to the TIA/EIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class EA requirements.

Certification – The testing and documentation of the transmission performance (e.g., Category 5e / Class D) of a permanent link or channel, based on sweep frequency (where applicable) testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of installation. Channel certification is optional and is the responsibility of the group using the channel.

Channel – The entire physical pathway between active equipment ports, inclusive of all patch cords, patch panels, jacks and cabling segments.

Class C – A category of transmission performance, defined in ISO and EN standards, that specifies electrical properties up to 16 MHz (equivalent to EIA

Conduit – A raceway of circular cross-section.

Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point (MPOE) and interconnection point to the network. Commonly referred to as Telco Room in Americas, POP Room in EMEA and Building Entrance in AsiaPac. Referred to as Building Entrance Facility in international and European industry standards and Entrance Facility (EF) in American industry standards. The EF is linked to the CD, where present, or to the BD.

Floor Distributor (FD) – Termination point for horizontal cabling and interconnection point for network access. Commonly referred to as IDF in Americas and AsiaPac and as Sub Comms Room in EMEA. Referred to as Floor Distributor (FD) in international and European industry standards and Horizontal Cross-connect (HC) - FD quantities and locations are determined by building size and geometry so that all points served are within 90 cable meters (295 cable feet) of an FD. The FD feeds all Telecommunications Outlets (TO's) in its service zone. All FD's in a building are linked to the building's Building Distributor (BD) via backbone cabling.

Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.

Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept is based on the assumption that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed and the electrical characteristics of the permanent link will remain unaltered.

Plenum -A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

Spine – also called a backbone, the main communications cables in an IDF.

27 02 30 Project Drawings

- A. **General Drawing Specifications:** Detail and elevation drawings shall be D size (24" x 36") with a minimum scale of $1/4" = 1'0"$ or larger. ER, TR and other enlarged detail floor plan drawings shall be D size (24" x 36") with a minimum scale of $1/4" = 1'0"$ or larger. Building composite floor plan drawings shall be D size (24" x 36") with a minimum scale of $1/8" = 1' 0"$.
- B. **Building composite floor plans:** Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations. Identify TO's that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for PSE's Representative's consideration.
- C. **Telecommunications space plans/elevations:** Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.
- D. **Logical Drawings:** Provide logical riser or schematic drawings for all systems. Include schematic symbol key.

27 02 50 Substitutions

- A. **Substitution requests:** Substitution requests will be considered only if submitted to PSE's Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at PSE's Representatives sole discretion. No exceptions. Requests for substitutions shall be considered *not approved* unless approval is issued in writing by PSE's Representative.

- B. **Rejection:** For equipment, cabling, wiring, materials, and all other products indicated or specified as *no substitutions* or *no alternates*, PSE does not expect nor desire requests for substitutions and alternate products other than those specified. PSE reserves right for PSE's Representative to reject proposed substitution requests and submissions of alternates without review or justification.

27 02 63 Pre-Installation Meeting

- A. **General:** After award, convene a pre-installation meeting at least 14 calendar days prior to commencing SCS and related work. The meeting must be scheduled at least 14 days in advance. Require attendance of parties directly affecting work of this section, including other trades and utilities if necessary. Review conditions of operations, procedures and coordination with related work.
- B. **Agenda:** Comply with following agenda specifications:
1. Tour, inspect, and discuss building conditions relating to telecommunications system cabling and equipment, coordination with Telephone Utility Company, PSE's telecommunications system requirements, and coordination with existing conditions and other work in contract.
 2. Review exact location of each item within building construction, casework, and fixtures, and their requirements.
 3. Review required submittals, both completed and yet to be completed.
 4. Review drawings and specifications.
 5. Review proposed equipment, cabling, and related work.
 6. Review and finalize construction schedule related to telecommunications system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 7. Review required inspections and testing.
 8. Review cable routing and support provisions.

27 02 65 Warranty

27 02 65.10 Contractors Warranty

- A. **General requirements:** Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other 27xxx sections for specific additional warranty requirements that exceed or are in addition to those of this section.
- B. **Contractor warranty:** Provide all services, materials and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial

use by PSE and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to PSE's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

1. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in PSE's designated name. Replace material and equipment that require excessive service during guarantee period as determined by PSE.
 2. Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to PSE. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to PSE's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.
 3. Submit copies of equipment and material warranties to PSE before final acceptance.
 4. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to PSE.
 5. If warranty work problems cannot be corrected immediately to PSE's satisfaction, advise PSE in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary to resolve problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by PSE.
- C. **PSE's rights:** This section shall not be interpreted to limit PSE's rights under applicable codes and under this Contract.
- D. **Pathways Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.
- E. **Grounding and Bonding Material and Installation warranty:** Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.
- F. **Firestopping Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

27 02 65.20 SCS Manufacturers Extended Warranty

- A. SCS Systems will be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow on program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support the applications for which it is designed, during the 20-year warranty of the certified system.
- B. The second portion of the certification is a 20-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).
- C. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.
- D. Documentation proving the cabling system's compliance to the End-to-End Link Performance recommendations, as listed in ANSI/TIA/EIA-568-B shall be provided by the Vendor prior to the structured cabling system being installed.
- E. The cabling system must conform to the current issue of industry standard ANSI/TIA/EIA-568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.
- F. Purchaser demands strict adherence to the performance specifications listed in ANSI/TIA/EIA-568-B series standards.
- G. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacture the product used in this cabling system.

27 02 67 Completeness of Work

- A. **Complete and usable work:** The contractor is responsible for providing complete and usable work according to contract documents. All materials and equipment shall be provided with all accessories and additional work required for field conditions, as well as additional work and accessories required for complete, usable, and fully functional construction and systems, even if not explicitly specified or indicated. Telecommunications system in this Contract shall be provided as complete and operable systems in full compliance with requirements on drawings and specification requirements. Drawings are diagrammatic and specifications are performance-based, and Contractor shall provide all work required to comply with drawings and specifications, even if not explicitly indicated or specified. Contractor shall be responsible for coordinating installation of electrical systems with all field conditions and work of other trades. Minimum clearances and work required for compliance with NFPA 70, *National Electrical Code*® (NEC®), and manufacturer's instructions shall be provided. Comply with additional requirements indicated for access and clearances. Contractor shall verify all field conditions and dimensions that affect selection and provision of materials and equipment, and shall provide any disassembly, reassembly, relocation, demolition, cutting and patching required

to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment. Contractor shall protect from damage resulting from Contractor's operations existing facility, equipment, and wiring. Extra charges for completion and contract time extension will not be allowed because of field conditions or additional work required for complete and usable construction and systems. Comply with additional requirements indicated for access and clearances.

- B. **Drawings and specifications form complementary requirements;** provide work specified and not shown, and work shown and not specified as though explicitly required by both. Except where explicitly modified by a specific notation to contrary, it shall be understood that indication or description of any item, in drawings or specifications or both, carries with it instruction to furnish and install item, provided complete.
- C. **Terms:** As used in this specification, *provide* means *furnish* and *install*. *Furnish* means "to purchase and deliver to project site complete with every necessary appurtenance and support," and *install* means "to unload at delivery point at site and perform every operation necessary to establish secure mounting and correct operation at proper location in project."
- D. **Authority approvals:** Give notices, file plans, obtain permits and licenses, pay fees, and obtain necessary approvals from authorities that have jurisdiction as required to perform work according to all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.
- E. **Supplementary items:** Provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure and complete installation. Examine project drawings and other Sections of specifications for requirements that affect work of this section. Completely coordinate work of this section with work of other Sections and provide a complete and fully functional installation. Refer to all other drawings and other specifications sections that indicate types of construction in which work shall be installed and work of other sections with which work of this section must be coordinated
- F. **Quantities:** Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

27 02 70**Project Conditions**

- A. **Field verification:** Carefully verify location, use and status of all material, equipment, and utilities that are specified, indicated, or deemed necessary for removal. Verify that all materials, equipment, and utilities to be removed are completely inactive and will not be required or in use after completion of project. Replace with equivalent any material, equipment and utilities that were removed by Contractor that are required to be left in place.
- B. **Existing utilities:** As applicable, do not interrupt utilities serving facilities occupied by PSE or others unless permitted under following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

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1. Notify PSE in writing at least 14 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without PSE's written permission.
2. Equipment installation:
 - a. Determine suitable path for moving unit substation into place; consider Project conditions.
 - b. Verify clearance requirements and locate equipment to meet installation tolerances.
 - c. Revise locations and elevations from those indicated to those required to suit Project.

27 02 73 Delivery Storage and Handling

- A. **General:** Contractor shall be responsible for the deliveries, storing and handling of all materials relative to the SCS systems, including materials supplied by others that are part of the SCS installation contract. Material shall be stored and protected according to manufacturer's instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

27 02 75 Permits and Inspections

- A. **General:** All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.
- B. Contractor shall obtain and pay for all licenses, permits, and inspection fees required by local agencies and/or other agencies having jurisdiction.
- C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.
- D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to PSE's Representative prior to request for Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations.
- E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.
- F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the National Electrical Code and other applicable sections of the *National Fire Code*, as published by the National Fire Protection Association (NFPA).
- G. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).

27 02 77 Examination

- A. **General:** Prior to submitting a proposal, Contractor shall examine site, review Project drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain

complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.

- B. **Bidders' questions:** Should bidders have questions as to intent of drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to PSE's Representative in manner dictated by PSE's Representative. All answers and clarifications to drawings and specifications will be issued in writing.
- C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

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Additional Costs

- A. **General:** Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.
- B. **Inspections and testing:** For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by PSE's Representative or Architect/Engineer to verify Project compliance for same material or equipment, PSE reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions. PSE's Representative will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. PSE reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.
- C. **Exclusions:** Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

END of SECTION

27 04 00 Execution

27 04 01 General Requirements

- A. General: Sequence, coordinate, and integrate various elements of telecommunications system, materials, and equipment. Comply with following requirements as a minimum.
- C. Coordinate systems, equipment, and materials installation with other building components.
- D. Verify all dimensions by field measurements.
- E. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.
- F. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- G. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in building.
- H. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.
- I. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- J. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by Contract Documents, recognizing that portions of Work are shown only in diagrammatic form. In case of conflict among individual system requirements, request direction in writing from PSE's Representative.
- K. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.
- L. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- M. Provide access panel or doors where units are concealed behind finished surfaces.
- N. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- O. Comply with all requirements and work indicated on drawings.

- P. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of PSE and according to code requirements.
- Q. Install equipment and cabling/wiring so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel or roof curbs as appropriate.
- R. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall and ceiling mounting of equipment as required.
- S. Provide steel supports and hardware for proper installation of hangers, anchors, guides, and other support hardware.
- T. Obtain and analyze catalog data, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.
- U. Structural steel and hardware shall conform to ASTM standard specifications. Use of steel and hardware shall conform to requirements of AISC Code of Practice: Section Five.
- V. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

27 04 10 Equipment Installation

- A. General: Install equipment according to manufacturer's written instructions. Install equipment level and plumb. Install wiring and cabling between equipment and all related devices.
- B. Mounting: If neither the PSE's Instructions nor the individual section call out the required hardware mounting, use the following.
 - 1. For equipment at walls, bolt units to wall or mount on structural steel channel strut bolted to wall.
 - 2. For equipment not at walls, provide freestanding racks fabricated of structural steel members and slotted structural steel channel strut.
 - 3. Use feet consisting of 0.25 inch thick steel plates, 6 square inch, bolted to floor.
 - 4. Use feet for welded attachment of vertical posts not over 3 feet on center.
 - 5. Connect posts with horizontal U channel steel strut and bolt control equipment to channels.
- C. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.
- D. Connections: Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published

connection or terminal torque values, comply with torque values specified in UL 486A and UL 486B.

27 04 30 Cutting and Patching

- A. General: Perform cutting and patching according to contract general requirements. In addition, following requirements apply:
 - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
- B. Demolition and removal: Cut, remove, and legally dispose of selected equipment, components, and materials as indicated, including but not limited to removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new Work. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- C. Protection of work: Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. During cutting and patching operations, protect adjacent installations. Patch finished surfaces and building components using new materials specified for original installation and experienced Installers.

27 04 33 Penetrations and Sleeves

- A. General: Coordinate work with other sections. SCS Installation Contractor shall be responsible for the provision of cabling sleeves and conduits unless specifically provided by the Electrical Contractor. SCS Installation Contractor shall coordinate with Electrical Contractor to determine exact requirements.
- B. When required, set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured or otherwise constructed without sleeves and wall penetration is required. Do not penetrate structural members. Provide sleeves and packing materials at all penetrations of foundations, walls, slabs (except on-grade), partitions, and floors. Sleeves shall meet requirements of pertinent specifications. Lay out penetration and sleeve openings in advance, to permit provision in work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed.
- C. Sleeve fill: Sleeves that penetrate outside walls, basement slabs, footings, and beams shall be waterproof.
 - 1. Fill slots, sleeves and other openings in floors or walls if not used.
 - 2. Fill spaces in openings after installation of conduit or cable.

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3. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes.
 4. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes. See section 27 05 32 - Firestopping for Telecommunications Systems.
 5. Sleeves through floors shall be watertight and shall extend 2 inches above floor surface.
 6. Where raceways passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.
- D. Conduit sleeves:
1. Annular space between conduit and sleeve shall be at least 1/4 inch.
 2. Sleeves shall not be provided for slabs-on-grade unless specified or indicated otherwise.
 3. For sleeves through rated fire walls and smoke partitions, comply with requirements for firestopping. See section 27 05 32 - Firestopping for Telecommunications Systems.
- E. Supports: Do not support piping risers or conduit on sleeves.
- F. Future use: Identify unused sleeves and slots for future installation.

27 04 36 Core Drilling

- A. General: Core drilling shall be avoided where possible. Where core drilling is unavoidable, locate all required openings prior to coring.
- B. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
- C. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.
- D. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc. Protect all areas from damage.

27 04 39 Cleaning

- A. Contractor is responsible for clean up of debris on a daily basis. Cost of clean up is the responsibility of the Contractor.
- B. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of PSE's Representative.
- C. After completion of Project, clean exterior surface of all equipment, including concrete residue, dirt, and paint residue. Final cleaning shall be performed prior to Project acceptance by PSE's Representative.

27 04 50 Access and Access Panels

- A. General: Provide access to materials and equipment that require inspection, replacement, repair or service. Provide access panels and/or doors as required to allow service of all equipment components. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling. Ceilings consisting of lay-in or removable splined tiles do not require access panels. Locations of equipment requiring access shall be noted on record drawings. Access panels shall have same fire rating classification as surface penetrated.
- B. Coordination: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to PSE.
- C. Construction: Panels shall be at least 12 inches by 12 inches, and located to provide optimum access to equipment for maintenance and servicing. Verify access panel locations and construction with PSE's Representative.

27 04 60 Startup and Operational Testing

- A. General: PSE maintains right to have access to entire project site to prepare facility for occupancy and operation. Completion of start up and field testing shall be accomplished as a prerequisite for substantial completion. Operate and maintain systems and equipment until final acceptance by PSE. All guarantees and warranties shall not begin until final acceptance of systems and equipment by PSE. Acceptance requires, at a minimum, complete systems startup and testing.

27 04 70 Special Responsibilities and Information

- A. Coordination of information: Cooperate and coordinate with work of other sections in executing work of this section. Perform work such that progress of entire project, including work of other sections, shall not be interfered with or delayed. Provide information as requested on items furnished under this section, which shall be installed under other sections. Obtain detailed installation information from manufacturers of equipment provided under this section.
- B. Information gathering: Obtain final rough-in dimensions or other information as needed for complete installation of items furnished under other sections or by PSE. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other sections. Give full information so that openings required by work of this section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at no expense to PSE.
- C. Housekeeping pads: Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor mounted equipment
- D. Maintenance of equipment and systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- E. Use of premises: Use of premises shall be restricted as directed by PSE's Representative and as required below:
 - 1. **Cleaning and rubbish removal:** Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of PSE's Representative.
 - 2. **Rubbish Removal:** Provide for the removal from the site of all spoils, debris, boxes, packaging, crates, and trash generated from the work.
 - 3. **Storage:** Store materials maintaining an orderly, clean appearance. If stored on site in open or unprotected areas, all equipment and material shall be kept off ground by means of pallets or racks, and covered with tarpaulins.
- F. Protection of fireproofing:
 - 1. Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, if possible, prior to start of spray fire proofing work.
 - 2. Conduits and other items that would interfere with proper application of fireproofing shall be installed after completion of spray fire proofing work.
 - 3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be performed by installer of fireproofing and paid for by section responsible for damage and shall not constitute grounds for an extra to PSE.
- G. Temporary utilities: Refer to contract general requirements regarding requirements.
- H. Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.

27 04 80 Division of Work

- A. General: Division of work responsibility matrix at the end of this section is for Contractor's reference to clarify roles of various manufacturers, installers, subcontractors, and trades involved in telecommunications system Project.
- B. Contractor holding contract with PSE is responsible for coordinating work of all subcontractors to provide a complete and usable Project complying with contract provisions of Project documents.
- C. Failure to coordinate work by subcontractors and suppliers will not be considered justification for additional compensation or extension of schedule.

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Division of work responsibility chart						
Spec. section	System	Contractors				Remarks
		Gen	Elec	Mec	Telecom	
25 xx xx	Building Automation System (BAS)	1	C	C	C	BAS low voltage cabling by Division 15 uses telcom cable tray.
21 xx xx	Fire Detection And Alarm System (FDAS)	1	C	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Electrical wiring (line voltage)	1	2,W	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Poke-through fittings and floor boxes	1	2, E	C	C	Telcom to provide data jacks and A-V connectors
26 xx xx	Cable tray	1	2, E	C	C	Comply with Section 27 05 28
26 xx xx	Electrical raceways	1	2, E	C	C	Comply with Section 27 05 28
27 02 00	General requirements for telecommunications system	2	C	C	1	
27 10 00	Structured Cabling System (SCS) for telecommunications systems		C	C	1, E, W	
27 05 28	Pathways for telecommunications systems	1	2, P	C	1	
27 05 26	Grounding and Bonding System (GBS) for telecommunications systems	1	2, G	C	1	
27 05 32	Firestopping for telecommunications systems		2, FP	C	1, FC	

1 = primary contractual responsibility

2 = secondary responsibility

3 = tertiary responsibility

C = coordination of work responsibility

E = provision of specified equipment and devices

W = provision of specified system wiring/cabling

P = provision of specified system pathways/conduits

S = provision of specified system spaces

FP = provision of specified firestopping for pathways

FC = provision of specified firestopping for cabling

END of SECTION

27 05 00 Common Work Results for Communications**27 05 26 Grounding and Bonding for Communications Systems****1. GENERAL****1.1. Work Includes**

Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).
- B. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Grounding Electrode System
 - 2. Busbars
 - 3. Bonding accessories

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current revision of the following:
 - ANSI/TIA – 568 Commercial Building Telecommunications Cabling Standard
 - TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces
 - ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - NFPA 70 – National Electric Code
 - BICSI – Telecommunications Distribution Methods Manual

1.4. Submittals

- A. Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

2.1. Grounding Electrode System

A. Grounding Electrode System

1. When required the Grounding Electrode System shall meet the following
 - a. Active grounding system constantly replenishing moisture into the soil
 - b. Provide low resistance to ground
 - c. Provide season to season stability
 - d. Be maintenance-free for 30 years
 - e. Contain no hazardous materials or chemicals
2. Approved Manufacturers:

2.2. Wall-mount Busbars

A. Telecommunications Main Grounding Busbar (TMGB)

1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 4" (100 mm) high and 20" (510 mm) long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
3. 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.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.

B. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 2" (50 mm) high and 12" (300 mm) long and shall have 9 attachment points (one row) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.

2.3. Bonding Accessories

A. Two Mounting Hole Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. 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.
5. Ground terminal block shall be UL Listed as a wire connector.

B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.

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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.
- C. Antioxidant Joint Compound
1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.
- D. C-Type, Compression Taps
1. Compression taps shall be manufactured from copper alloy.
 2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
 3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
 4. Compression taps shall be UL Listed.
- E. Pedestal Clamp With Grounding Connector
1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.
 2. Pedestal clamps shall be sized to fit a specific size conductor, size #6 and/or 2/0, as stated below.
 3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8" to 1-3/4" in diameter, as stated below.
 4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.
 5. Pedestal clamp shall be UL Listed as grounding and bonding equipment.
- F. Pipe Clamp With Grounding Connector
1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.
 2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.
 3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1" to 6" (.75" to 6.63" in diameter), as stated below.
 4. Pipe clamp shall be UL Listed as grounding and bonding equipment.
- G. Equipment Ground Jumper Kit
1. Kit includes one 24"L insulated ground jumper with a straight two hole compression lug on one end and an L-shaped two hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.
 2. Ground conductor is an insulated green/yellow stripe #6 AWG wire
 3. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5" to .625" apart that accept 1/4" screws.
 4. Jumper will be made with UL Listed components

2. EXECUTION

2.1. Installation

- A. Outdoor grounding and bonding connections.

1. All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.

B. Wall-Mount Busbars

1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

C. Rack-Mount Busbars and Ground Bars

1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.
2. Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.
3. Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

D. Ground Terminal Block

1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

E. Pedestal Clamp

1. At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.
2. If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.
3. Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.
4. Remove insulation from conductors where wires attach to the pedestal clamp.

F. Pipe Clamp

1. Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.
2. Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.

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3. Remove insulation from conductors where wires attach to the pipe clamp.

G. Equipment Ground Jumper Kit

1. Bond equipment to a vertical rack-mount busbar or groundbar using ground jumper according to the manufacturer's recommendations.
2. Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or groundbar to help prevent corrosion at the bond.

END of SECTION

27 05 28 Pathways for Communications Systems

1. GENERAL

1.1. Scope of Work

- A. Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system, as indicated for distribution of Telecommunications wiring which includes cables for Data, Voice, Video, Audio, Security and future signal requirements.
- A. The location at which all new telecommunications wiring will terminate is called a Telecom Outlet (TO). There are several styles of outlets:
 - 1. New construction
 - 2. Existing construction typical
 - 3. Existing construction variations
 - 4. Telephone (Voice) only
 - 5. Data only
- B. Furnish and install split channel raceway and outlet boxes as specified in the Drawings and as specified herein.
- C. Furnish and install conduit stubs in walls and floors for cable routes.

1.2. References

ASI/NFPA 70/250 - National Electric Code – Ground and Bonding
ANSI/NFPA 70/318 – National Electric Code – Cable Trays
CANSI/NFPA 70/645 – National Electric Code – Information Technology Equipment
ANSI/NFPA 70/770 – National Electric Code – Optical Fiber Cables and Raceways
ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3
ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
ANSI/TIA - 568-B Commercial Building Telecommunications Cabling Standard.
ANSI/TIA - 569-A Commercial Building Standard for Telecommunications Pathways and Spaces
ASTM – A276-06 Standard Specification for Stainless Steel Bars and Shapes
ASTM A580/A580M-06 Standard Specification for Stainless Steel Wire
NEMA VE 2-2006 Cable Tray Installation Guidelines
NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems
UL and cUL E209183
ANSI C80.1 Rigid Steel Conduit - Zinc Coated
ANSI C80.4 Fittings for Rigid Metal Conduit
BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition

BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition

BICSI Network Design Reference Manual (NDRM), current edition

BICSI Telecommunications Distribution Methods Manual (TDMM), current edition

BICSI Wireless Design Reference Manual (WDRM), current edition

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.
- D. Material and work specified herein shall comply with the applicable requirements of the current revision of the following:

ANSI/TIA – 568 Commercial Building Telecommunications Cabling Standard

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to cable tray systems.

1.4. Submittals

- A. Product Data: For features, ratings, and performance of each component specified.
- B. Submit manufacturer's instructions for storage, handling, protection, examination, preparation, operation, and installation of products. Include application conditions or limitations of use stipulated by any product testing agency. Submit for the following:
 - 1. Wall Boxes
 - 2. Raceway
 - 3. Conduit
 - 4. Conduit Bushings

C. Shop Drawings:

1. Component List: List manufacturer, part number, and quantity of each component.
2. Include dimensioned plan and elevation views of equipment rooms, labeling each individual component. Show raceway assemblies, method of field assembly, workspace requirements, and access for cable connections.

1.5. Delivery Storage And Handling:

- A. Delivery: Deliver materials to site in manufacturer's original un-opened containers and packaging, with labels clearly indication manufacturer and material.
- B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage.

1. PRODUCTS

1.1. Telecom Outlets (TO)

- A. New construction TO consists of one (1) 4-11/16" square by 2-1/8" deep flush mounted box. Each outlet box shall have a EMT conduit stubbed above the drop ceiling or extended into the hallway cabletray. Conduits size is as follows:
 1. For Outlets with 3 or less cables, use a 1" EMT conduit
 2. For Outlets with 3-6 cables, use a 1.25" EMT conduit
 3. For all other sizes, calculate fill ratio at 40% for proper sized conduit
- B. Existing surface-mounted construction TO typically consists of surface-mounted raceway including base, cover, end fitting, entrance end fitting, and (2) 1" EMT conduits stubbed out top of entrance end fitting to above ceiling or out to nearest hallway distribution system. Size of the raceway is site dependent based on number of conductors to be installed.
- C. The intent of the installation of the TOs which consist of the raceway is as follows:
 1. Where ceilings are accessible, the raceway and entrance end fitting shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
 2. Where ceilings are partially accessible, or if the Drawings and/or Specifications indicate installation of access panels, the raceway shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
 3. Where ceilings are inaccessible or no ceilings exist, the raceway shall extend up as close to the ceiling as practical to allow installation of conduits as high as possible to the nearest hallway distribution system.

1.2. Horizontal Distribution Systems

- A. Conduit System (Renovations only, where conduit exists)

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1. Provide conduits secured to wall above corridor ceilings as shown on the Drawings or as specified herein for installation of telecommunications cables. Any exposed conduit
2. Corridor conduits shall be 4" EMT, furnished in 10 foot lengths wherever possible, with no sharp edges, reamed as necessary, evenly supported at two locations per 10 foot section spacing. Conduits shall be sized and quantified to account for handling cables in all TO conduits at 40% fill back to the TR and/or ER rooms. Verify size prior to installation. Bushings and/or connectors on ends of EMT are required.
3. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8" rod attached to building structure utilizing unistrut channel to form a trapeze. Double nut the top and bottom at the unistrut. Utilize conduit clamp to secure conduits to unistrut.
4. Provide measured pull line in each conduit rated at 1200 lbs. minimum. Increments must be in 12" steps.
5. Grounding of conduits is not required per NEC #250-33, Exception No. 2. shall be painted except conduit above suspended ceilings or in mechanical, electrical or telecommunication rooms. Color to match that of surface installed upon or as directed by PSE's Representative. Coordinate with other trades prior to painting.
6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire rated construction to be verified with AHJ. See Section 27 05 32 for more firestopping information.

B. Corridor Cable Tray System

1. Complete wall mounted or suspended aluminum cable tray system and necessary accessories shall be provided as shown on plans. Install entire cable tray system in accordance with manufacturer's minimum installation practices and all local governing codes.
2. Coordinate installation of cable tray with other trades to allow a minimum of 12" above, 12" in front, and 12" below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to the tray with reasonable room to work. Obstructions to the tray must be minimized and cannot block more than 6 feet of the tray at any point in the run.
3. Submittal drawings, in the form of 8 1/2" x 11" catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories and load data.
4. Cable tray shall not be loaded beyond 60% of manufacturer's recommended load capacity.
5. Install wall mounted cable tray on both sides of hallway as shown on drawings and where applicable.
6. Where a new cable tray distribution system encounters a wall, install sufficient 4" EMT sleeves through the wall so cabling does not exceed 20% fill.
7. Where cable tray is exposed below ceiling, install the appropriate solid bottom inserts to conceal cables.
8. Install cable tray dropouts where large quantities of cables exit the distribution system.

9. Cable tray must be sized to facilitate sufficient growth capacity for migration cable plant to coexist in same tray as existing cable plant, wherever possible.
10. Manufacturer of cable tray in corridors and telecom rooms shall be:

C. Telecommunication Room Cable Tray System

1. TR cable tray shall completely wrap all walls within the room. Cable tray shall extend over all equipment frames.
2. Cable tray shall be a minimum width of 2" high x 12" wide. Cable tray may be sized upwards if fill ratio requirements need to be met based on cable quantities.
3. Manufacturer of tubular ladder type cable tray in telecommunication rooms shall be CommScope.
4. Cable tray shall be 12 inch cable runway.
5. Rectangular steel tubing cross members welded at 12-inch intervals. Finish in black enamel. CommScope, Part Number CR-SLR-10L-12W or equivalent.
 - a. 12-inch Wall Angle Assembly Kit – CommScope Part Number CR6-12WRSK or equivalent.
 - b. 3-inch Channel Rack-To-Runway Mounting Plate - CommScope Part Number CRR2RRMK or equivalent.
 - c. End Closing Tube - CommScope Part Number CRPECK or equivalent.
 - d. Corner Clamp - CommScope Part Number CRTJSK or equivalent (2 required per End Closing Tube to complete assembly).
- D. All open pathway/trays shall be installed a minimum of six (6) inches away from any light fixture or other source of EMI (Electromagnetic Interference).
- E. All pathways shall be grounded per NEC Article 250.
- F. Provide external grounding strap at expansion joints, sleeves and crossover and at other locations where pathway/tray continuity is interrupted.
- G. Support all pathways from building construction. Do not support pathways from ductwork, piping, or equipment hangers.
- H. Install cable tray level and straight unless noted on the construction drawings

1.3. Station Conduits

Station conduit is defined as conduit that originates at the TO and rises within the walls or is exposed from a raceway and extends up into the drop ceiling or over to the hallway distribution system.

- A. Provide station conduits from TOs to above the drop ceiling or extend over to the hallway distribution systems consisting of 1" EMT minimum or appropriate size as shown on the Drawings or as specified herein for installation of telecommunications cables.
- B. Provide an insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. To prevent conflicts with other cables or conduits to cable tray, the conduit shall be stubbed not less than 6" above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend station conduits down such that the flow of installed cables

promotes the minimum length back to the TR and the least amount of bends in the cables. Bushings must be rated to be used in an environmental air handling space (Plenum).

- C. Manufacturer of insulating bushing on all telecommunication conduits shall be:
- D. Provide measured pull line in 12" increments in each empty conduit to hallway distribution system.
- E. Indelibly mark station conduit at hallway distribution end with Room # that conduit serves.
- F. The use of 90 degree electrical pulling elbows is prohibited.
- G. Do not include more than two 90 degree bends between pulling points when installing station conduit runs. If the path of the station conduits requires more than 180 degrees of total bends, installation of an appropriate sized junction box is required. See section 2.4 for junction box requirements.
- H. Place an appropriate sized junction box in each individual station conduit run that exceeds 100 feet in length.
- I. The use of a third bend in a conduit is only acceptable if:
 - 1. The total conduit run is reduced by 15%.
 - 2. The conduit size is increased to the next trade size.
 - 3. One of the bends is located within 12" of the cable feed end.

1.4. Junction Box Requirements For Station Conduits

- A. If the station conduit route exceeds the 180 degree of total bends limitation, an appropriate sized junction box is required within a straight section of the conduit run.
- B. Each station conduit run requires a separate junction box. The sharing of a junction box by multiple conduits is prohibited.
- C. A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

1.5. Service Entrance Conduits

- A. Minimum of (4) 4" IMC conduits shall be installed from the nearest utility tunnel on outside of the building as shown on the Drawings. Terminate entrance conduits entering ER rooms from below grade to extend 4" above finished floor. Location of entrance conduits shall be within 12" of room corners.
- B. Terminate entrance conduits entering ER rooms from above ceiling height to extend 4" below finished ceiling or 12" above cable tray.
- C. Terminate entrance conduits entering an ER rooms from below ceiling height to extend 4" into the room.
- D. Entrance conduits shall be continuous into the building and to the ER. Securely fasten all entrance conduits to the building to withstand any cable placing

operation. Do not include more than two 90 degree bends between pulling points when installing entrance conduits.

- E. On exterior wall penetrations, seal both sides of the wall around outside of conduit with hydraulic cement to prevent water from entering the building. Seal the inside of the conduit on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering the building.

1.6. Pathway Requirements For Entrance Conduits

- A. If the entrance conduits exceeds the 180 degree of total bends limitation, an appropriate sized junction box, manhole, or handhole is required.
- B. As-built drawings of entrance conduit path required to be submitted to PSE's Representative before covered with soil.

1.7. Riser Conduits

Riser conduits shall only be used when noted on the Construction Documents for special applications only. Riser conduits are not required as a general rule for the riser system. However, when required:

- A. Minimum of (2) 4" conduits shall be installed between the ER room and each TR room as shown on the Drawings.
- B. Conduits entering ER and TR rooms shall be reamed or bushed and terminated not more than 4" from entrance wall and within 12" of room corners.
- C. Conduits entering ER and TR rooms from below floor shall be terminated not more than 4" above finished floor.
- D. Conduits for riser cables shall be continuous and separate from all other conduit or enclosed raceway systems. Do not include more than two 90 degree bends between pulling points when installing riser conduits. Where junction boxes are required, locate in accessible areas, such as above suspended ceilings in hallways.
- E. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12" increments rated at a minimum 1200 pound test.
- F. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction to be verified with AHJ. See Section 27 05 32 for more firestopping information.
- G. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).
 - 1. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington or equal.
- H. Riser conduits shall not be used for the distribution of horizontal cables.

1.8. Firestopping

- A. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations must be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.

- B. Contact PSE's Representative to identify walls which are fire-rated construction. Walls must be sealed with a 2-hour fire stop assembly at a minimum.
- C. Communication pathways requiring fire stopping shall utilize removable/re-usable fire stopping putties for ease of Moves, Adds, and Changes.
- D. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM.
- E. See Section 27 05 32 - Firestopping for Telecommunications Systems

2. EXECUTION

2.1. General Requirements

- A. The intention of the telecommunications conduits is to provide a route between ER and TR rooms, routes from the TRs throughout building floors to hallways, and routes from hallway distribution systems into rooms to individual TOs for telecommunications cabling.
- B. Installation of new pathways shall not interfere with existing pathways in such a way that installation of new cables within the existing pathway is made more difficult.

2.2. Examination

- A. Examine areas to receive cable management system. Notify the PSE's Representative of conditions that would adversely affect the installation or subsequent utilization of the system.
- B. Do not proceed with installation until unsatisfactory conditions are corrected.

2.3. Installation

- A. Install in accordance with recognized industry practices, to ensure that the equipment complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA "Standards of Installation" pertaining to general electrical installation practice.
- B. Coordinate installation with other trades.
- C. Field verification is required before installation.
- D. Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions.

END OF SECTION

27 05 29 Hangers and Supports for Communications Systems

1. GENERAL

1.1. Work Includes

The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports as described in this specification.

1.2. Scope of Work

This Section includes the minimum requirements for the support structures for the Communications Systems for the project as outlined in the Bid Document.

- A. Non-continuous cable supports (2.3A)
- B. Adjustable non-continuous cable support sling (2.3B)
- C. Multi-tiered non-continuous cable support assemblies (2.3C)
- D. Non-continuous cable support assemblies from tee bar (2.3D)
- E. Non-continuous cable support assemblies from drop wire/ceiling (2.3E)
- F. Non-continuous cable support assemblies from beam, flange (2.3F)
- G. Non-continuous cable support assemblies from C & Z Purlin (2.3G)
- H. Non-continuous cable support assemblies from wall, concrete, or joist (2.3H)
- I. Non-continuous cable support assemblies from threaded rod (2.3I)
- J. Raised floor non-continuous cable support assemblies (2.3J)
- K. Cantilever-Mounted Option for non-continuous cable supports (2.3K)
- L. Installation accessories for non-continuous cable supports (2.3L)

1.3. Submittals

- A. Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

1.4. Quality Assurance

- A. Non-continuous cable supports and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).
- B. Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.
- C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.

1.5. Coordination

Coordinate installation of hangers, supports and cables with other trades.

1. PRODUCTS

1.1. Acceptable Manufacturers

- A. Subject to compliance with these specifications, non-continuous cable supports shall be as manufactured by:

1.2. References

ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel
ASTM B 695-90 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A109 Standard Specification for Steel, Strip, Carbon, Cold-Rolled
ASTM A167 Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A480/A480M Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled
A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process
ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality
ASTM A879 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
ASTM B117 Standard Method of Salt Spray (Fog) Testing
ASTM D610 Standard test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.
ANSI/ TIA-568 Commercial Building Telecommunications Cabling Standard, current revision level.
ANSI/ TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.
NFPA 70 National Electrical Code®

1.3. Non-continuous Cable Support Systems

- A. Non-continuous cable supports
 - 1. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
 - 2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
 - 3. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
 - 4. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
 - 5. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
 - 6. Non-continuous cable supports shall be as manufactured by:
- B. Adjustable non-continuous cable support sling
 - 1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5e and higher cable, or optical fiber cable; cULus Listed.
 - 2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.

3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
4. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
5. Acceptable products:
- C. Multi-tiered non-continuous cable support assemblies
 1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
 2. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
 3. The multi-tiered support bracket shall consist of:
- D. Non-continuous cable support assemblies from tee bar
 1. Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
 2. Acceptable products:
- E. Non-continuous cable support assemblies from drop wire/ceiling
 1. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
 2. Acceptable products:
- F. Non-continuous cable support assemblies from beam, flange
 1. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
 2. Acceptable products:
- G. Non-continuous cable support assemblies from C & Z Purlin
 1. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
 2. Acceptable products:
- H. Non-continuous cable support assemblies from wall, concrete, or joist
 1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
 2. Acceptable products:
- I. Non-continuous cable support assemblies from threaded rod
 1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
 2. The multi-tiered support bracket shall have a static load limit of 300 lbs.
 3. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
 4. Acceptable products:
- J. Raised floor non-continuous cable support assemblies
 1. Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.
 2. Acceptable products:
- K. Cantilever-Mounted cable supports
 1. U-hook shall be able to be assembled to a wide variety of wall mount brackets.
 2. Spacing of individual U-hooks as needed, max of 4' to 5' apart.
 3. U-hooks may have the optional attachment of a cable roller for ease in pulling cables.
 4. Acceptable products:
- L. Installation accessories for non-continuous cable supports
 1. Cable Pulley

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- a. Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included. The pulley shall be made of plastic and be without sharp edges. The pin and bail assembly must be able to be secured to the J-Hook during cable installation. The pulley must remain secured while cables are being pulled.
 - b. The pin and roller assembly must be removed after cables are installed.
 - c. Acceptable products:
2. Cable Protector
- a. The protective steel tube shall fit over threaded rod and be at least 4" in length.
 - b. The tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. The tube shall not inhibit the pulling of cables.
 - c. Acceptable products:

1.4. Finishes

- A. ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel
ASTM B 695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- B. Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

2. EXECUTION

2.1. Installation

- A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Do not exceed load ratings specified by manufacturer.
- C. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.
- E. Locate pathways per Telecommunications Drawings.

END of SECTION

27 05 33 Conduits and Backboxes for Communications Systems

1. GENERAL

1.1. Outlets

- A. Each data outlet in a wall or floor shall be served by two (2) 27 mm (1 in.) conduits and a double-gang deep device box with a single-gang mud ring.
- B. Wall mounted telephones shall be served by one 21 mm (0.75 in.) conduit and a single-gang deep device box with a single-gang mud ring. The outlet box shall be mounted at a center height of 1220 mm (48 in.) above the finished floor, unless otherwise specified on the drawing, and shall have a clearance of 305 mm (12 in.) of wall surface on all sides.
- C. All outlet conduits shall be stubbed into accessible ceiling space.
- D. All outlet conduits shall have burrs and any other abrasive elements removed and an insulating bushing shall be installed on both ends.
- E. No section of conduit shall be longer than 30 m (100 ft.) between pull points.
- F. No more than 180 degrees of conduit bends shall be permitted between pull points.
- G. The minimum inside radius for any bend of an outlet conduit shall be six times the inside diameter of that conduit.

1.2. Conduits

- A. Electric metallic tubing: Comply with UL 797. Tubing shall have hot dipped galvanized exterior, enamel-coated interior.
- B. Flexible conduit shall not be used in lieu of conduit bends and offsets.
- C. PVC conduit: Comply with UL 651, listed for use with 90 degrees C conductors operating at 90 degrees C.

1.3. Standards Compliance

- A. General standards: Comply with current revision of TIA 569 as amended

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

- A. Coordinate installation of labels with other trades.
- B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

1. PRODUCTS

1.1. Approved Products

- A. Dry location device boxes: Manufacturer shall be:
Equivalent products by other manufacturers may be used where approved in writing by PSE's Representative.
- B. Wet location boxes: Manufacturer shall be:
Equivalent products by other manufacturers may be used where approved in writing by PSE's Representative.

2. EXECUTION

2.1. Installation

- A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- C. Install conduits using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

END of SECTION

27 05 36 Cable Trays for Communications Systems

1. GENERAL

1.1. Scope

- A. Continuous, rigid, welded steel or stainless steel wire mesh cable management system.
- B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

1.2. Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3. Summary

References:

IEC 61537 (2001) – Cable Tray Systems and Cable Ladder Systems for Cable Management
NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems
ANSI/NFPA 70 – National Electrical Code (NEC)
TIA 569– Commercial Building Standard for Telecommunications Pathways & Spaces
ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
ASTM A 380 – Specification for Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

1.4. Submittals

- A. Shop Drawings: Submit shop drawings indicating materials, finish, dimensions, accessories, layout, supports, splices, and installation details.
- C. Design Calculations: Verify loading capacities for supports.
- D. Field verification of all dimensions, routing, etc., is directed.
- E. Factory-certified test reports of specified products, complying with IEC 61537, NEC, and NEMA VE 1/CSA C22.2 No. 126.1.
- F. Submit manufacturer's certification indicating ISO 9001 quality certified.
- G. Submit training procedure for certifying cable tray installers.

1.5. Quality Assurance

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- H. Approval and Labeling: Provide cable trays and accessories specified in this Section that are approved and labeled.

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The Terms "Classified" pertaining to cable trays (rather than "Listed") and "Labeled": As defined in NFPA 70, Article 100, including painted trays.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

- I. Comply with NFPA 70, National Electrical Code, Article 392: Cable Trays; provide UL Classification and labels.
- J. Comply with IEC 61537, Cable Tray Systems and Cable Ladder Systems for Cable Management.
- K. Comply with NEMA VE 1/CSA C22.2 No. 126.1, Metal Cable Tray Systems, for materials, sizes, and configurations; provide cCSAus Certificate and labels.
- L. Provide documentation of the following certifications:
 - ISO 9001 quality certification.
 - American Bureau of Shipping (ABS) Product Design Assessment certification.
 - Det Norske Veritas (DNV) certification.
 - E 90 Fire Testing certification.
 - VDE certification.
- M. Provide ETL test documentation showing cable compression/deformation testing.

1.6. Coordination

- A. Coordinate layout and installation of cable tray with other trades.
- N. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.
- O. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

1. PRODUCTS

1.1. Manufacturers

Subject to compliance with requirements, provide products by the following:

1.2. Materials And Finishes:

- A. Cable Tray Materials:
 - Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.
- P. Cable Tray Finishes:
 - Finish for Carbon Steel Wire after welding and bending of mesh;
 - 1. Electrodeposited Zinc Plating: ASTM B 633, Type III, SC-1.
 - 2. Powder-Coated Trays – UL classified Black powder-coated surface treatment over Electrodeposited Zinc Plating (or plain steel) using ASA 61 black polyester coating.

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- Q. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray (including UL Classified painted tray) acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers.
- R. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.
- Mesh: 2 x 4 inches (50 x 100 mm).
 Straight Section Lengths: 118 inches (3,000 mm).
 Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray Strength; and to allow tray to remain lightweight.
 Safe-T-Edge: Patented Safe-T-Edge technology on side wire to protect cable insulation and installers' hands.
 Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions and Item 2.3.
- S. CF Series Cable Tray Size:
1. Depth: Cable tray depth will be 4 inches
 2. Width: Cable tray width will be 6, 12, 18, or 24 inches as shown on Telecommunications Drawings:
 3. Length: Cable tray section length will be 118 inches (3000mm) unless otherwise shown on drawings.
 4. Fill Ratio: Cable tray may be filled to total fill capacity per NEC. Minimum 20% spare capacity recommended to accommodate future cabling changes or additions.
 5. Load Span Criteria:
 6. Cable tray will be capable of carrying a uniformly distributed load of 50 pounds per foot on an 8 ft support span, according to load tests of standard shown in Item A above.

1.3. Cable Tray Supports & Accessories

- A. Fittings/Supports: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions. Supports will include the FAS (Fast Assembly System) where possible so that screws, bolts, and additional tools are not required for cable tray mounting; installation time is reduced; and tray path can adapt to installation obstacles without the need for additional parts. Place supports so that support span does not exceed that shown on the drawings.
1. FAS System support methods to mount from ceiling and wall structures with 1/4", 3/8" or 1/2" threaded rod, if applicable
 2. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer. Select one of the following splicing methods, if applicable:
 - a. UL Classified EDRN Fast Splice: No hardware required
 - b. UL Classified SWK Splice Washer Kit: Swaged set for splicing, turns, bends, tees
 - c. UL Classified ED Universal Splice Bar: Cut & bend to fit any configuration
 - d. Preclick Splice: Bolted connection optional
 - e. UL Classified EDT Splice Plate: Bolted connection
 - f. UL Classified CE 25 & CE 30 Square Splice Washers: Use with EZ BN 1/4" Nut & Bolt
 - g. UL Classified CE 40 Square Splice Washer: Use with EZ BN 1/4" to splice trays on bends, adjustable tees

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- h. FASLock Splice: For sweeps and bends with tray 12" (300mm) and wider.
 - i. UL Classified EZ T 90 kit: For Tees and 90s
 - j. UL Classified RADT90 kit: For 5-1/2" radius Tees and 90s
- T. Accessories: As required to protect, support, and install a cable tray system. Select from the following accessories, if applicable:
 - 1. Cable Routing Accessories:
- U. Support Accessories:

1.4. Equipment Grounding Conductor Function & Grounding

- A. UL Classified cable trays (including painted tray) may act as Equipment Grounding Conductors.
- V. Use UL Classified splicing methods to ensure cable tray is electrically continuous and bonded as recommended.
 - Ground cable trays at end of continuous run.
- W. Test cable tray system per NFPA70B, Chapter 18 to verify grounding less than 1 ohm.
- X. Ground cable trays against fault current, noise, lightning, and electromagnetic interference by mounting grounding wire to each 10' cable tray section with grounding clamp.

2. EXECUTION

2.1. Examination:

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

2.2. Installation

- A. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.
 - 1. Cut cable tray wires in accordance with manufacturer's instructions.
 - 2. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
 - 3. Remove burrs and sharp edges from cable trays.
- C. Vendor Certified Installers

END of SECTION

27 05 43 Underground Ducts and Raceways for Communications Systems

- A. Outdoor telecommunications pathways connect building, pedestals, maintenance holes, handholds, and towers. These pathways consist of underground, direct-buried or aerial. Underground or direct-buried are generally preferred over aerial because of aesthetics and security. Generally, underground duct banks are preferred over direct-buried because of security, ease of future cable installation and maintenance.

B. Conduit Types

Examples of conduit types include:

- EB-20 – For encasement in concrete;
- EB-35 – For encasement in concrete;
- DB-60 – For direct burial or encasement in concrete;
- DB-100 – For direct burial or encasement in concrete;
- DB-120 – For direct burial or encasement in concrete;
- Rigid Nonmetallic Conduit Schedule 40 – For direct burial or encasement in concrete;
- Rigid Nonmetallic Conduit Schedule 80 – For direct burial or encasement in concrete;
- Multiple Plastic Duct (MPD) – For direct burial or installation in conduit;
- Rigid Metallic Conduit – For direct burial or encasement in concrete;
- Intermediate Metallic Conduit – For direct burial or encasement in concrete;
- Fiberglass Duct – For direct burial or encasement in concrete;
- Innerduct Polyethylene (PE) – For direct burial or installation in conduit;
- Innerduct Polyvinyl Chloride (PVC) – For direct burial or installation in conduit

C. Installation

1. The length of conduit between pulling points shall not exceed 600 ft (183m).
2. Manufactured bends should be used whenever possible. No section of conduit shall contain more than two 90-degree bends, or equivalent between pull points.
3. Conduits should be installed such that a slope exists to allow drainage and prevent the accumulation of water.
4. When conduits connect maintenance holes, a slope of .125 in per foot (10 mm per meter) should exist from the middle of the span to each maintenance hole.
5. Conduits must be buried at a minimum depth of 18 in. (45.7 cm).

END of SECTION

27 05 53 Identification for Communications Systems

1. GENERAL

1.1. Work Includes

Work covered by this Section shall consist of furnishing labor, equipment and materials necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.

1.2. Scope of Work

This Section includes the minimum requirements for the Identification and labeling of the Communications Systems for the project as outlined in the Bid Document.

1.3. Summary

- A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces. All facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.
- B. The PSE maintains a campus wide labeling scheme for voice and data outlets and patch panels.
- C. Industry Labeling Standards and Conventions shall be used unless otherwise stated in the bid documents or by the PSE's Representative.
- D. Telecommunications Infrastructure Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A cable record is prepared for each backbone cable. The record will show the cable name, and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX.
- E. Installer shall maintain accurate, up-to-date Installation or Construction Drawings. At a minimum, the Installation Drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.
- F. Installer shall provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and wiring portions of the infrastructure which may each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings.

1.4. Quality Assurance

- A. All labels shall be installed in a neat and workmanlike manner. All methods of labeling that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the PSE or PSE Representative.

- B. Labels shall be of the quality and manufacture indicated. The labels and labeling equipment specified are based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data labeling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
 - ANSI/TIA/EIA - 606-A Administration Standards.
 - ANSI/TIA - 569 Pathway and Spaces
 - ANSI/TIA - 568 Telecommunications Cabling Standard
 - BICSI Telecommunications Distribution Methods Manual
 - UL 969 - UL Standard for Safety for Marking and Labeling Systems

1.5. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.6. Coordination

- A. Coordinate installation of labels with other trades.
- B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

1. PRODUCTS

1.1. Manufacturers

1.2. Labels

- A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
- C. Where insert type labels are used provide clear plastic cover over label.
- D. Outside plant labels shall be totally waterproof even when submerged.
- E. Equipment Room Copper, Fiber, and Coax Backbone Cable Labels
- F. Equipment Room Copper, Fiber, and Coax Horizontal Cable Labels

G. Work Area Copper, Fiber, and Coax Riser Cable Labels

H. Patch Panel Labels

2. EXECUTION

2.1. Identification & Labeling

- A. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.
- B. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.
- C. All labels shall be printed or generated by a mechanical device.

2.2. Telecommunication Identifiers

- A. Refer to the University of Houston Information Technology Telecommunications Infrastructure Standards Manual for labeling practices.
- B. Outside Plant cabling shall be clearly marked using permanent means. Outside plant shall use the following system of numbering and labeling:
 - 1. Fiber Optic:
 - a. Identify: far-end building name, building number, fiber-type and strand-count
 - b. Label at entrance and exit points of tunnel system and at conduit entry points between 12 inches and 36 inches from the conduit or at closet point that is clearly visible and long cable length in tunnel at 200 foot intervals.
 - c. Label at termination panels at both ends.
 - 2. Copper:
 - a. Identify: far-end building name, building number and strand-count
 - b. Label at entrance and exit points of tunnel system and at conduit entry points between 12 inches and 36 inches from the conduit or at closet point that is clearly visible and long cable length in tunnel at 200 foot intervals.
- C. Riser cabling shall be clearly marked using permanent means. Riser cabling shall use the following system of numbering and labeling:
 - 1. Fiber Optic:
 - a. Identify: far-end EF / ER / TR, fiber-type and strand-count .
 - b. When small facilities are fed from a primary location and treated as an ER, riser shall be labeled similar to Outside Plant Fiber Optic.
 - 2. Copper:
 - a. Identify: far-end EF / ER / TR and pair-count
 - b. Termination points shall be labeled as to actual pair at every fifth (5th) pair-point.

2.3. Labeling Procedures

- A. To be consistent with ANSI/TIA/EIA standards and industry practices, it is important that both labeling and color coding be applied to all telecommunications infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall telecommunications infrastructure of the facility.
- B. Visibility and durability:
 - 1. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.
 - 2. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.
 - 3. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
 - 4. Outside plant labels shall be totally waterproof, even when submerged.
 - 5. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
 - 6. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.
- C. Mechanical generation
 - 1. All labels shall be printed or generated by a mechanical device.
 - 2. Hand written labels are NOT acceptable.

END of SECTION

27 10 00 Structured Cabling

27 10 10 General Requirements

- A. Transmission performance of structured cabling varies with length, connecting hardware, cords and total number of connections. The installer must take care to properly install the cabling components. To ensure that the installed structured cabling solution meets or exceeds the required performance it must be 'tested' or 'certified'.
- B. The requirements for each category of cabling (Cat5e, Cat6, or Cat6A) and optical fiber optics links are located in the ANSI/TIA-568 series standards.
- C. Test equipment must meet the requirements set forth in the ANSI/TIA-568 series Standard for Field Test Equipment. All Copper testers shall be Level III. All fiber testers shall meet the requirements in ANSI/TIA-568.
- D. Field Power Meters shall meet the following:
 - Accuracy ± 0.2 dB
 - Resolution 0.01 dB
 - Precision ± 0.15 dB
- E. The Field light source shall meet the following:
 - Accuracy ± 0.01 dB
 - Wavelength 850 ± 30 nm
 - 1300 ± 50 nm
 - 1310 ± 30 nm
 - 1550 ± 30 nm
- F. The calibration on all test equipment shall be current.
- G. The software in all test equipment shall be current.

27 10 10 Manufacturers

The following manufacturer's testers are approved.

- A. FLUKE
 - 1. DTX1800
 - 2. OptiFiber OTDR
 - 3. DTX-CLT CertiFiber Optical Loss Test Set
- B. Ideal
 - 4. LanTEK II
 - 5. LANTEK 6/6A/7G
 - 6. FIBERTEK
- C. Or other test equipment approved by the PSE

27 10 20 Systems Testing and Documentation

27 10 20.01 General Requirements

- A. Provide installation testing of equipment where required by manufacturer's installation instructions.
- B. Provide complete end to end testing for all copper and fiber optic systems/channels based on latest applicable standards. Document all testing and submit with final as-built submittal package.
- C. For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.
- D. Prior to substantial completion and project acceptance inspection, submit test reports to indicated scope of startup and operational tests, with results of testing for each specified operation.

27 10 20.10 Copper Cabling System Testing

- A. General: Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein, and shall be tested according to test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all of electrical parameters as specified under Product. All cables and termination hardware shall be 100 percent tested by installation contractor for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested according to contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced in order to ensure 100 percent useable conductors in all cables installed, at no additional cost to PSE.
- B. Continuity: Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by test unit according to manufacturers' recommended procedures, and referenced to appropriate cable identification number and circuit or pair number. Any faults in wiring shall be corrected and cable re-tested prior to final acceptance.
- C. Length: Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to maximum distances set forth in TIA/EIA-568-C standards and all other applicable standards specified in Appendix 1: Codes, Standards, and Informative References. Cable lengths shall be recorded, referencing cable identification number and circuit or pair number. For multi-pair cables, shortest pair length shall be recorded as length for cable.

- D. Factory testing: Every reel of cable shall be tested by cable manufacturer for all characteristics specified for cable type in this section. This testing shall be performed using a sweep test method and include frequencies specified for cable. A test report shall be available electronically, at no additional cost, for a minimum of five (5) years from the date of manufacture. The test report shall include the reel number, the date of the test, the Lot number, and test results for Return Loss (RL), Insertion Loss (Attenuation), Pair-to-Pair NEXT, and Power Sum NEXT Pair-to-Pair ELFEXT and Power Sum ELFEXT. The test report shall show the “Worst Case Margin” for the listed transmission characteristics.
- E. Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from TIA/EIA-568-C standards and all other applicable standards specified in Appendix 1: Codes, Standards, and Informative References, and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.
- F. Test reports: Test reports for all factory testing and field test reports for copper cabling installation shall be submitted to the PSE’s Representative and manufacturer prior to commissioning voice and data system and final contract payment. Refer to Submittals in this Section.

27 10 20.30 Test Documentation

- A. Electronic Format – if required
 - 6. Certification Test Reports shall be submitted in electronic format using the appropriate software supplied by the test equipment manufacturer. The data format should be that of the test report software (i.e. *.flw files for Fluke). The contractor shall provide any necessary software to view and evaluate the test data.
 - 7. The following list is provided as a reference:

<u>Tester</u>	<u>Test Report Software</u>
Fluke	LinkWare™
Ideal	LanTek® Reporter
 - 8. One electronic copy of the Test Reports shall be provided.
- B. Paper Format – if required
 - 1. Provide test documentation in 3-ring binders within 2 weeks after completion of project testing. Binders shall be clearly marked on outside front cover and spine with words Test Results, project name, and date of completion (month and year). Major heading tabs, Horizontal and Backbone, shall divide binder. Each major heading shall be further sectioned by test type. Within horizontal and backbone sections, divide by tabs scanner test results by category, optical fiber attenuation test results, and continuity test results. Present test data within each section in sequence listed in administration records.
 - 2. Provide test equipment by name, manufacturer, model number and last calibration date at the end of document. Unless manufacturer specifies more frequent calibration cycle, annual calibration cycle shall be required on all test equipment used for this installation.

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3. Test document shall detail test method used and specific settings of equipment during test. Scanner tests shall be printed on 8 1/2 by 11 inches. Hand written test results (attenuation results and continuity results) shall be documented on a suitable test form.
4. When repairs and re-tests are performed, note problem found and corrective action taken, and collocate in binder both failed and passed test data.

END OF SECTION

27 11 00 Communications Equipment Room Fittings**27 11 16 Communications Racks****1. GENERAL****1.1. Work Includes**

- A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).
- B. Included in this section are the minimum composition requirements and installation methods for the following:

Communication Racks and Rack Cable Management

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of
Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and
Bonding Requirements for Telecommunications

EIA-310-E, Cabinets, Racks, Panels, and Associated Equipment (most recent version)

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

1.4. Submittals

- A. Provide product data for the following:
- B. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

1.1. General

A. RACKS

1. Racks shall be manufactured from aluminum and/or steel extrusion.
2. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
3. Equipment mounting channels will be punched on the front and rear flange with the EIA-310 Universal Mounting hole pattern.
 - a. Aluminum Racks will be threaded with 12-24 roll-formed threads and will include 40 each combination pan head, pilot point mounting screws.
 - b. Steel Racks will have 3/8" square holes and will include 40 each #12-24 x 1/2" mounting screws and 40 each #12-24 cage nuts.

The rack will include assembly and equipment-mounting hardware.

The rack will be rated:

- a. Two Post Racks: 1,000 lb. (453.6 kg) of equipment
 - b. Four Post Racks: 2,000 lb. (907.2 kg) of equipment
4. The rack will be UL Listed
 5. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment.

B. RACK CABLE MANAGEMENT

1. Vertical cable management shall have doors that are lightweight, sturdy, and be available in different sizes to allow flexibility in design.
2. The cable management system shall have a C-Channel bracket that allows for easy access to the cable trough.
3. The vertical cable management system shall allow tool-less installation of Cable Spool.
4. Doors shall come standard with on all cable management and be available in both single and double sided configurations.
5. The door shall have dual hinge design that can be opened to the right or left.
6. The door latching mechanism shall have an easy closing feature.
7. The door shall have one point removal and installation process for door.
8. Horizontal wire managers: The door shall have horizontal cover hinges up or down and be lockable into position with cylindrical finger ends for easy snap on installation
9. The door shall have a recessed handle to eliminate snag potential for clothes and arms.
10. The Horizontal cable management system shall have an open back on 2U and 3U horizontal troughs for easy pass-through of cables

1.2. Free Standing Two Post Aluminum Racks

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack

1. Rack is to provide 45 rack-mount spaces in a "7 foot rack" for equipment. Each mounting space will be marked and numbered on the mounting channel.
2. For the "7 foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
3. Finish shall epoxy-polyester hybrid powder coat in the color as specified below.

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4. Approved Manufacturer: CommScope

[RK3-45A \(MID 760082479\)](#), Black

- B. 52U - 8ft (2438 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
 1. Rack is to provide 52 rack-mount spaces in an "8 foot rack" for equipment. Each mounting space will be marked and numbered on the mounting channel.
 2. For the "8 foot rack" the assembled rack will measure 96" (2438 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
 3. Finish shall be epoxy-polyester hybrid powder coat in the color as specified below.
 4. Approved Manufacturer: CommScope

[RK3-52A \(MID 760082487\)](#), Black

1.3. Vertical Cable Management For Racks

- A. The vertical cable management kits are installed on the side of a 19-inch or 23-inch (483 or 584 mm) wide industry standard rack.
- B. The door(s) shall be designed to provide a concealed vertical space for organizing patch cables.
- C. Cable spools shall be used to organize longer patch cable lengths.
- D. Cable managers are to be matched to the cable rack. Cable managers are available in 6 inch (152 mm), 8 inch (203 mm), 10 inch (254 mm), and 12 inch (305 mm) widths and in 7 foot (2.1 m), 8 foot (2.4 m), and 9 foot (2.7 m) heights.
- E. Approved Manufacturer: CommScope

[VCM-SS-84-12B \(760089458\)](#) 12" Single Side, Vertical Cable Management, Black Door
[VCM-DS-84-6B \(760089375\)](#) 12" Double Side, Vertical Cable Management, Black Door
[VCM-SS-84-6B \(760089425\)](#) 6" Single Side, Vertical Cable Management, Black Door
[VCM-DS-84-6B \(760089342\)](#) 6" Double Side, Vertical Cable Management, Black Door

1.4. Horizontal Cable Management For Racks

- A. The horizontal cable management kits are installed on a 19-inch (483 mm) wide industry standard rack above or below panels to organize patch cables.
- B. The kits shall be available in a single-sided and double-sided configuration, and in a 1U-, 2U-, and 3U-height.
- C. The units shall include covers that can be opened from the top, the bottom, or removed altogether.
- D. The cover hinges shall be designed to hold the cover open from the top or bottom to facilitate faster cabling.
- E. The 2U and 3U cable managers shall have a pass-through feature allowing access to and from the rear for additional cable routing.

- F. The depth of the units shall be
1. Single-sided: 5-1/2 inches (140 mm) deep from front to back with the cover closed
 2. Double-sided: 11 inches (280 mm) deep from front to back with the covers closed.
- G. Approved Manufacturer: CommScope

HTK-19-SS-3U ([760072967](#)) 3RU Horizontal Cable Management
HTK-19-SS-2U ([760072959](#)) 2RU Horizontal Cable Management
HTK -19-SS-1U ([760072942](#)) 1RU Horizontal Cable Management

2. EXECUTION

2.1. Installation

- A. Racks and Cable Management
1. Assemble racks and cable management according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
 2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
 3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
 4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
 5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
 6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

END of SECTION

27 11 19 Communications Termination Blocks and Patch Panels

1. GENERAL

1.1. Work Includes

- A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for Horizontal and Backbone cable terminations installed in communications equipment rooms (Telecommunications Rooms, Equipment Rooms, or "Telecommunications Closets").
- B. Included in this section are the minimum composition requirements and installation methods for the following:

Patch Panels

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of
Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and
Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
ISO/IEC 11801 - Generic cabling for customer premises
CENELEC EN-50173 - Generic cabling systems
BICSI – Telecommunications Distribution Methods Manual

1.4. Submittals

- A. Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

1.1. Patch Panels

B. Category 6/Class E Patch Panels

1. General specifications: Patch panel shall be constructed of high strength steel with satin chrome finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in 24-port and 48-port configurations, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches) for each group of 24 ports.
3. Removable rear mounted cable management bar and front and rear identification labels.
4. Patch panels must be capable of connection to the CommScope Intelligent Patching solution or upgradable to connection to the CommScope Intelligent Patching Solution.
5. Patch panels shall support 5 meter cables in 3 and 4 connector channels, 3 meter cables in 2 connector channels and cross connect cords down to 1 meter.
6. Comply with the standards for Category 6/Class E patch panels listed in the TIA/EIA-568 Series Standards and ISO/IEC 11801.
7. Approved Manufacturer:

a. CommScope SYSTIMAX Patch Panels

360-IPR-1100-E-GS3-1U-24 ([760152561](#))

360-IPR-1100-E-GS3-2U-48 ([760152579](#))

b. CommScope SYSTIMAX Angled Patch Panels

360-IPR-1100A-E-GS3-1U-24 ([760151308](#))

360-IPR-1100A-E-GS3-2U-48 ([760151753](#))

c. CommScope SYSTIMAX VisiPatch Panels

VP360-4U-32P ([760049445](#)) VisiPatch 360 4U (32 ports) Kit

VP360-12U-96P ([760049452](#)) VisiPatch 360 12U (96 ports) Kit

VP360-19PNL-KT ([760074278](#)) VisiPatch 360 19-Inch 1U Panel Kit

C. High Density Modular Patch Panels

1. General specifications: Patch panel shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in a 48-port configuration, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches).
3. Panel shall be designed for CommScope Category 6 and 6A Information Outlets.
4. Removable rear mounted cable management bar and front and rear identification labels.
5. Approved Manufacturer:

a. CommScope SYSTIMAX Patch Panel

M4800-1U-GS ([760105429](#))

b. CommScope SYSTIMAX Angled Patch Panel

M4800A-1U-GS ([760109744](#))

c. CommScope SYSTIMAX VisiPatch Panels

VP360-4U-32P ([760049445](#)) VisiPatch 360 4U (32 ports) Kit

VP360-12U-96P ([760049452](#)) VisiPatch 360 12U (96 ports) Kit
VP360-19PNL-KT ([760074278](#)) VisiPatch 360 19-Inch 1U Panel Kit

- A. Broadband Community Antenna Television (CATV) patch panel
 - 1. Provides for analog broadband video distribution over horizontal UTP cabling to video adapters located in the work area locations. Horizontal UTP cabling shall be category 6 or higher, as specified or indicated. Video signal transmission distances supported by the system shall be as follows for the operational frequency bandwidth of 5 to 550 megahertz:
 - a. 60 meters: 77 channels for minimum received signal level of 0 decibels referenced to millivolt
 - b. 100 meters: 28 channels for minimum received signal level of 0 decibels referenced to millivolt
 - c. 100 meters: 50 channels for minimum received signal level of –10 decibels referenced to millivolt
 - 2. Construction: Rack mounted base unit, 1 RU (44 millimeters [1.72 inches])
 - 3. Port types:
 - a. Input: F-type coaxial input connector (female)
 - b. Output: 8P8C connector jacks rated as Category 6A/Class EA, Category 6/Class E_A or Category 6 compliant
 - 4. Port quantity: Provide mounting for 16 outlets.
 - 5. Standards compliance:
 - UL, CSA, and IEC 950
 - FCC Part 76
 - CISPR 22

2. EXECUTION

2.1. Installation

- A. All Patch Panels shall be installed in the racks installed in the telecommunications space.
- B. Each patch panel shall be attached to the rack using the four (4) rack screws supplied with the panel
- C. All Patch Panels shall be installed level and plum within the racks.
- D. Patch Panels shall be installed per the elevation drawings for the Telecommunications space.

END of SECTION

27 11 23 Communications Cable Management and Ladder Rack/Tray

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of work called for in the contract documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for the equipment and cable installations in telecommunications rooms.
- B. Included in this section are the minimum composition requirements and installation methods for the following:

Ladder Rack/Tray

1.3. 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 PSE or PSE 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 PSE or the PSE representative.
- C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

NEMA – VE-1 – Metal Cable Tray Systems

NEMA – VE-2 – Metal Cable Tray Installation Guidelines

1.4. Submittals

Provide product data for the following:

Manufacturers data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

1.1. Ladder Rack/Tray, Supports, And Accessories

A. Ladder Rack / Tray

1. Ladder rack/tray shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness. Cross members (rungs) will be made from 1" wide by 1/2" high tubular steel with .065" wall thickness.
2. Ladder rack/tray cross members will be welded in between stringers on 9" centers. There will be 8" of open space in between each cross member.
3. Design Make:

CommScope example part numbers

CR-SLR-10L12W ([760085647](#)) 10ft long, 12" wide, Black
 CR-SLR-10L18W ([760085654](#)) 10ft long, 18" wide, Black
 CR-SLR-10L24W ([760085662](#)) 10ft long, 24" wide, Black

B. Horizontal 90° Turns (Cable Runway E-Bend)

1. Horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" 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 an inside radius that will create a smooth horizontal 90° turn.
3. Design Make:

CommScope example part numbers

CR90FCB-12W ([760085530](#)) 12 inch (305 mm) W
 CR90FCB-18W ([760085548](#)) 18 inch (457 mm) W
 CR90FCB-24W ([760085555](#)) 24 inch (610 mm) W

C. Ladder Rack/Tray Splices

1. Splice kits will provide a method of mechanically connecting ladder rack/tray sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Design Make:

CommScope example part numbers

CRBSK ([760083899](#)) Butt Splice Kit
 CRTJSK ([760084046](#)) Junction Splice Kit

D. Ladder Rack/Tray Accessories

1. Cable straps used for attaching cable bundles to the ladder rack/tray cross members must be reusable with a hook and loop-style closure, at least 3/4" wide, and sized for cable bundles that are 2", 3" or 4" in diameter.
2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack/tray shall be manufactured from 1" by 1/2" tubular steel with .065" wall thickness. Cable retaining posts will be 8" high and will attach to the side stringer of the ladder rack/tray 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/tray will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8" wide by 1-1/2" high side stringers and will be sold in pairs.

4. Radius drops or “waterfalls” used to maintain the bend Radius of the cables as they exit or enter the ladder rack/tray will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3”. Radius drops will attach to either the side stringer or the cross member of the ladder rack/tray using a clevis pin. Radius drops will include 1-1/2” high cable spools that attach to the top of the radius drop to guide cables.
5. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack/tray will be made from 1/8” x 1” steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack/tray. The bracket will hang below the ladder rack/tray a minimum of 4”. The bracket support surface will be 4” long. The bracket will be zinc plated with a gold chem. finish.
6. 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.
7. Design Make:
CommScope example part numbers

[CRRP-8H \(760083980\)](#) Cable retaining posts

[CRPECK \(760084012\)](#) Ladder rack end caps

[CRDK-12W \(760083956\)](#) Radius Drops

2. EXECUTION

2.1. Installation

- E. Provide all components of the ladder rack/tray system (ladder rack/tray, turns, splices, supports, and accessories) from a single manufacturer.
- F. Ladder rack/tray shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
- G. Ladder rack/tray shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer’s recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).
- H. Ladder rack/tray splices will be made in mid-span, not over a support, with the manufacturer’s recommended splice hardware.
- I. Ladder rack/tray shall be supported every 5’ or less in accordance with TIA-569. Ladder rack/tray shall be supported within 2’ of every splice and within 2’ on both/all sides of every intersection. Support ladder rack/tray within 2’ on both sides of every change in elevation. Support ladder rack/tray every 2’ when attached vertically to a wall.
- J. When the pathway is overhead, ladder rack/tray shall be installed with a minimum clearance of 12” above the ladder rack/tray. Leave a minimum of 12” in between ladder rack/tray and ceiling/building truss structure. Leave a minimum of 3” in between ladder rack/tray and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack/tray shall be installed with a minimum clearance of 12” in between each tier of ladder rack/tray. When located above an acoustical drop

ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack/tray.

- K. All threaded rod used in support of overhead cable trays shall have cable guard protectors installed over the exposed threaded rod in the area of the tray. The exposed end of the threaded rod hangers shall be cut flush with the mounting brackets, filed, and painted to match site conditions. Install rubber finishing caps on any exposed metal end rail or potential sharp point.
- L. When installed under a raised floor, ladder rack/tray shall be installed with a minimum 3" clearance between the top of the ladder rack/tray and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks/trays wherever ladder racks/trays cross.
- M. Within each telecommunications room, ladder rack/tray should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack/tray and turns shall be bonded across each splice with a bonding kit. Ladder rack/tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack/tray and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack/tray where bonding/ground lugs contact the ladder rack/tray so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack/tray and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack/tray sections and turns and through the bond to the TGB.
- N. The quantity of cables within the ladder rack/tray will not exceed a whole number value equal to 50% of the interior area of the ladder rack/tray divided by the cross-sectional area of the cable. The interior area of ladder rack/tray will be considered to be the width of the ladder rack/tray multiplied by a height of 2", unless cable retaining posts are added to the ladder rack/tray. The interior area of ladder rack/tray equipped with cable retaining posts will be considered to be the width of the ladder rack/tray multiplied by a height of 6". Actual cable fill for ladder rack/tray that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack/tray equipped with cable retaining posts will not exceed 6" in height.
- O. The combined weight of cables within the ladder rack/tray will not exceed the stated load capacity of the ladder rack/tray as stated in the manufacturer's product specifications or load/design tables.
- P. Cables (cable bundles) will be secured to the cross members of ladder rack/tray with $\frac{3}{4}$ " wide reusable straps. Straps are not required when ladder rack/tray is equipped with cable retaining posts.
- Q. Use a radius drop to guide cables wherever cable exits overhead ladder rack/tray to access a rack, cabinet or wall-mounted rack, and cabinet or termination field. Provide a support other conductors that should be physically separated from cables within the ladder rack/tray as defined by local code or the authority having jurisdiction (AHJ).

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- R. Whenever possible, maintain a 2' separation between ladder rack/tray used for communications cables and pathways for other utilities or building services.
- S. The installer will provide touch-up paint color-matched to the finish on the ladder rack/tray and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the PSE. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack/tray system.

END of SECTION

27 13 00 Communications Backbone Cabling

27 13 13 Communication Copper Backbone Cabling

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all voice backbone applications called for in the Contract Documents. Provide sufficient pair count to support 100% expansion at the outlet locations.

1.2. Scope of Work

- A. This section includes the minimum requirements for Inter and Intra Building Copper Backbone Cables.
- B. Included in this section are the minimum composition requirements and installation methods for the following:

Intra-Building Backbone (Inside buildings (ISP))

Inter-Building Backbone (Between buildings (OSP))

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of
Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and
Bonding Requirements for Telecommunications

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

1.4. Submittals

Cable Manufacturer's data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment

The Contractor shall submit installation plan indicating:

1. Equipment and personnel
2. Materials and staging area
3. Start and completion dates
4. Locations, including floor, room and building

The Contractor shall submit a copper cable pulling plan for all multi-pair copper cables with a pair count of 25 pairs or greater, that includes, but is not limited to, the following:

1. Each cable run and route.
2. Date and duration of the pull.
3. Pulling methodology and equipment setups.
4. Pulling tension calculations for each pull in the run.
5. Safety issues and precautions to be taken.

Product data for all termination and test equipment to be used by Contractor to perform work.

1. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.
2. Contractor shall include copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

1.1. Intra-Building Copper Backbone for Analog/Voice only

- A. All cable shall be listed for use per the National Electrical Code (NFPA-70).
- B. Cable shall meet one of the following, per bid document:
 1. UL-listed CMR cable: Solid copper conductors with high-density polyolefin insulation and overall low smoke PVC jacket to achieve riser (i.e., non-plenum) rating by UL standards
 2. UL-listed CMP cable: Solid copper conductors with FEP insulation and overall low smoke PVC jacket to achieve plenum rating by UL standards
 3. LSZH cable: Solid copper conductors with non-halogen HDPE insulation and low smoke, zero halogen, compound jacket to achieve LSZH rating by:
 - IEC 60754—Part 2.
 - IEC 61034—Part 2.
 - IEC 60332—Part 1.
 - Def Stan 713.
- C. Cable shall meet the requirement of ANSI/TIA/EIA-568 series Standards for Category 3 performance.
- D. Approved Manufacturer:
 1. CommScope, Inc.

1010 025 ([106824329](#)) 25 Pair Riser Rated
 1010 050 ([106824378](#)) 50 Pair Riser Rated
 1010 100 ([106824469](#)) 100 Pair Riser Rated
 2010 025 ([107765992](#)) 25 pair Plenum Rated
 2010 050 ([107766040](#)) 50 pair Plenum Rated
 2010 100 ([107766057](#)) 100 pair Plenum Rated
 3010 025 ([760010900](#)) 25 pair LZSH Rated

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3010 100 ([760010918](#)) 100 pair LZSH Rated

1.2. Inter-Building Copper Backbone for Analog/Voice only

- A. All cable shall be manufactured and constructed for use in the Outside Plant Environment.
- B. Cable shall meet the requirement of ANSI/TIA/EIA-568 series Standards for Category 3 performance
- C. Approved Manufacturer:
 - 1. CommScope, Inc.

[Outdoor Multi-Pair Data Cable, 25 pair \(999903004\)](#)
[Outdoor Multi-Pair Data Cable, 50 pair \(999903005\)](#)
[Outdoor Multi-Pair Data Cable, 100 pair \(999903006\)](#)
[Outdoor Multi-Pair Data Cable, 200 pair \(999903010\)](#)

1.3. Building entrance protection

Building entrance protection for copper cabling shall be installed utilizing a two (2) foot fuse link between outside plant cable plant splice and the protector module with IDC-type input and output terminals, 100 pair-pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Sufficient protector modules shall be provided to completely populate all building entrance terminals.

1.4. Voice backbone cables

Voice backbone cables shall have a minimum 10-foot service loop when terminated in the ER and TR, and at any splice points in telecommunications manholes.

1.5. Protector Panels

1.6. Copper Termination Hardware

- D. Main Cross Connect (MC) and Entrance Facility (EF)

- 1. Approved Manufacturer:
 - a. CommScope SYSTIMAX

[110AA2-100FT \(107058901\)](#) 110 Field Terminated Cross-Connect System Terminal Blocks, 20 X 110C-5
[VP360-4U-32P \(760049445\)](#) VisiPatch 360 4U (32 ports) Kit
[VP360-12U-96P \(760049452\)](#) VisiPatch 360 12U (96 ports) Kit
[VP360-19PNL-KT \(760074278\)](#) VisiPatch 360 19-Inch 1U Panel Kit
[M2000A-48 2U \(760049965\)](#) U/UTP Modular Panel 2U, 48 port angled

2. EXECUTION

2.1. Installation

- A. General - Inter And Intra Building Copper Backbone Cable

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1. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
2. Provide all necessary products for installation of Copper Backbone cablings to include cable attachments, etc.
3. Backbone cable shall be installed following industry standard practices.
4. All Outside Plant Backbone cable shall terminate on Primary protection (per the NEC) upon entering the building.
5. All installations shall comply with:
 - ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
 - TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
 - ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - NFPA 70 – National Electric Code
 - BICSI – Telecommunications Distribution Methods Manual

B. Backbone Cable Testing

1. Complete end-to-end test results for all copper UTP cables installed are required.
2. All multi-pair copper cable pairs installed shall be tested to TIA/EIA 568A, Category 3 or Category 6 equivalent performance specifications. In addition, provide loop resistance measurements in ohms and dB loss at 1KHz, 8KHz, and 256KHz.
3. The PSE is to be notified at least 24 hours prior to testing to allow observation at the PSE's discretion. If the PSE confirms his intention to observe, a reasonable starting time shall be agreed upon. Should the PSE not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.
4. 100% of all pairs in backbone copper cables shall be tested for continuity and wire-map.
5. Testing Format: Test Results must be submitted in two (2) formats. First, must be original file(s) down loaded from tester. Second, the file must be cohesively placed in Excel format with the following fields:
 - ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.
6. All test results are to be recorded and submitted to the PSE.

C. Cable And Termination Panel Labeling Backbone Cable Testing

Label the installed cables in accordance with Section 27 05 53

D. Cable Support

1. Provide cable supports and clamps to attach cables to backboards and walls.
2. Attach horizontal and vertical backbone cables at 2 foot intervals using PSE approved supports; such as D-rings or jumper troughs utilized for wire management.
3. Attach cables to manhole racks using PSE approved methods
4. Backbone cabling shall be secured to the cable/ladder tray following manufacturer recommended procedures, and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

E. As-built Drawings

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1. CAD Files: Provide CAD files in .dwg or .dgn formats showing floor plans with room numbers and actual backbone cabling and pathway locations and labeling. The deliverable is required within 5 business days of final cable testing.
2. Red Line Drawings: Contract must kept one (1) E size set of floor plans on site during work hours showing installation progress marked and backbone cable labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END of SECTION

27 15 00 Communications Horizontal Cabling

27 15 13 Communication Copper Horizontal Cabling

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Copper Horizontal Cabling applications called for in the Bid Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for Copper Horizontal Cables.
- B. Horizontal (to desktop) cable shall consist of Category 5E, 6 or 6A copper cable for all Data and Voice applications.
- C. At corporate, engineering and campus facilities, horizontal cabling to typical work area outlets (including offices, cubicles and conference rooms) shall consist of four Category 5e or Category 6 cables serving each outlet. At field sales offices, horizontal cabling to typical work area outlets shall consist of two Category 5e or Category 6 cables serving each outlet.
- D. Outlets for wall-mounted or other “telephone only” installations shall consist of one Category 5e cable as a minimum.
- E. Outlets for wireless access points (APs) shall consist of two Category 5e or 6 cables as a minimum.

1.3. 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 PSE or PSE Representative. 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
 - ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards
ISO/IEC 11801 - Generic Cabling for Customer Premises
CENELEC EN-50173 - Generic Cabling Systems

1.4. Cable Construction (by Type):

- A. Listed CMR cable: Solid copper conductors with high-density polyolefin insulation and an overall low smoke polyvinyl chloride (PVC) jacket to achieve a riser (i.e., non-plenum) rating by applicable NEC requirements.
- B. Listed CMP cable: Solid copper conductors with fluorinated ethylene propylene (FEP) insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.
- C. LSZH cable: Solid copper conductors with non-halogen high-density polyethylene (HDPE) insulation and a low smoke, zero halogen, compound jacket to achieve a LSZH rating by applicable IEC standards
- D. LC cable: Solid copper conductors with FEP fluoropolymer insulation and overall FEP fluoropolymer jacket to achieve CMP 50 rating by UL standards
- E. OSP outdoor cable rated for wet locations: Solid copper conductors with polyethylene insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket
- F. Comply with following general physical specifications:
 - 1. Maximum pulling tension: 110 Newton's (25 pound-force)
 - 2. Operating temperature: -20 to 60 degrees C [-4 to 140 degrees F]

1.5. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.6. Coordination

Coordinate layout and installation of cable tray with other trades.

1. PRODUCTS

1.1. Data/Voice Communications Horizontal Cabling (Category 3/Class C)

- A. Category 3 horizontal cabling shall not be used for Data Communication cable. Category 3 cabling may be used for telephone cable for special instances where ANALOG ONLY service is required and is specified in the bid document.
 - 1. All Cables shall be of round construction
 - 2. Each cable shall contain 4 to 100 color coded pairs as required in the bid document.
 - 3. Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.)
 - 4. Approved Manufacturer:
 - a. CommScope SYSTIMAX

1010 4 pair ([106062524](#)) Riser Cat 3

2010 4 pair ([107078388](#)) Plenum Cat 3
- B. Category 3 Cabling shall comply with the following application standards:
 - 1. Voice, facsimile, modem, Switched 56, T-1, and ISDN.
 - 2. RS-232, RS-422, and RS-485.
 - 3. IEEE 802.3 1BASE5, 10BASE-T, 100BASE-T, and 1000BASE-T.
 - 4. IEEE 1394B transfer mode S100.
 - 5. IEEE 802.5 at 4 megabits per second and 16 megabits per second at 100 meters (328 feet).
 - 6. TP-PMD technology at 100 megabits per second.
 - 7. ATM at 155 megabits per second and 622 megabits per second using parallel transmission schemes.
- C. Category 3 Cabling shall comply with following BAS application specifications:
 - 1. Operating voltages for dry locations: 0 to 30 Vac at 60 hertz, 0 to 70.7 Vac for audio frequencies, and 0 to 60 Vdc
 - 2. Operating currents at 25 degrees C (77 degrees F) ambient temperature
 - a. One current-carrying pair per cable: 1.5 amperes on each conductor
 - b. Two to Four current-carrying pairs per cable: 3.36 amperes for all pairs
 - c. Audio frequencies and 1 current-carrying pair per cable: 1 ampere on each conductor

1.2. Data Communications Horizontal Cabling (Category 5e/Class D)

- A. Category 5 Enhanced (5e) Unshielded Twisted-Pair (UTP) Cable
 - 1. All Cables shall be of round construction
 - 2. Each cable shall contain 4 color coded pairs
 - 3. Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.)
 - 4. Approved Manufacturer:
 - a. CommScope SYSTIMAX

1061 4 pair ([107078388](#)) Riser Cat 5e

2061 4 pair ([760041939](#)) Plenum Cat 5e

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3061 4 pair (760158741) LSZH Cat 5e

- B. Category 5e horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel.

Test Parameter	Guaranteed Margins/Values
Attenuation	5%
Pair-Pair NEXT	3dB
PSNEXT	5.5dB
Pair-Pair ELFEXT	4.5 dB
PSELFEXT	5.5dB
Return Loss	1dB
Delay	580-546.9ns ²
Delay Skew	30ns

1. All guarantees described in this document are subject to the terms and conditions of the SYSTIMAX Extended Product Warranty and Applications Assurance Program
2. Phase Delay is frequency dependent

- C. Category 5e horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

Freq (MHz)	Atten (dB)	pr-pr NEXT (dB)	ACR (dB)	PS NEXT (dB)	PS ACR (dB)	pr-pr ELFEXT (dB)	PS ELFEXT (dB)	Return Loss (dB)	Phase Delay (ns)	Delay Skew (ns)
1	2.1	66.3	64.2	66.1	64.0	61.8	59.8	18.0	580	30
4	4.2	56.6	52.4	56.2	52.0	49.8	47.8	18.0	562	30
8	6.0	51.6	45.6	51.2	45.2	43.8	41.8	18.0	557	30
10	6.7	50.0	43.3	49.6	42.9	41.8	39.8	18.0	555	30
16	8.6	46.6	38.0	46.2	37.6	37.8	35.8	18.0	553	30
20	9.6	45.0	35.4	44.6	35.0	35.8	33.8	18.0	552	30
25	10.4	43.4	33.0	42.9	32.5	33.9	31.9	17.0	551	30
31.25	12.2	41.7	29.5	41.2	29.0	31.9	29.9	16.0	550	30
62.5	17.6	36.6	19.0	36.1	18.5	25.9	23.9	13.1	549	30
100	22.8	33.1	10.3	32.6	9.8	21.9	19.9	11.0	548	30
125	25.8	31.5	5.7	30.9	5.1	19.9	17.9	10.1	547	30
155.5	29.1	29.8	0.7	29.2	0.1	18.0	16.0	9.1	547	30

1. The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.

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2. All values and equations apply to worst-case channels utilizing four-pair 61C+ or 61B series cables with full cross-connects consolidation points and work area outlets (4 connections in a channel) for the length up to 100 meters.

1.3. Data Communications Horizontal Cabling (Category 6/ClassE)

A. Category 6/Class E Unshielded Twisted-Pair (UTP) Cable

1. All Cables shall be of round construction
2. Each cable shall contain 4 color coded pairs
3. Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.)
4. Approved Manufacturer:
 - a. CommScope SYSTIMAX

1071 4 pair ([700211931](#)) Riser Cat 6

2071 4 pair ([700214372](#)) Plenum Cat 6

3071 4 pair ([760095554](#)) LSZH Cat 6

- B. Category 6 horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel:

Electrical Parameter (1-250MHZ)	Guaranteed Margins to Category 6 Class E Channel Specifications
Insertion loss	5%
NEXT	6 dB
PSNEXT	7.5 dB
ELFEXT	6 dB
PSELFEXT	8 dB
Return Loss	4 dB

- C. Category 6 horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

Guaranteed Channel Performance Specifications for 4-Connection GigaSPEED XL7 U/UTP Systems										
Freq (MHz)	Insertion Loss (dB)	NEXT (dB)	ACR (dB)	PSNEXT (dB)	PSACR (dB)	ELFEXT (dB)	PSELFEXT (dB)	Return Loss (dB)	Delay (ns)	Delay Skew (ns)
1.0	2.0	71.0	69.0	69.5	67.5	69.3	68.3	23.0	580	30
4.0	3.8	69.0	65.2	68.0	64.2	57.2	56.2	23.0	562	30
8.0	5.4	64.2	58.8	63.1	57.7	51.2	50.2	23.0	557	30
10.0	6.0	62.6	56.6	61.5	55.5	49.3	48.3	23.0	555	30
16.0	7.6	59.2	51.6	58.1	50.4	45.2	44.2	22.0	553	30
20.0	8.6	57.6	49.1	56.5	47.9	43.2	42.2	21.5	552	30
25.0	9.6	56.0	46.4	54.8	45.2	41.3	40.3	21.0	551	30

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31.25	10.8	54.4	43.6	53.2	42.4	39.4	38.4	20.5	550	30
62.5	15.6	49.4	33.7	48.1	32.4	33.3	32.3	18.0	549	30
100.0	20.2	45.9	25.7	44.6	24.3	29.3	28.3	16.0	548	30
200.0	30.0	40.8	10.8	39.4	9.4	23.2	22.2	13.0	547	30
250.0	34.1	39.1	5.0	37.7	3.5	21.3	20.3	12.0	546	30

1. The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.
 2. All values and equations apply to worst-case channels utilizing four-pair 71E series cables with full cross-connects, consolidation points and work area outlets (4 connectors in a channel) for any channel lengths up to 100 meters.
- D. Category 6 horizontal cabling shall provide the following Margin to the specification when installed in a 6 connector Channel

Electrical Parameter (1-250MHZ)	Guaranteed Margins to Category 6 Class E Channel Specifications
Insertion loss	4%
NEXT	4 dB
PSNEXT	5.5 dB
ELFEXT	4 dB
PSELFEXT	6 dB
Return Loss	2 dB

- E. Category 6 horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 6 connector Channel.

Guaranteed Channel Performance Specifications for 6-Connection GigaSPEED XL7 U/UTP Systems										
Freq (MHz)	Insertion Loss (dB)	NEXT (dB)	ACR (dB)	PSNEXT (dB)	PSACR (dB)	ELFEXT (dB)	PSELFEXT (dB)	Return Loss (dB)	Delay (ns)	Delay Skew (ns)
1.0	2.1	69.0	66.9	67.5	65.4	67.3	66.3	21.0	580	30
4.0	3.9	67.0	63.2	66.0	62.1	55.2	54.2	21.0	562	30
8.0	5.4	62.2	56.7	61.1	55.7	49.2	48.2	21.0	557	30
10.0	6.1	60.6	54.5	59.5	53.4	47.3	46.3	21.0	555	30
16.0	7.7	57.2	49.5	56.1	48.4	43.2	42.2	20.0	553	30
20.0	8.7	55.6	47.0	54.4	45.8	41.2	40.2	19.5	552	30
25.0	9.7	54.0	44.3	52.8	43.1	39.3	38.3	19.0	551	30
31.25	10.9	52.4	41.5	51.2	40.3	37.4	36.4	18.5	550	30
62.5	15.8	47.4	31.6	46.1	30.3	31.3	30.3	16.0	549	30
100.0	20.4	43.9	23.5	42.6	22.1	27.3	26.3	14.0	548	30
200.0	30.3	38.8	8.5	37.4	7.1	21.2	20.2	11.0	547	30
250.0	34.5	37.1	2.6	35.7	1.2	19.3	18.3	10.0	546	30

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1. The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.
2. All values and equations apply to worst-case channels utilizing four-pair 71E series cables with up to 6 embedded connections in a channel for any channel lengths up to 100 meters.

1.4. Data Communications Horizontal Cabling (Category 6A/Class EA)

A. Category 6 Augmented (6A)/Class EA Unshielded Twisted-Pair (UTP) Cable

1. All Cables shall be of round construction
2. Each cable shall contain 4 color coded pairs
3. Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.)
4. Approved Manufacturer:
 - a. CommScope SYSTIMAX

1091B 4 pair ([760107078](#)) Riser Cat 6A
 2091B 4 pair ([760107250](#)) Plenum Cat 6A
 3091B 4 pair ([760107334](#)) LSZH Cat 6A
 1088B 4 pair ([760142547](#)) Riser EXPRESS Cat 6A
 2088B 4 pair ([760142638](#)) Plenum EXPRESS Cat 6A
 3088B 4 pair ([760142679](#)) LSZH EXPRESS Cat 6A

- B. Category 6A horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel.

Electrical Parameter (1-250MHZ)	Guaranteed Channel Margins to Amendment 1 to ISO/IEC 11801:2002 "Class E _A "
Insertion loss	3%
NEXT	3 dB
PSNEXT	5 dB
ACR-N	5 dB
PSACR-N	6.5 dB
ACR-F	6 dB
PSACR-F	8 dB
Return Loss	1 dB
Return Loss, PSANEXT, PSAACR-F, Avg. PSANEXT, Avg. PSAACR-F	2 dB

- C. Category 6A horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

Guaranteed Channel Performance Specifications for 4-Connection GigaSPEED 360X10D U/UTP Systems

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Freq (MHz)	Insertion Loss (dB)	PS ANEXT (dB)	Avg. PS ANEXT (dB)	PS AACR-F (dB)	AVG. PS AACR-F (dB)	NEXT (dB)	ACR-N (dB)	PS NEXT (dB)	PS ACR-N (dB)	ACR-F (dB)	PS ACR-F (dB)	Return Loss (dB)	Delay (ns)	Delay Skew (ns)
1	2.2	82.0	84.3	79.0	83.0	75.7	73.5	75.3	73.1	69.3	68.3	20.0	580	40
4	4.0	76.0	78.2	67.0	71.0	66.0	62.0	65.5	61.5	57.2	56.2	20.0	562	40
8	5.6	73.0	75.2	60.9	64.9	61.2	55.5	60.6	55.0	51.2	50.2	20.0	557	40
10	6.3	72.0	74.3	59.0	63.0	59.6	53.3	59.0	52.7	49.3	48.3	20.0	555	40
16	7.9	70.0	72.2	54.9	58.9	56.2	48.3	55.6	47.7	45.2	44.2	19.0	553	40
20	8.9	69.0	71.2	53.0	57.0	54.6	45.7	54.0	45.1	43.2	42.2	18.5	552	40
25	9.9	68.0	70.3	51.0	55.0	53.0	43.1	52.3	42.4	41.3	40.3	18.0	551	40
31.3	11.1	67.0	69.3	49.1	53.1	51.4	40.3	50.7	39.6	39.3	38.3	17.5	550	40
62.5	15.9	64.0	66.3	43.1	47.1	46.4	30.5	45.6	29.7	33.3	32.3	15.0	549	40
100	20.3	62.0	64.3	39.0	43.0	42.9	22.7	42.1	21.8	29.3	28.3	13.0	548	40
200	29.2	57.5	59.7	33.0	37.0	37.8	8.6	36.9	7.7	23.2	22.2	10.0	547	40
250	32.9	56.0	58.3	31.0	35.0	36.1	3.2	35.2	2.3	21.3	20.3	9.0	546	40
300	36.2	54.8	57.1	29.5	33.5	34.7	-1.5	33.8	-2.5	19.7	18.7	8.2	546	40
400	42.3	53.0	55.2	27.0	31.0	32.6	-9.8	31.6	-10.8	17.2	16.2	7.0	546	40
500	47.8	51.5	53.8	25.0	29.0	30.9	-17.0	29.8	-18.0	15.3	14.3	7.0	546	40

1. The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.
2. All values and equations apply to worst-case channels utilizing four-pair 91A series cables with full cross-connects, consolidation points and work area outlets (4 connections in a channel) for the length up to 100 meters.

2. PART3 – EXECUTION

2.1. Installation

- A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
- B. Cable shall be installed following industry standard practices.
- C. Horizontal cabling shall be installed from the work area outlet location to the nearest Telecommunications Space.
- D. Horizontal cabling shall be terminated on a patch panel in the telecommunication space which is the same category rating as the Cable. i.e. Cat 6 cable terminates on Cat 6 panels.
- E. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.
- F. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 15 43 Communications Faceplates and Connectors**27 15 43.10 Communications Copper Jack/Information Outlets and Connectors****1. GENERAL****1.1. Work Includes**

Provide all labor, materials, and equipment for the complete installation of all Jack/Information outlets and connections called for in the Bid Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for Jack/Information outlets and Connectors.
- B. The channel performance for the installation shall meet or exceed the requirements of ANSI/TIA-568 and ISO/IEC 11801 for the specified Category.
- C. The Jack/Information outlets shall match the category of the cabling
- D. All jacks/information outlets shall meet UL 94 V-O

1.3. 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 PSE or PSE 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
 - ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
 - TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
 - ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - NFPA 70 – National Electric Code
 - BICSI – Telecommunications Distribution Methods Manual
 - Bellcore, fiber distributed data interface (FDDI), and EIA standards

ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable
Telcordia's Generic Requirements for Optical Fiber and Optical Fiber Cable
TIA/EIA-568-C .1
TIA/EIA-568-C.2
TIA/EIA-568-C.3
ISO/IEC 11801
CENELEC EN-50173

1.4. Submittals

Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Jack/Information outlets and connectors with other trades.

1. PRODUCTS

1.1. General

- A. All products will be compliant to RoHS 2002/95/EC
- B. All products will be designed, manufactured and/or distributed under this quality management system: ISO 9001:2008
- C. Telecommunications jacks shall be 8-position/8-conductor modular outlets accepting industry standard modular RJ45 type plugs and insulation displacement conductor (IDC) terminations.
- D. The Universal design shall support T568A and T568B wiring and shall have universal wiring labels, including color-coded insert identification labels to ensure accurate identification.
- E. Color shall be specified or selected by PSE's Representative from manufacturer's standard colors.
- F. Provide crosstalk cancellation with compensation and alien crosstalk mitigation using printed wiring board materials and compensation technology.
- G. Jack shall be backward compatible with lower category cords and cables.
- H. Low-profile wire cap shall protect against contamination and secure connection. Jacks shall be suitable for:
 - 1. Modular patching applications or as modular TO
 - 2. Installation without special faceplates at either 45- or a 90-degree angle in manufacturer's modular faceplates and frames, including those on surface-mounted boxes
- I. Dimensions
 - 1. Depth: 30.48 mm (1.20 in)
 - 2. Height : 20.32 mm (0.80 in)

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3. Width : 20.32 mm (0.80 in)

J. Electrical Specifications

1. Contact Resistance Variation, maximum: 20 mOhm
2. Contact Resistance, maximum: 100 mOhm
3. Current Rating : 1.5 A @ 20 °C, 1.5 A @ 68 °F
4. Dielectric Withstand Voltage, RMS, conductive surface : 1500 Vac @ 60 Hz
5. Dielectric Withstand Voltage, RMS, contact-to-contact : 1000 Vac @ 60 Hz
6. Insulation Resistance, minimum : 500 MOhm

K. Environmental Specifications

1. Flammability Rating: UL 94 V-0
2. Operating Temperature: -10 °C to +60 °C (+14 °F to +140 °F)
3. Relative Humidity : Up to 95%, non-condensing
4. Safety Standard: cUL , UL
5. Storage Temperature: -40 °C to +70 °C (-40 °F to +158 °F)

L. Mechanical Specifications

1. Conductor Type: Solid, Stranded (7 strands)
2. Material Type: Copper alloy, High-impact, flame retardant, thermoplastic
3. Outlet/Module Contact Plating: Precious metals
4. Plug Insertion Life, minimum: 750 times
5. Plug Insertion Life, test plug: IEC 60603-7 compliant plug
6. Plug Retention Force, minimum: 30 lbf, 133 N
7. Rear Termination Contact Plating: Precious metals
8. Rear Termination Type: IDC
9. Wiring: T568A or T568B
10. Can be mounted either at 90 degrees (straight) or 45 degrees (angled)
11. Angled feature eliminates the need for special faceplates

1.2. Category 6/Class E Outlets

- A. GigaSPEED® XL MGS400 Series Category 6 U/UTP Information Outlet
- B. Electrical performance guaranteed to meet or exceed TIA/EIA 568-C.2 Category 6 and ISO/IEC Category 6/Class E specifications.
- C. Optional Plastic Icons (M61A) and Dust Covers (M20A) available in several colors
- D. Backward compatible with Category 5e, 5 and 3 cords and cables, however optimal performance achieved when used with GigaSPEED XL GS8E patch cords.
- E. Can support network line speeds in excess of 1 gigabit per second.
- F. Qualifies for a 20-year product and applications assurance warranty when included as part of a certified SYSTIMAX GigaSPEED XL channel.
- G. Approved Manufacturer:

- a. CommScope SYSTIMAX

[MGS400- 226 – Cat 6 Green](#)

[MGS400-318 – Cat 6 Blue](#)

[MGS400-112](#) – Cat 6 Orange

[MGS400-262](#) – Cat 6 White

[MGS400-003](#) – Cat 6 Black

2. EXECUTION

2.1. Installation

- A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
- B. Jack/Information outlets and Connectors shall be installed following industry standard practices.
- C. Horizontal cabling shall be terminated on a Jack/Information outlet which is the same category rating as the Cable. i.e. Cat 6 cable terminates on Cat 6 Jack/Information outlets.
- D. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.
- E. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 15 43.20 Multimedia audio/video connectors and adapters

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all audio/video connectors and adapters called for in the Bid Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for audio/video connectors and adapters.
- B. The performance for the installation shall meet or exceed the requirements of ANSI/TIA-568 and ISO/IEC 11801 for the specified Category.
- C. The audio/video connectors and adapters shall match the type of cabling installed.
- D. All audio/video connectors and adapters shall meet UL 94 V-O

1.3. 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 PSE or PSE 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,

ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard

TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards

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TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard
ISO/IEC 11801 - Generic Cabling for Customer Premises
CENELEC EN-50173 - Generic Cabling Systems

1.4. Submittals

Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Jack/Information outlets and connectors with other trades.

1. PRODUCTS

1.1. General

A. All products will be:

1. Compliant to RoHS 2002/95/EC
2. Designed, manufactured and/or distributed under this quality management system: ISO 9001:2008

1.2. Coaxial cable adapters:

- A. Function: Outlets shall provide data and radio frequency (RF) video connectivity for signals transmitted on coaxial cable.
- B. Modular BNC coupler: 50 ohm impedance module designed for data applications
- C. M-Series F-81 coaxial coupler: 75 ohm module designed for video applications
- D. Approved Manufacturer:
(Following Catalog Number/Part numbers are provided as examples, see CommScope representative for assistance in selecting the proper connectors)

a. CommScope

M81C [108009432](#) F-Coax Pass Through Coupler

2. EXECUTION

2.1. Installation

- A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
- B. Jack/Information outlets and Connectors shall be installed following industry standard practices.
- C. Horizontal cabling shall be terminated on a Jack/Information outlet which is the same category rating as the Cable. i.e. Cat 6 cable terminates on Cat 6 Jack/Information outlets.

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- D. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.
- E. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 15 43.25 Work Area Faceplate/Wall Plates and Surface Mount Boxes

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Faceplate/wall plates and Surface mount Boxes called for in the Bid Documents.

1.2. Scope of Work

- A. This section includes the minimum requirements for Faceplate/wall plates and Surface mount Boxes.
- B. All Faceplates and Surface Mount boxes shall be constructed of high-impact, flame retardant; UL rated 94 V-0 Thermoplastic.
- C. Faceplates and SMB shall be designed to accept the CommScope SYSTIMAX information outlets.
- D. Number of outlets per faceplate shall be as detailed on the Telecommunications Drawings.

1.3. 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 PSE or PSE 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, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,

ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

NFPA 70 – National Electric Code

BICSI – Telecommunications Distribution Methods Manual

TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard

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TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards

TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard

ISO/IEC 11801 - Generic Cabling for Customer Premises

CENELEC EN-50173 - Generic Cabling Systems

1.4. Submittals

Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Faceplate/wall plates and Surface mount Boxes with other trades.

1. PRODUCTS

1.1. Faceplates and Surface Mount Boxes (SMB)

A. Approved Manufacturer:

(Following Catalog Number/Part numbers are provided as examples, see CommScope representative for assistance in selecting the proper faceplates and SMBs)

a. CommScope

[M13FP-262](#) – Single Gang Flexible Frame White

[M30FP-2RJ45-262](#) – Double port adapter for Flexible frame white

[M30FP-BLANK-262](#) – Double Blank adapter for Flexible Frame white

[M102SMB-B-262](#) – 2 port surface mount box white

[M104SMB-B-262](#) – 4 port surface mount box white

[630B8](#) – Stainless Steel wall Phone jack (T-568B)

[M81LS-LS](#) – 4 port faceplate for LC M81LS-XX fiber spools

1.2. Dust Covers for Faceplates and Surface Mount Boxes (SMB)

A. Dust Covers shall be dual purpose blank covers designed for use with modular outlets and faceplates. They shall be used to cover the outlet opening of all empty faceplate openings and unpopulated jacks to protect the wires from collecting dust.

B. Approved Manufacturer:

(Following Catalog Number/Part numbers are provided as examples, see CommScope representative for assistance in selecting the proper faceplates and SMBs)

a. CommScope

[M20AP-246](#) [107067860](#) Ivory cover for empty faceplate openings

[M21A-246](#) [108066457](#) Ivory cover for unpopulated jacks

2. EXECUTION

2.1. Installation

1. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
2. Faceplate/wall plates and Surface mount Boxes shall be installed following industry standard practices.
3. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.
4. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

Summary of Part Numbers

Copper products

360-IPR-1100-E-GS3-1U-24 (760152561)
360-IPR-1100-E-GS3-2U-48 (760152579)
360-IPR-1100A-E-GS3-1U-24 (760151308)
360-IPR-1100A-E-GS3-2U-48 (760151753)
VP360-4U-32P (760049445) VisiPATCH 360 4U (32 PORTS) KIT
VP360-12U-96P (760049452) VisiPATCH 360 12U (96 PORTS) KIT
VP360-19PNL-KT (760074278) VisiPATCH 360 19-INCH 1U PANEL KIT
M4800-1U-GS (760105429)
M4800A-1U-GS (760109744)
VP360-4U-32P (760049445) VisiPATCH 360 4U (32 PORTS) KIT
VP360-12U-96P (760049452) VisiPATCH 360 12U (96 PORTS) KIT
VP360-19PNL-KT (760074278) VisiPATCH 360 19-INCH 1U PANEL KIT
110AA2-100FT (107058901) 110 FIELD TERMINATED CROSS-CONNECT SYSTEM TERMINAL BLOCKS, 20 X 110C-5
VP360-4U-32P (760049445) VisiPATCH 360 4U (32 PORTS) KIT
VP360-12U-96P (760049452) VisiPATCH 360 12U (96 PORTS) KIT
VP360-19PNL-KT (760074278) VisiPATCH 360 19-INCH 1U PANEL KIT
M2000A-48 2U (760049965) U/UTP MODULAR PANEL 2U, 48 PORT ANGLED
OUTDOOR MULTI-PAIR DATA CABLE, 25 PAIR (999903004)
OUTDOOR MULTI-PAIR DATA CABLE, 50 PAIR (999903005)
OUTDOOR MULTI-PAIR DATA CABLE, 100 PAIR (999903006)
OUTDOOR MULTI-PAIR DATA CABLE, 200 PAIR (999903010)
1010 025 (106824329) 25 PAIR RISER RATED
1010 050 (106824378) 50 PAIR RISER RATED
1010 100 (106824469) 100 PAIR RISER RATED
2010 025 (107765992) 25 PAIR PLENUM RATED
2010 050 (107766040) 50 PAIR PLENUM RATED
2010 100 (107766057) 100 PAIR PLENUM RATED
3010 025 (760010900) 25 PAIR LSZH RATED
3010 100 (760010918) 100 PAIR LSZH RATED
1010 4 PAIR (106062524) RISER CAT 3
2010 4 PAIR (107078388) PLENUM CAT 3
1061 4 PAIR (107078388) RISER CAT 5E
2061 4 PAIR (760041939) PLENUM CAT 5E
3061 4 PAIR (760158741) LSZH CAT 5E
1071 4 PAIR (700211931) RISER CAT 6
2071 4 PAIR (700214372) PLENUM CAT 6
3071 4 PAIR (760095554) LSZH CAT 6
1091B 4 PAIR (760107078) RISER CAT 6A
2091B 4 PAIR (760107250) PLENUM CAT 6A
3091B 4 PAIR (760107334) LSZH CAT 6A
1088B 4 PAIR (760142547) RISER EXPRESS CAT 6A
2088B 4 PAIR (760142638) PLENUM EXPRESS CAT 6A
3088B 4 PAIR (760142679) LSZH EXPRESS CAT 6A

MGS400-226 – CAT 6 GREEN
MGS400-318 – CAT 6 BLUE
MGS400-112 – CAT 6 ORANGE
MGS400-262 – CAT 6 WHITE
MGS400-003 – CAT 6 BLACK
M81C 108009432 F-COAX PASS THROUGH COUPLER

Fiber products

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Other products

RK3-45A (MID 760082479), BLACK
RK3-52A (MID 760082487), BLACK

HTK-19-SS-3U (760072967) 3RU HORIZONTAL CABLE MANAGEMENT
HTK-19-SS-2U (760072959) 2RU HORIZONTAL CABLE MANAGEMENT
HTK-19-SS-1U (760072942) 1RU HORIZONTAL CABLE MANAGEMENT
VCM-SS-84-12B (760089458) 12" SINGLE SIDE, VERTICAL CABLE MANAGEMENT, BLACK DOOR
VCM-DS-84-6B (760089375) 12" DOUBLE SIDE, VERTICAL CABLE MANAGEMENT, BLACK DOOR
VCM-SS-84-6B (760089425) 6" SINGLE SIDE, VERTICAL CABLE MANAGEMENT, BLACK DOOR
VCM-DS-84-6B (760089342) 6" DOUBLE SIDE, VERTICAL CABLE MANAGEMENT, BLACK DOOR
CR-SLR-10L12W (760085647) 10FT LONG, 12" WIDE, BLACK
CR-SLR-10L18W (760085654) 10FT LONG, 18" WIDE, BLACK
CR-SLR-10L24W (760085662) 10FT LONG, 24" WIDE, BLACK
CR90FCB-12W (760085530) 12 INCH (305 MM) W
CR90FCB-18W (760085548) 18 INCH (457 MM) W
CR90FCB-24W (760085555) 24 INCH (610 MM) W
CRBSK (760083899) BUTT SPLICE KIT
CRTJSK (760084046) JUNCTION SPLICE KIT
CRRP-8H (760083980) CABLE RETAINING POSTS
CRPECK (760084012) LADDER RACK END CAPS
CRDK-12W (760083956) RADIUS DROPS
M20AP-246 107067860 IVORY COVER FOR EMPTY FACEPLATE OPENINGS
M21A-246 108066457 IVORY COVER FOR UNPOPULATED JACKS
M13FP-262 – SINGLE GANG FLEXIBLE FRAME WHITE
M30FP-2RJ45-262 – DOUBLE PORT ADAPTER FOR FLEXIBLE FRAME WHITE
M30FP-BLANK-262 – DOUBLE BLANK ADAPTER FOR FLEXIBLE FRAME WHITE
M102SMB-B-262 – 2 PORT SURFACE MOUNT BOX WHITE
M104SMB-B-262 – 4 PORT SURFACE MOUNT BOX WHITE
630B8 – STAINLESS STEEL WALL PHONE JACK (T-568B)
M81LS-LS – 4 PORT FACEPLATE FOR LC M81LS-XX FIBER SPOOLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. Comply with all requirements of Divisions 26 and 27, according to Division 26, "Races and Boxes."

1.02 DEFINITIONS

- A. Pathway: Conduit, cable tray, sleeves, junction-hooks and D-rings.

1.03 SUMMARY

- A. Design Build Pathway System:
 - 1. In general, only devices have been shown on the drawings. The Contractor shall provide a complete design build pathway system.
 - 2. Minimum raceway size shall be 3/4 inch.
 - 3. Unless specified as "open cabling" all wire and cabling shall be installed in continuous metallic raceways.
 - 4. Where specified as "open cabling" provide metallic raceways for cables in walls, above inaccessible ceilings, exposed or where subject to physical damage. Minimum raceway size shall be 3/4 inch.
 - 5. Raceway fill shall not exceed 40 percent.
- B. Wire and Cable:
 - 1. Comply with all requirements of Division 26 and other provisions of this section.
 - 2. Unless specified otherwise all cabling shall be plenum rated.
 - 3. Provide wire and cable for each system according to the manufacturers requirements.
 - 4. Underground cabling shall be UL listed for direct burial.

1.04 SUBMITTALS

- A. Product Data: Submit for each type of product provided.
- B. Shop Drawings:
 - 1. Raceway Riser Diagrams: Provide detailed raceway layout. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - 2. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building.
 - 3. Device Identification: Identify each device by its address or identification number.
 - 4. System Wiring Diagrams: Include system diagrams unique to project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 5. Shop drawings shall utilize the final room numbers established by the Owner not the room and building numbers shown on the architectural floor plans.

PART 2 PRODUCTS

2.01 GENERAL

- A. Comply with all requirements of Division 26 and 27.

2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 x 48 x 96 inches.

PART 3 EXECUTION

3.01 PATHWAY INSTALLATION

- A. Comply with requirements in Division 27, "Common Work Results for Communications."

3.02 WIRING INSTALLATION

- A. Do not share raceways with other building wiring systems.
- B. Wiring Within Enclosures: Bundle, lace and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and nonpower-limited conductors as recommended in writing by the manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Splices, Taps and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets, and equipment enclosures.
- D. Identification of Conductors and Cables: Color code conductors and apply wire markers. Coordinate with shop drawings.

3.03 BACKBOARDS

- A. Provide plywood backboards on all four walls of each telecommunications room.
- B. Install backboards with 96-inch dimension vertical. The bottom of plywood is to be six inches above finished floor. Butt adjacent sheets tightly and form smooth gap-free corners and joints.
- C. Paint backboards flat white.

3.04 SLEEVES

- A. Interior Penetrations of Nonrated Walls, Floors and Ceilings: Provide EMT sleeves. Seal annular space between the raceway and the wall or floor using joint sealant appropriate for the size, depth and location of the joint. Comply with requirements in Division 07, "Joint Sealants."
- B. Fire-Rated Assemblies Penetrations:
 - 1. Provide STI "EZ Path" assemblies for penetrations at walls, partitions and ceilings.
 - 2. Provide EMT sleeves for penetrations and floors. Seal pathway and cable penetration with fire stop material.

3.05 IDENTIFICATION DEVICES

- A. Identify system components, wiring, cabling, and terminals according to Division 26, "Identification."

3.06 FIRESTOPPING

- A. Provide firestopping to penetrations of fire-rated assemblies to restore original fire-resistance rating of assembly.

3.07 ACCEPTANCE TESTING

- A. Comply with Section 260126, Acceptance Testing of Electrical Systems.

3.08 AS-BUILT SHOP DRAWINGS

- A. At the completion of the project, provide a complete set of as-built shop drawings (hard copy and CD) showing the as built:
 - 1. Raceway layout

2. Device locations
3. Device identification numbers

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUBMITTALS

- A. Product Data: Submit for each type of product indicated.

PART 2 PRODUCTS

2.01 LOW-VOLTAGE CONTROL CABLE

- A. Provide cabling for each system according to the manufacturer's requirements.

2.02 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden
 - 2. West Penn Wire/CDT
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair not less than No. 18 AWG.
- D. Nonpower-Limited Circuits: Solid-copper conductors with 600-Volt rated, 75 degree C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.03 IDENTIFICATION PRODUCTS

- A. Comply with requirements in Division 26, "Identification."

PART 3 EXECUTION

3.01 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than six inches from cabinets, boxes, fittings, outlets, racks, frames and terminals.
 - 3. 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.
 - 4. 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.
 - 5. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend copper cable not in a wireway or pathway a minimum of eight 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.
- D. 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 six feet long shall be neatly coiled not less than 12 inches in diameter below each feed point.
- E. 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 2kVA: A minimum of five inches.
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5kVA: 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 2kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of six inches.
 - c. Electrical Equipment Rating More Than 5kVA: 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 2kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of three inches.
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of six inches.
 5. Separation between Cables and Electrical Motors and Transformers, 5kVA or HP and Larger: A minimum of 48 inches.
 6. Separation between Cables and Fluorescent Fixtures: A minimum of five inches.

3.02 FIRE ALARM WIRING INSTALLATION

- A. Comply with NFPA 72.
- B. Wiring Method: Comply with Division 28, "Common Work Results for Electronic Safety and Security Systems."
1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
 2. Smoke Control or Fire Pump Systems: Use of two-hour, fire-rated fire alarm cables, NFPA 70; Types MI and CI is permitted.
- C. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- D. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: One-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.03 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26, "Identification."

END OF SECTION

Section 281000 – ACCESS CONTROL

PART – 1 GENERAL

1.1 RELATED DOCUMENTS

- A. General provisions of contract and drawings, including general and supplemental conditions, and Division 1 specification sections apply to this section

1.2 SUMMARY

- A. Provide and install Access Control system for this improved facility, and site; to include vehicle gate(s), and pedestrian gate(s). Provide all devices and equipment necessary to include, but not limited to, controllers, sub-controllers, reader, request to exit devices, door and gate position sensors, as well as system programming, commissioning, and testing.
 - 1. Access control system shall use Open Options software, hardware, and components. No substitutions shall be permitted.
 - 2. Access control system shall integrate with Intrusion detection system, see section 283100.
 - 3. Access control system shall integrate with Video Surveillance system, see section 282000.
- B. Related Sections
 - 1. Division 26 – Electrical
 - 2. Division 27 – Communications
 - 3. Section 283100 – Intrusion Detection
 - 4. Section 282000 – Video Surveillance

1.3 STANDARDS AND REFERENCES

- A. National Electric Code, NEC (NFPA 70)
- B. National Fire Alarm Code, NFPA
- C. American National Standards Institute (ANSI)
 - 1. ANSI/TIA -568-C.0,568-C.1,568-C.2 Telecommunications Cabling Standards
 - 2. ANSI/TIA -569-D Telecommunications Pathways and Spaces
 - 3. ANSI/TIA -607-C Generic Telecommunications Bonding and Grounding

4. ANSI/TIA -862-A Building Automation Systems Cabling Standard
 5. ANSI/TIA -1005-A Building Automation Systems Cabling Standard
- D. International Organization for Standardization (ISO)
1. ISO 9001 Quality Management Systems
 2. ISO/IEC 11801 Generic Cabling for Customer Premises
- E. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 802.3af Power over Ethernet (PoE) Standard
 2. IEEE 802.3at Power over Ethernet+ (Plus) Standard
- F. Underwriters Laboratories, Inc. (UL)
1. UL 50 Enclosures for Electrical Equipment, Non-Environmental
 2. UL 50E Enclosures for Electrical Equipment, Environmental
 3. UL 294 Standard for Access Control System Units
 4. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Access Control Systems
 5. UL 639 Standard for Intrusion-Detection Units

1.4 SUBMITTALS

- A. Product Data/Specifications for each product indicated
- B. Equipment layout
1. Rack layouts
 2. Wall mount equipment layouts
- C. Shop Drawings
1. Provide shop drawings showing cable routing and wiring in conduits and raceways.
 2. Shop drawing will show all equipment, enclosures, and junction box locations.
 3. Shop drawings will be provided in AutoCAD 2016 format, and in PDF format

1.5 QUALIFICATIONS

- A. Contractor must be an authorized Open Options dealer, for a period of no less than 2 years

- B. Contractor must have at least two EL-06 Journeyman Specialty Electricians on staff who are Open Options factory trained and certified technicians with a minimum of 2 years of experience installing and servicing Open Options equipment and applications.
- C. Bidding contractors must have at least 5 years of experience installing, and servicing systems of the type specified, and have completed at least ten projects of similar size and scope within the last 5 years.
- D. Contractor is required to have at least one Open Options certified EL-06 Journeyman Specialty Electrician on the job site at all times when work is being performed.

1.6 SUBSTITUTIONS

- A. No substitutions shall be permitted, except were expressly permitted by owner in writing. Substitution requests shall be submitted in writing, and shall include product descriptions, model numbers, and pricing for item specified and requested substitution, as well as price variances.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall be responsible for storage and handling of all materials and equipment
- B. Materials and equipment shall be delivered in manufacturers original unopened and undamaged packaging
- C. Products shall be stored in manufactures unopened packaging and protected from environmental conditions and physical damage
- D. Products shall be handled in accordance with manufacturers recommendations
- E. Any products or materials showing signs of misuse, mishandling, or damage shall be replaced with new at no additional charge to the owner
- F. Waste management
 - 1. Excess materials shall be discarded in an appropriate manner
 - 2. All hazardous materials shall be handled appropriately, and disposed of within compliance of applicable codes and regulations.

1.8 PROJECT CONDITIONS

- A. Contactor shall not install products where environmental conditions are outside the manufactures recommendations.
- B. Contractor shall be aware of project and site conditions that may impact scheduling or quality of work and materials specified. The Contractor shall be responsible for coordination of work as site conditions change to optimize installation for owner.
- C. Lack of awareness of project conditions resulting in additional effort by Contractor shall not require additional compensation by owner.

PART – 2 PRODUCTS

2.1 MANUFACTURER

- A. All equipment and materials shall be of manufacturer's current production, to include revision and firmware where applicable
- B. Access Control System controllers, sub-controllers, and modules shall be Open Options, no substitutions shall be permitted
- C. Access Control System enclosures shall be Honeywell Pro2200 series
- D. Card readers shall be HID Multiclass SE, no substitutions shall be permitted
- E. See appendix A for complete listing of approved equipment

2.2 PRODUCTS

- A. Access Control System Hardware (Sec 281400)
 - 1. Provide all equipment and materials required to deliver a fully operational Access Control System. To include, all enclosures, controllers, sub-controllers (dual reader, 16 inputs, 16 output), cabling, and programming. Additionally, the Access Control System shall be integrated with the Intrusion System and Video

Surveillance systems via physical I/O hardware and interconnects, as well as programming logic.

- a) Manufacture, Open Options
 - 1) Intelligent Controller,
 - a. SSP-EP
 - 2) Intelligent Controller,
 - a. SSP-D2
 - 3) Reader Sub-controller – board only,
 - a. RSC-2-BO
 - 4) Input Sub-controller,
 - a. ISC-16
 - 5) Output Sub-controller,
 - a. OSC-16
 - b) Manufacturer, Honeywell (Note: custom spacers required to accommodate Open Options board form factor)
 - 1) Wall Mount Enclosure,
 - a. PRO22ENC1
 - 2) Rack Mount Enclosure,
 - a. PRO22ENC2
 - 3) Enclosure,
 - a. PRO22ENC3
 - 4) Power Supply,
 - a. PRO32E1PS
 - 5) Daisy Chain Cable,
 - a. PRO22DCC
- 2. Quantity of equipment (controller, sub-controller, enclosures, etc.) shall be determined by contractor based on device quantities identified on security plan.
 - 3. All equipment enclosures require door tamper switch.

B. Card Readers

- 1. Card reader quantities and locations shall be indicated on security drawings.
- 2. Card readers shall be HID Signo 40
 - a) 40TKS-00-000017
- 3. Card readers shall be configured to transmit card data to the reader sub-controller utilizing OSDPv1 format if applicable.
- 4. Card readers shall be configured with red indicator LED when door is locked, reader LED shall flash green for momentary unlock, and remain green in continuous unlocked state.

- a) Manufacture, HID
 - 1) Standard switchplate reader,
 - a. Model 40TKS-00-000017
 - 2) Switchplate reader with keypad,
 - a. Model ?
 - 3) Mullion reader,
 - a. Model ?

C. Request to Exit Devices

- 1. Quantities and locations shall be indicated on security drawings.
- 2. All exterior pedestrian access controlled gates shall be cabled to provide request to exit functionality, and shall incorporate request to exit function where gate hardware includes request to exit interface.
- 3. All access controlled building interior and exterior doors shall include a request to exit motion detector, with integrated sounder. Integrated request to exit function as part of electrified locking hardware or exit devices shall not be utilized.
- 4. Request to exit motion detectors shall include double end-of-line resistor packs to provide circuit supervision.
- 5. Request to exit sound shall be connected and configured such that a door forced or held condition will cause the sounder to alarm.
- 6. Request to exit circuit shall be wired through door position sensor such that the request to exit circuit will not function with door open, and will not allow a reset of audible door forced/held sound if the door remains open.
- 7. Request to exit motion sensor shall include manufacturer trim plate
- 8. Manufacturer is Kantech
 - 1) Request to exit motion detector,
 - a. T.REX-XL2
 - 2) Request to exit trim plate,
 - a. T.REX-PLATE

D. Door Position (Door Contacts)

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Door position sensors shall be included on all access controlled doors.
- 3. Door position sensor shall be DPDT with closed loop function, where one contact provides output for door position, and the other contact provides interruption of the request to exit circuit while the door is open.
- 4. Recessed door position sensors shall be 1" diameter for metal or wood doors and frames, and shall be rated for 1" gap.

5. Surface mount door position sensors shall be or armored type, and terminations shall be within an electrical back box.
6. Manufacturer is Tane
 - a) Recessed door position sensor (DPDT),
 - 1) SD-84C
 - b) Surface mount armored door position sensor,
 - 1) MET-CDS

E. Exit Indicator LED

1. Quantities and locations shall be indicated on security drawings.
2. Where the access control system includes high security doors as defined by the owner, each access controller door will include an exit reader and exit indicator LED light.
3. Exit LED light shall be red in color, and include a 1" diameter housing, and be rated for 12vdc or 24vdc.
4. Manufacturer is LEDTronics
 - a) Lamp Holder Only, HLDR-BS850S
 - b) Bulb Only, BA9S-R4-90-12VDC
 - 1) <https://www.superbrightleds.com/moreinfo/ba9s-ba7s/ba9s-led-bulb-4-led-ba9s-retrofit-car-classic-car-bulbs/6/>
 - c) Lens Cap (RED), LENS-LCF850-CRF
5. Exit LED light will be center mounted to single gang cover plate. Cover plate may be vinyl, plastic, or metal as required to match other cover plates on the project.
6. The exit LED shall be configured such that it is constantly illuminated in the normal mode. When exit is granted via card reader, the exit LED will turn off for a period of 5 seconds.

F. Automatic Vehicle Gate Operators

1. The access control system shall interface with automatic vehicle gate operators, allowing operation (opening) of the vehicle gate upon a valid card reader transaction.
2. All automatic vehicle gates shall include entry and exit card readers. Additionally, where applicable, gates may include hi/low card readers at entry and exit.
3. Where multiple entry and exit readers are required, programming shall be implemented such that a valid card read from an exit reader or secondary entry reader unlocks the primary reader.
4. All vehicle gates shall include a "free exit" in ground detection loop. The access control system shall be configured to control the free exit loop via programmed schedule, or direct control via software.

5. The access control system shall also monitor the state of the “free” exit loop via supervised input.
6. Gate position shall be monitored via surface mount armored position sensor, with the magnet mounted to the moving gate (provided standoff must be installed), and the contact mounted to a fixed structure. Where the operator includes integral gate position monitoring and output, it may be utilizing in lieu of surface mounted position sensor, but only when the gate cannot be opened without a change of state occurring through the integrated gate position switch. Typically, hydraulic operators meet this requirement, and chain drive do not. The contractor will be responsible verifying correct function of gate position, and ensuring that this requirement is met.

G. Manual Gates

1. All Access Control System gate locks shall be the Securitron GL-1 gate locks, and include lock override cylinders which receive Best style small format 7 pin interchangeable lock cores
2. All Access Control System gate locks shall be protected from tampering and intrusion by a custom fit box that completely covers the gate lock from the outside. This custom fit box will have a cutout to allow access the override cylinder when the gate is in the closed and locked position

H. Automatic Entry Door Operators

1. The access control system shall interface with automatic door operators/openers.
2. The access control system shall unlock electric lock, strike, or mag lock; then after the locking mechanism has unlocked (requires 1-2 second delay), provide output to operator/opener to open door.
3. Where ADA buttons are required
 - a) Exit ADA buttons shall function at all times where free egress is permitted
 - b) Entry ADA buttons shall be enabled via valid card read at reader.
 - 1) ADA buttons shall be connected to access control system inputs, and shall not interface directly with operator.
 - 2) The access control system will unlock the lock, strike, or mag lock, then provide output to the operator (as previously defined), upon an input from the ADA button.

I. Door Override Button

1. Quantities and locations shall be indicated on security drawings.

2. Where the access control system includes interior doors in which the owner designates the need for an override button, the button shall:
 - a) Be of a momentary type (door function achieved through programming)
 - b) Include a bi-color Red and Green LED indicator. Red shall indicate locked, and Green shall indicate unlocked
 - c) Manufacture and model TBD, site specific.

J. Door Exit Button

1. Quantities and locations shall be indicated on security drawings.
2. Where an access door is physically secured on both sides, and an exit button must be utilized due to code or emergency egress requirements, the button shall:
 - a) Provide a mechanical disconnect of power to the "fail safe" locking device, resulting in an unlocked condition when activated.
 - b) Provide alarm output to the Access Control System to indicate use of the button.
 - c) Manufacture and model TBD, site specific.

K. Alarm Inputs and Outputs – Sub-controllers

1. The Access Control System is fully integrated with site intrusion detection systems and devices.
 - a) Intrusion System Status – There is a circuit from the alarm panel to an alarm system status input for reference and monitoring of the alarm system status
 - b) Auto Arm – Access Control System output is triggered, on a programmed time schedule or manually, and wired to the alarm panel to arm the alarm system when the output is momentarily energized
 - c) Auto Arm output to Intrusion Detection System does not fire when the alarm system is armed
 - d) Auto Arm output to Intrusion Detection System cannot disarm the alarm system
 - e) Masking – Designated inputs into Access Control System are masked or shunted so transactions are not logged when the alarm system is disarmed
 - f) Valid Access Disarm – Access Control System programming and interconnect wiring to pulse a momentary output to disarm the alarm system when a valid access card or PIN is presented at designated readers

- g) Valid Access Disarm output to Intrusion Detection System must be programmed so it does not activate when the alarm system is not armed
 - h) Valid Access Disarm output to Intrusion Detection System must not be able to arm the alarm system
 - i) Access Control System must be programmed to provide remote reset of the Intrusion Detection System.
- 2. The Access Control System shall include a minimum of three ISC-16 sub-controllers providing a total of 48 inputs. The first 32 inputs shall be utilized for system monitoring and integration.
- 3. The Access Control System shall include a minimum of three OSC-16 sub-controllers providing a total of 48 outputs. The first 32 outputs shall be utilized for system monitoring and integration.
- 4. Each ISC-16 sub-controller includes 16 inputs; only 12 shall be utilized, 4 shall be reserved.
- 5. Each OSC-16 sub-controller includes 16 outputs; only 12 shall be utilized, 4 shall be reserved.
- 6. All intrusion detection and monitoring devices are connected to the access control system via input points on input sub-controllers.
 - a) Includes all motion detection, glass breakage detection, door position sensors, photo electric beam detectors, laser beam detectors, fence detection systems.
 - b) Includes all ac power monitoring, backup battery monitoring, panel tamper monitoring, communication fail, NVR video fail
- 7. All intrusion detection and monitoring devices shall be configured with double end-of-line supervision.
- 8. The access control system shall include output points on output sub-controllers for each intrusion device input.
- 9. Contractor shall link inputs and outputs via programming of triggers and macros, such that an input results in an output.
- 10. All outputs shall be hardwired via interconnects to inputs on the Intrusion Detection System, see Section 283100.
- 11. The Access Control System is fully integrated with the Video Surveillance System.
 - a) The Access Control System is configured to receive inputs from the Video Surveillance system for video fail, and/or video analytics events
 - b) The Access Control System is configuring to send outputs to the Video Surveillance system for intrusion alarms. Outputs shall be wired via interconnects to inputs on the Video Surveillance system, see Section 282000.

12. Where rack mounting systems are utilized, each Access Control System shall include a rack mount drawer for system documentation and spare parts.

L. Telephone Entry Systems (Sec 281521)

1. Quantities and locations shall be indicated on security drawings.
2. Where applicable, telephone entry systems shall be utilized at gates and building entrances to provide communication with site visitors.
3. Telephone entry system must be rated for site conditions, and include optional heater if required.
4. Telephone entry systems shall be fully programmed with directory entries and phone numbers of all site staff, or offsite staff as designated by the owner.
5. Telephone entry systems shall be recessed mounted at gate stanchions or building entrances. Surface mounting will only be permitted by approval from the owner, in writing.
6. The telephone entry system shall integrate with the Access Control System, and shall not interface directly with gate operators, automatic door operators, or electronic locking devices.
7. Where applicable, the Access Control System shall be configured to unlock or open a gate or door upon input from the telephone entry system.
8. Manufacture is Door King.
 - a) Approved models
 - 1) DKS 1802-EPD

M. Intercom Entry Systems (Sec 281523)

1. Quantities and locations shall be indicated on security drawings.
2. Where applicable, intercom entry systems shall be utilized at gates and building entrances to provide communication with site visitors.
3. The intercom system shall consist of IP audio/video door stations at gate stanchions and building entrances where applicable.
4. The intercom entry system shall include IP audio/video master stations.
5. Intercom entry systems shall be recessed mounted at gate stanchions or building entrances. Surface mounting will only be permitted by approval from the owner, in writing.
6. The intercom entry system shall integrate with the Access Control System, and shall not interface directly with gate operators, automatic door operators, or electronic locking devices.
7. Where applicable, the Access Control System shall be configured to unlock or open a gate or door upon input from the intercom entry system.

8. Contractor shall connect IP intercom entry system to POE network security switch. The intercom entry system shall communicate on the private Video Surveillance System network subnet, unless specified otherwise.
9. Contractor to perform all intercom entry system programming and configuration.
10. Manufacture is Aiphone.
 - a) Approved models
 - 1) Master Station,
 - a. IX-MV7-HB
 - 2) Door Station,
 - a. IX-DVF
 - 3) Aiphone IP 4 In/Out Relay Module,
 - a. IXW-MA
 - 4) Aiphone 12vdc Power Supply,
 - a. PS1225UL?

N. POWER SUPPLIES

1. The Access Control System shall include a dedicated power supply for each enclosure. The power supply shall be UL rated, and shall include the following specifications:
 - a) 12 VDC 4 amp continuous power limited output with backup battery charging and battery supervision
 - b) 110 VAC/60 hz .5 amp
 - c) Maximum battery charging current .5 amp
 - d) AC on LED
 - e) AC Fail supervision when connected to PRO22IC or other PRO-2200 I/O at PFL (Power Fail) input
 - f) Low battery supervision when connected to an auxiliary input
 - g) Short circuit and thermal overload protection with self-resetting poly fuses
2. Access Control System power supply manufacture is Honeywell
 - a) Power Supply with Battery Backup, PR02200E1PSs
3. All electrified locking hardware (electrified locksets, electric strikes, mag locks, electrified trim, and latch retraction) shall be powered centrally from the Access Control System lock power supply. Except where latch retraction exceeds current limitations of the power supply, in which case, individual power supplies (per manufacturers recommendation) should be installed at each latch retraction door location.

4. Access Control System lock power supply shall be rack mounted, unless otherwise specified, and shall have the following specifications:
 - a) Sixteen (16) Class 2 Rated PTC protected power-limited outputs
 - b) 12VDC or 24VDC
 - c) 12VDC @ 4.5A per channel of 4 outputs or 24VDC @ 4.5A per channel of 4 outputs
 - d) 18A total supply current
 - e) Short circuit and thermal overload protection Filtered and regulated
5. Rack mount Access Control power supply manufacturer is Altronix
 - a) Model R1224DC16CB
6. Approved wall mount power supply (where applicable) manufacturer is Altronix; with the following specifications
 - a) 12VDC or 24VDC @ 6 amp supply current
 - b) Eight (8) independently controlled outputs
 - c) Eight (8) form "C" 5 amp rated relay outputs
 - d) Output ratings: - Fuses are rated @ 3.5 amp
 - e) Filtered and electronically regulated outputs (built-in power supply)
7. Wall mount power supply manufacturer is Altronix
 - a) Model AL600ULACM
8. Where rack mount power supply is utilized and fire alarm interface is required, the Altronix RBR1224 Relay Module may be utilized
9. Access Control System peripheral device power supply shall be rack mounted, unless otherwise specified, and shall have the following specifications:
 - a) Sixteen (16) Class 2 Rated PTC protected power-limited outputs
 - b) 12VDC or 24VDC
 - c) 12VDC @ 4.5A per channel of 4 outputs or 24VDC @ 4.5A per channel of 4 outputs
 - d) 18A total supply current
 - e) Short circuit and thermal overload protection Filtered and regulated
10. Rack mount Access Control System peripheral power supply manufacturer is Altronix
 - a) Model R1224DC16CB
11. The Access Control System shall include power supplies with adequate capacity to provide an individually fused or protected output per powered device (i.e., each detector (glass breakage, motion, lock, etc.) shall have a dedicated output)
12. ServerTech 20 amp Switched IP PDU, CW-8H2A211
13. Rack Mount Drawer – Middle Atlantic 2RU, UD2

O. Rack Drawer

1. Rack mount – Middle Atlantic 2RU

a) UD2

P. CABLING

1. Contractor shall provide all necessary power and control cable per manufacturers recommendation.
2. All cable and head end patch panels shall be CommScope brand and be UL listed, class II, power limited, and rated for the application
3. All interior cable, except readers, shall be CommScope brand, such as 2071E SG 4/23 W1000, and have a continuous "Green" jacket
 - a) Readers shall have OSDP Reader cable
 - 1) Such as SMARTWIRE™ BAC NET RS232/485 ARC 156
4. All underground cable shall be CommScope brand, such as 1571A BK 4/24 R1000
5. Network cable, shall be CommScope brand and meet the following minimum specifications
 - a) Non-plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMR, meets or exceeds TIA/EIA 568B-C-1
 - b) Plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMP, meets or exceeds TIA/EIA 568B-C-1
 - c) Outdoor locations shall utilize direct burial cable rated for wet locations. No substitutions permitted.
6. Access Control System Cabling, indoor locations shall be CommScope brand
 - a) Cabling shall be riser rated (CMR), or plenum rated (CMP) as applicable
 - b) Cabling shall have minimum 300 V rating
 - c) Card Reader
 - 1) Minimum 22 AWG, 6 Conductor, Shielded, Stranded, or; Minimum 24 AWG, 3 Twisted Pair, Shielded, Solid, as required
 - d) Request to Exit Motion Detector
 - 1) Minimum 22 AWG, 6 Conductor, Non-Shielded, Stranded
 - e) Door Position Sensor
 - 1) Minimum 22 AWG, 4 Conductor, Non-Shielded, Stranded
 - f) Electric Locking Device
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
7. Access Control System Cabling, outdoor locations shall be Comm Scope brand
 - a) All cables must be rated for direct burial, and for wet locations, no substitutions permitted
 - b) Cabling shall have minimum 300 V rating
 - c) Card Reader
 - 1) Minimum 18 AWG, 6 Conductor, Shielded, Stranded, or; Minimum 24 AWG, 3 Twisted Pair, Shielded, Solid, as required
 - d) Request to Exit Motion Detector

- 1) Minimum 18 AWG, 6 Conductor, Non-Shielded, Stranded
- e) Door Position Sensor
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
- f) Electric Locking Device
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded

Part – 3 EXECUTION

3.1 GENERAL

- A. The contractor is responsible for verifying all project requirements with owner or owner's representative prior to commencing work. Including system configuration, programming, and installation standards. Lack of knowledge or awareness of requirements resulting in additional effort by Contractor shall not require additional compensation by owner.
- B. Contractor shall provide all necessary equipment, materials, and labor to perform the work specified.
- C. Contractor shall provide a complete and fully operational system, to include all necessary configuration, programming, and integration with other systems as specified.
- D. System configuration and programming shall be consistent with other owner sites.

3.2 INSTALLATION

- A. Equipment and Materials
 - 1. Installation of equipment and materials shall be performed with quality workmanship
 - 2. Manufacturers current installation standards and recommendations shall be followed.
 - 3. All work performed shall be in compliance with the local authority having jurisdiction (AHJ), applicable codes, and standards referenced within this document.
 - 4. All wall or ceiling mounted equipment (enclosures, power supplies, wire management, surge protectors, keypad, readers, motion detectors, etc.) shall be fastened to a stud or must include a wall anchor. Screw fasteners in drywall without anchors shall not be permitted.
 - 5. All equipment mounted to concrete, cinder block, or stucco shall have utilize anchors rated for the application.
 - 6. Where devices are mounted to metal structures or enclosures

- i. All holes shall be drilled and tapped
 - ii. Only appropriately sized machine screws shall be utilized
 - iii. Sheet metal screws shall not be permitted
- 7. Where connectors or conduits are utilized to connect cable path to a metal structure (stanchion, fence post), the mounting hole shall be drilled and tapped to the size of the connector.
- 8. All device or equipment mounting holes must be utilized and have fasteners installed.
- 9. All machine screws used for mounting devices on stanchions, gate posts or any other exterior location, shall be tamper proof stainless steel type that is intended for the purpose
- 10. All devices with spliced connections shall require a back box or low voltage box.
- 11. All ceiling mount devices shall include a back box with support, or manufacturer provide ceiling mount.
- 12. Terminations to screw terminals shall have crimp on spade connections. No bare wire connections shall be permitted
 - i. This includes but is not limited to shielding drain wires, grounding conductors, transformer terminals and key switch terminals
- 13. All wire connections shall use gel filled compression type connectors (blue beans).
- 14. All wall mounted equipment must be installed on appropriately rated backboard
- 15. All wall mounted equipment must include finger duct for cable routing, sized appropriately (3" typical")
- 16. All connections shall be labeled at head-end equipment, to include:
 - i. Every circuit pair (door position, request to exit, glass break detector, motion detector, etc.)
 - ii. Every data connection (Reader cable, RS485 data, network cable)
 - iii. Every power circuit pair (device power, lock power, etc.)
- 17. All head-end equipment enclosures must be labeled, to include labeling for each controller, and sub-controller located within enclosures.
- 18. All card readers must be labeled with card reader number
- 19. All similar devices must be mounted at consistent elevations throughout the project (all card readers at 42" AFF, keypads at 60" AFF, motion detectors at 78" AFF, etc.)
- 20. See attached specifications for additional installation requirement
 - i. Door Detail
 - ii. Typical Stanchion Detail
 - iii. High/Low Stanchion Detail

B. Cable Installation

1. Contractor shall install cable in compliance with applicable codes and standards referenced within this document.
2. All outdoor cable must be rated for direct burial and for use in wet locations
3. All cabling shall be sized and rated for the application. Doubling of conductors to increase capacity shall not be permitted
4. Device cable runs will include a 10' service loop at each device location
5. All cable runs will include a 10' service loop at the head end location, service loop to be routed via cable management systems.
6. All cabling shall be labeled during pre-wire, utilizing a matrix or key for cable identification.
7. All cabling in cable trays, hooks, or bridal rings must be neatly bundled and tied with zip ties or velcro.
8. All cable entering security equipment room (Com Rm IDF, MDF) on cable management systems shall be neatly combed, bundled, and uniform. Where required, cable shall be installed within cable sleeve (mesh sock).
9. Where cable enters equipment enclosures
 - i. Cable jacket/sheathing shall be continuous from cable management system into enclosure. When removing cable jacket/sheathing, 2"-3" shall remain at entry point of enclosure; all cable shall be prepared in the same way, so as to provide a consistent result.
 - ii. All individual wire pairs (input circuits, output circuits, reader connections, etc.) shall be braided/twisted.
10. All cabling within enclosures must be managed. Cable to be secured with zip ties affixed to "screw down" type saddles (stick on zip tie bases shall not be permitted). "Screw down" saddles must utilize machine screws (not sheet metal screws). Mounting holes must be drilled and tapped. Screws must not exceed ¼" in length
11. Plastic bushings or chase nipples must be utilized where cables penetrate enclosures or housings (per code)
12. All connections within access control, alarm system or other enclosures must be soldered and insulated with heat shrink (These connections include but are not limited to Tamper Switches, Battery Fail outputs, AC Fail outputs, etc.)
13. Where cables terminate to power supplies or external connections
 - i. Cable jacket/sheathing shall be continuous to equipment locations, jacket/sheathing shall be removed at the point where the cable transitions from the cable management to the equipment.
 - ii. All individual wire pairs (device power, lock power, aux power, etc.) shall be braided/twisted.
14. Where conductors are terminated to devices in the field
 - i. When terminating conductors on terminal strips, conductor should be stripped such that minimal or no exposed copper is visible beyond the terminal connection.

- ii. Where conductor splicing is required for device connections, conductors shall be twisted, and terminated with gel filled crimp on connector (blue beans)
 - iii. Conductors and connections should be finished by neatly wrapping with electrical tape
- 15. Cable must be continuous from device location to terminating equipment. No field splicing shall be permitted, without prior written authorization.
- C. Programming and Configuration
 - 1. Contractor shall perform all necessary programming and configuration required to deliver a fully operational and functional system, consistent with other owner sites. To include:
 - i. Hardware configuration
 - 1. Controllers, Sub-controllers, Input Points, Output Points, Door Objects (includes Reader, REX, DC, Lock)
 - 2. Network Devices
 - ii. Programming logic
 - 1. All necessary triggers and macros (based on existing customer template) necessary to provide the desired functionality
 - a. Input to output interconnect programming
 - b. Alarm Status, Auto Arm, Valid Access Disarm
 - c. Device Masking, Masking Groups
 - d. Vehicle Exit Loop enable/disable
 - e. Door override, Storm Mode
 - 2. Schedules
 - a. Auto unlock and auto relock
 - b. Auto unlock pending first user, and relock
 - c. Auto Arm
 - d. Vehicle Gate free egress
 - iii. Characters & Naming Requirements for Everbridge
 - 1. Our PSIM, Everbridge has some very specific requirements which must be adhered to
 - a. No Illegal Characters
 - i. There are several characters which should never be used when naming devices, points or Cameras. These names are illegal to Everbridge and should not be used. These characters are:
 - ii. <
 - iii. >
 - iv. ‘
 - v. “

vi. &

b. No Duplicate Naming

- i. Everbridge can't manage duplicate names. All naming for input or output points or cameras must be unique. For example if multiple slots if there are multiple camera slots which are identified as future:
 1. It causes Everbridge to fail out when attempting to upload the equipment.
 2. A simple solution is to use unique names, such as "Future 1", "Future 2" etc.
 - ii. Everbridge cannot tell if cameras or equipment are connected or not. If the ports are open and assigned, they will be imported.
2. All devices (controller, sub-controller, doors, readers, inputs, outputs, etc.) be programmed with text descriptions approved by the owner. All device descriptions must be consistent throughout the integrated system.
 3. Contractor will be required to access owner's IT systems to perform required programming. Contractor shall meet owner requirements for access, including any necessary customer provided training.

D. Testing

1. Contractor shall complete a full test of the Access Control System and all associated equipment and components to verify proper functionality, and resolve discrepancies before requesting to test with PSE Corporate Security.
2. Contractor shall perform all testing based on manufactures recommended test procedures, to include utilizing manufacturer recommended testing equipment and methods.
3. Where systems are monitored by owner or third part, all pre-testing shall include signal verification and accuracy with owner or third party.

E. Final Acceptance

1. Final acceptance testing may only be scheduled after inspection and pre-testing has be completed as previously defined.
2. Once vendor has completed security installation and a full test of security systems, final acceptance inspection and testing can be scheduled with owner:

- i. A full on-site review of Access Control System by owner is required
 - ii. A full test of all Access Control System and integrated devices shall be conducted with owner. This may be performed by the vendor under supervision, or direction and remote monitoring by owner
 - iii. Contractor to provide all tools and equipment necessary to perform testing.
 - iv. All test results shall be documented with owner approved test report
- 3. Owner reserves the right to reject any portions of work that are found to be deficient or not in compliance with contract documents. In the event that work is rejected, contractor shall be required to correct deficiencies, then perform testing and acceptance procedures as necessary until work is approved.
- 4. Contractor shall create and provide termination schedules using the owner template identifying all devices and programming points per owner standard.
- 5. Project termination schedules shall include:
 - i. All input points
 - ii. All output points
 - iii. All device terminations
 - iv. All power supply terminations
 - v. All equipment types including model & part numbers
 - vi. All IP addresses
 - vii. All configuration data
- 6. Contractor shall provide owner with project "As-Builts", "As-Built" drawings shall:
 - i. Be in AutoCAD format
 - ii. Include all device locations
 - iii. Devices shall be named and numbered as defined in termination schedules
 - 1. All device naming shall be consistent across all systems

F. Training

- 1. Contractor shall provide training on system operation, maintenance, and functionality as requested by owner. Training time not to exceed 8 hours.

G. Warranty

1. Contractor shall warrant assemblies, components, parts, materials, cabling, and labor against defects in materials and workmanship, for a period of 12 months from date of substantial completion.
2. Warranty service response shall not exceed 6 hours.
3. Repair or replacement of defects in materials or workmanship shall be completed at no charge to the owner during the warranty period.
4. Contractor shall correct system defects within 5 business days of receipt of request from owner.

Section 282000 – VIDEO SURVEILLANCE

PART – 1 GENERAL

1.1 RELATED DOCUMENTS

- A. General provisions of contract and drawings, including general and supplemental conditions, and Division 1 specification sections apply to this section

1.2 SUMMARY

- A. Provide and install Video Surveillance System for this improved facility, and site. Provide all devices and equipment necessary, to include, but not limited to: video recorders, power supplies, network switches, network distribution equipment, cameras, infra-red illuminators, as well as system programming, commissioning, and testing.
 - 1. Video Surveillance System shall use Salient Video Management Systems. No substitutions shall be permitted.
 - 2. Video Surveillance system shall integrate with Access Control System, see section 281000.
 - 3. Video Surveillance system shall integrate with Video Surveillance system, see section 282000.
- B. Related Sections
 - 1. Division 26 – Electrical
 - 2. Division 27 – Communications
 - 3. Section 281000 – Access Control System
 - 4. Section 283100 – Intrusion Detection System

1.3 STANDARDS AND REFERENCES

- A. National Electric Code, NEC (NFPA 70)
- B. National Fire Alarm Code, NFPA
- C. American National Standards Institute (ANSI)
 - 1. ANSI/TIA -568-C.0,568-C.1,568-C.2 Telecommunications Cabling Standards
 - 2. ANSI/TIA -569-D Telecommunications Pathways and Spaces
 - 3. ANSI/TIA -607-C Generic Telecommunications Bonding and Grounding

4. ANSI/TIA -862-A Building Automation Systems Cabling Standard
 5. ANSI/TIA -1005-A Building Automation Systems Cabling Standard
- D. International Organization for Standardization (ISO)
1. ISO 9001 Quality Management Systems
 2. ISO/IEC 11801 Generic Cabling for Customer Premises
- E. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 802.3af Power over Ethernet (PoE) Standard
 2. IEEE 802.3at Power over Ethernet+ (Plus) Standard
- F. Underwriters Laboratories, Inc. (UL)
1. UL 50 Enclosures for Electrical Equipment, Non-Environmental
 2. UL 50E Enclosures for Electrical Equipment, Environmental
 3. UL 294 Standard for Video Surveillance System Units
 4. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Video Surveillance Systems
 5. UL 639 Standard for Intrusion-Detection Units

1.4 SUBMITTALS

- A. Product Data/Specifications for each product indicated
- B. Equipment layout
1. Rack layouts
 2. Wall mount equipment layouts
- C. Shop Drawings
1. Provide shop drawings showing cable routing and wiring in conduits and raceways.
 2. Shop drawing will show all equipment, enclosures, and junction box locations.
 3. Shop drawings will be provided in AutoCAD 2016 format, and in PDF format

1.5 QUALIFICATIONS

- A. Contractor must be an authorized dealer of the following systems, for a period of no less than 2 years:
- a. Salient Systems, Video Management System

- B. Contractor must have at least two EL-06 Journeyman Specialty Electricians on staff who are Salient Systems factory trained and certified technicians with a minimum of 2 years of experience installing and servicing Salient Systems equipment and applications.
- C. Bidding contractors must have at least 5 years of experience installing, and servicing systems of the type specified, and have completed at least ten projects of similar size and scope within the last 5 years.
- D. Contractor is required to have at least one certified EL-06 Journeyman Specialty Electrician on the job site at all times when work is being performed.

1.6 SUBSTITUTIONS

- A. No substitutions shall be permitted, except were expressly permitted by owner in writing. Substitution requests shall be submitted in writing, and shall include product descriptions, model numbers, and pricing for item specified and requested substitution, as well as price variances.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall be responsible for storage and handling of all materials and equipment
- B. Materials and equipment shall be delivered in manufacturers original unopened and undamaged packaging
- C. Products shall be stored in manufactures unopened packaging and protected from environmental conditions and physical damage
- D. Products shall be handled in accordance with manufacturers recommendations
- E. Any products or materials showing signs of misuse, mishandling, or damage shall be replaced with new at no additional charge to the owner
- F. Waste management
 - 1. Excess materials shall be discarded in an appropriate manner
 - 2. All hazardous materials shall be handled appropriately, and disposed of within compliance of applicable codes and regulations.

1.8 PROJECT CONDITIONS

- A. Contactor shall not install products where environmental conditions are outside the manufactures recommendations.
- B. Contractor shall be aware of project and site conditions that may impact scheduling or quality of work and materials specified. The Contractor shall be responsible for coordination of work as site conditions change to optimize installation for owner.
- C. Lack of awareness of project conditions resulting in additional effort by Contractor shall not require additional compensation by owner.

PART – 2 PRODUCTS

2.1 MANUFACTURER

- A. All equipment and materials shall be of manufacturer's current production, to include revision and firmware where applicable
- B. Video Surveillance System network video recorders, and video management system components shall be Salient Systems, no substitutions shall be permitted.
- C. See appendix C for complete listing of approved equipment

2.2 PRODUCTS

- A. Video Surveillance System Hardware (Sec 282000)
 - 1. Provide all equipment and materials required to deliver a fully operational Video Surveillance System. To include, all network video recorders, input and output modules, cameras, network switches, network distribution, power supplies, cabling, and programming. Additionally, the Video Surveillance System shall be integrated with the Access Control System and Intrusion Detection Systems via physical I/O hardware and interconnects, as well as programming logic.

2. Quantity of equipment (network video recorders, input modules, output modules, power supplies, etc.) shall be determined by contractor based on device quantities identified on security plan.
3. Where a rack mounting system is utilized, the Video Surveillance System shall utilize a rack mount drawer for system documentation and spare parts.

B. Network Video Recorder

1. The system shall be designed and installed based on manufacturers recommendations.
2. The number and capacity of NVR's shall be determined by utilizing manufacturers design tools, based on the number of cameras, and owners recording requirements.
3. The Network Video Recorder shall be rack mounted, utilizing an adjustable rail kit.
4. The Network Video Recorder (NVR) shall meet the following requirements.
 - a) Configured for motion only recording, except where owner designates otherwise (high security locations)
 - b) 90 day video retention
 - c) Where installed in data centers or high security locations including all sites with NERC areas:
 - 1) RAID disk configuration must be utilized
 - a. OS Disk, RAID 1
 - b. Storage Disks, RAID 5
 - 2) Redundant power supplies shall be required
 - 3) 24/7 recording on high security cameras shall be required
 - a. Configure dual stream
 - i. Stream 1 normal recording
 - ii. Stream 2 reduced frame rate
 - d) Minimum frame rate 6 frames per second (fps)
 - e) Typical frame rate 8-10 frames per second (fps)
 - f) Inputs equal to the number of cameras, up to 48
 - g) Outputs equal to the number of cameras, up to 48
5. Manufacturer is Salient Systems, no substitutions permitted
 - a) Network Video Recorders, PowerPro and PowerPlus platforms only
 - 1) PowerPro Sized, and specified to accommodate the framerate/size, camera count, storage, etc. for 90 days @ 6-8FPS based on Salient Design Wizard
 - 2) - PowerPlus/PowerPlusR Sized, and specified to accommodate the framerate/size, camera count, storage, etc. for 90 days @ 6-8FPS based on Salient Design Wizard

- 3) Bundled PowerPro 4TB 16 CV PRO Hybrid Licenses Win 10
 - a. BP04T3B
 - 4) Bundled PowerPro 6TB 32 CV PRO Hybrid Licenses Win 10
 - a. BP06T3C
 - 5) Custom PSE Power Plus 12TB JBOD, No Lic., Win 10
 - a. PS512T3BPSE01
 - 6) Custom PSE Power Plus 18TB JBOD, No Lic., Win 10
 - a. PS518T3BPSE02
 - 7) Custom PSE Power Plus 18TB JBOD, No Lic., Win 10
 - a. PSN18T3BPSE06
 - 8) Custom PSE Power Plus 24TB JBOD, No Lic., Win 10
 - a. PS530T3BPSE03
 - 9) Custom PSE Power Plus 30TB JBOD, No Lic., Win 10
 - a. PS530T3BPSE04
 - 10) Custom PSE Power Plus 30TB JBOD, No Lic., Win 10
 - a. PSN30T3BPSE06 ????
 - 11) Custom PSE Power Plus 40TB, Raid 1, JBOD, No Lic., Win 10
 - a. PSN40T3BPSE06
- b) Additional Salient Information:
- 1) - Approved Salient Operating Systems: Windows-7 & Windows-10. No server based operating systems are allowed without pre-authorization from Corporate Security.
 - 2) - I/O for PTZ Call-ups, and email snapshots will be made via the salient I/O modules – AEIO
 - 3) - PTZ call up's will be triggered via Napco Alarm Outputs.
- c) Licensing, CompleteView Pro
- 1) 16 camera licenses minimum per NVR
 - 2) Licenses purchased in 16 camera license blocks up to 32 camera licenses
 - 3) Cameras licenses in excess of 32 may be purchased individually
 - 4) CV Pro IP camera License
 - a. SAL-CPI
- d) Input / Output Module,
- 1) AEIO
- e) USB to 16in / 16 out interface box
- 1) SAL-8221
- f) Rail Mount Kit Manufacturer is Norco
- 1) 122-2580
- g) POE Switch
- 1) Trendnet 24 port POE+ Switch

- a. TL2-PG284
 - 2) NVT Flex 24 Port UTP POE Manage Switch
 - a. NV-FLX-024
 - 3) NVT Flex –Link Plus Adapter
 - a. NVT-FLXLK
 - h) Rack Mount Drawer - Middle Atlantic 2RU
 - 1) UD2
 - i) PDU
 - 1) ServerTech 20amp Switched IP PDU w/appropriate power cord
 - a. CW-8H2A211
 - j) Power Supplies
 - 1) Altronix Rack Mount 24 VAC Power Supply, 16 Output
 - a. ALT-R2416600UL
 - 2) Altronix Camera UPS Power Supply 12VDC @ 2A & 24VAC @ 4A
 - a. ALT-REServ1
- C. KVM
 - 1. Each project shall include a rack mount all-in-one KVM to include monitor, mouse, and keyboard
 - 2. Manufacturer is Norco
 - a) Short depth 8 port 19" Rack KVM
 - 1) KVM-08WS
 - 3. Manufacturer is Crystal Image Tech, no substitutions permitted.
 - a) RM-131-19W-801
 - 1) 1U 19" Rackmount Monitor with 8 port KVM switch
- D. Network Switch
 - 1. Quantities shall be determined by contractor based on the number of devices indicated on the security drawings.
 - 2. Network switch shall provide adequate POE power for all cameras specified.
 - 3. Network switch shall be capable of providing POE power, and connecting cameras beyond 100m.
 - a) Manufacture is NVT
 - 1) NVT Flex 24 port UTP POE Managed Switch, NV-FLX-024-10G
 - 2) Link Adapter, FLXLK
- E. Exterior Cameras
 - 1. Quantities and locations shall be indicated on security drawings.

2. Exterior cameras shall be rated for intended use, and include environmental, tamper resistant housing
3. Exterior cameras shall be configured for maximum resolution and video quality.
4. Exterior cameras shall be back focused where applicable
5. Exterior cameras shall include vari-focal lens, focal lengths to be determined by application.
6. Box camera Manufacturer is Bosch Dinion, no substitutions permitted
 - a) 5MP Day / Night Starlight Camera with analytics
 - 1) BOS-NBN80052BA
 - b) Lens,
 - 1) LVF5005CS4109
7. Box camera housing Manufacturer is Pelco
 - a) Outdoor IP Housing w/feed through mount
 - 1) PEL-EH16-M
8. Outdoor Dome camera
 - a) Bosch IP Dome camera, 1080p
 - 1) BOS-N1150022A3
 - b) Bosch Flush Mount Bracket for N115 Series Domes
 - 1) BOS-NDAFMTDOME
9. Manufacturer is Hikvision
 - a) 4MP IR Autotracking PTZ 36X,
 - 1) HIK-DS-2DF8442IXS-AELW(T2)
 - b) PTZ Wall Mount bracket only,
 - 1) HIK-WMP-L
 - c) PTZ wall mount with Junction box,
 - 1) HIK-JBPW-L
 - d) PTZ Pole (round) Mount Adaptor for WMP-L,
 - 1) PMPL
10. Manufacturer is Bosch
 - a) Bosch MIP PTZ, 2MP, 30X
 - 1) MIC-7522-Z30W
 - b) Bosch MIP Wall Mount
 - 1) MIC-WMB-WD
 - c) Bosch MIC PTZ IR and White Illuminator
 - 1) MIC-ILW-400
 - d) Bosch MIC Hinged DCA, White
 - 1) MIC-DCA-HW
11. Manufacturer is Acti
 - a) A82, 5 MP Outdoor Low-Light WDR, 3.6-10mm, AF
 - b) Mounts Hikvision brand used with Acti cameras

- 1) Hikvision WML for wall mount applications
- 2) Hikvision PC135 Pendent Mount Cap for WMS Mount and A82 camera

F. Thermal Cameras

1. Manufacturer is Bosch, no substitutions permitted
 - a) NHT-8001-F09VF
 - 1) Bosch DINION 640x480 IP Thermal W/housing 9mm 30FPS 1.5A @ 24V
 - b) NHT-8001-F17VF
 - 1) Bosch DINION 640x480 IP Thermal W/housing 16.7mm 30FPS 1.5A @ 24V
 - c) NHT-8001-F35VF
 - 1) Bosch DINION 640x480 IP Thermal W/housing 35mm 30FPS 1.5A @ 24V

G. Interior Cameras

1. Quantities and locations shall be indicated on security drawings.
2. Interior cameras shall be rated for intended use
3. Interior cameras shall be configured for maximum resolution and video quality, except where owner specifies otherwise.
4. Interior cameras shall be fully configured to leverage included features (wide dynamic, auto gain control, auto focus)
5. Interior cameras shall include vari-focal lens, focal lengths to be determined by application.
6. Manufacturer is Bosch, no substitutions permitted
 - a) IR Dome, NII50022A3
 - b) Panoramic Dome, NIN70122F0
 - c) FLEXIDOME IP 2MP 3-10MM AVF INDOOR IR, NDI-4502-AL
2. Manufacturer is Axis, no substitutions permitted
 - a) 180 Degree wall mount, P1224E

H. Infrared Illuminators

1. Quantities and locations shall be indicated on security drawings.
2. Infrared Illuminators (IR) shall be installed per manufacturers recommendations.
3. Infrared Illuminators shall provide complete coverage of camera view area.
4. Where Infrared Illuminators are mounted to a pole, or metal structure
 - a) A nylon electrical squeeze connector shall be used for the cable path.
The metal structure shall be drilled and tapped to receive the connector.
5. The Infrared Illuminator shall be mounted on an adjustable swivel bracket. The bracket shall be mounted to the structure with self-taping screws.

6. Manufacturer is Raytec,
 - a) Illuminator 200' 90 deg
 - 1) RAY-VAR-i8-2
 - b) 120 degree lens for i8 Illuminator 140' 180 deg
 - 1) RAY-i6 120 50
 - c) Wall mount swivel bracket for dual IR illuminators – for buildings
 - 1) WB1
- I. Inputs and Outputs – (Input Modules and Output Modules)
 1. The Video Surveillance System is fully integrated with site Access Control System and Intrusion System (see sec 281000 and 283100)
 2. The Video Surveillance System shall include video fail outputs, which shall be interconnected to inputs on the Access Control System.
 3. The Video Surveillance System shall include inputs to receive alarm outputs from the Intrusion Detection System and Access Control System, which shall be configured to initiate PTZ presets and video snapshots.
 4. The Video Surveillance System shall include a minimum of 2 16 Input/16 Output Modules per system.
- J. POWER SUPPLIES
 1. The Video Surveillance System shall include power supplies for PTZ cameras Infrared Illuminators.
 2. The Video Surveillance System shall include network switches capable of providing POE and POE+ power to all cameras.
 3. The Video Surveillance System shall include power supplies with adequate capacity to provide an individually fused or protected output per powered device (i.e., each camera or Illuminator shall have a dedicated output)"
 4. Rack mount power supply for PTZ cameras and IR illuminators will have the following specifications:
 - a) Sixteen (16) fuse protected outputs.
 - b) 24VAC @ 25A (600VA) supply current (0.7812A per device, 3.5A max.) or 28VAC @ 20A (560VA) supply current (0.625A per device, 3.5A max.).
 - c) Outputs are rated @ 3.5A.
 - d) Surge suppression.
 - e) Manufacture is Altronix,
 - 1) R2416600UL

K. CABLING

1. Contractor shall provide all necessary power and control cable per manufacturers recommendation.
2. All cable and head end patch panels shall be CommScope brand and shall be UL listed, class II, power limited, and rated for the application
3. All interior cable shall be CommScope brand, such as 2071E SG 4/23 W1000, and have a continuous "Green" jacket
4. All underground cable shall be CommScope brand, such as 1571A BK 4/24 R1000
5. All Video Surveillance System Network (IP) Camera cable shall be CommScope brand and meet the following minimum specifications
 - a) Non-plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMR, meets or exceeds TIA/EIA 568B-C-1
 - b) Plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMP, meets or exceeds TIA/EIA 568B-C-1
 - 1) Cat 6 CommScope Indoor Green Cable
 - a. 6P4P24-GN-PMAX-AP
 - c) Outdoor locations shall utilize direct burial cable rated for wet locations. No substitutions permitted.
 - 1) Cat 6 CommScope Outdoor Cable
 - a. 5EXHO4P24-BK-CMS-NR
6. Patch Cables
 - a) Cat-6 Comscope 1 Foot Patch Cable
 - 1) CPC3312-04F001
7. PTZ power and Infrared Illumination cabling shall be CommScope brand, indoor locations
 - a) Cabling shall be riser rated (CMR), or plenum rated (CMP) as applicable
 - b) Cabling shall have minimum 300 V rating (600 V where required)
 - c) Cable gauge shall be determined by contractor bases on cable length and device loads.
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
 - 2) Typical 16 AWG, 2 Conductor, Non-Shielded, Stranded
8. PTZ power and Infrared Illumination cabling, outdoor locations shall be CommScope brand
 - a) All cables must be rated for direct burial, and for wet locations, no substitutions permitted
 - b) Cabling shall have minimum 300 V rating (600 V where required)
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
 - 2) Typical 16 AWG, 2 Conductor, Non-Shielded, Stranded

Part – 3 EXECUTION

3.1 GENERAL

- A. The contractor is responsible for verifying all project requirements with owner or owner's representative prior to commencing work. Including system configuration, programming, and installation standards. Lack of knowledge or awareness of requirements resulting in additional effort by Contractor shall not require additional compensation by owner.
- B. Contractor shall provide all necessary equipment, materials, and labor to perform the work specified.
- C. Contractor shall provide a complete and fully operational system, to include all necessary configuration, programming, and integration with other systems as specified.
- D. System configuration and programming shall be consistent with other owner sites.

3.2 INSTALLATION

- A. Equipment and Materials
 - 1. Installation of equipment and materials shall be performed with quality workmanship
 - 2. All mounting hardware should be appropriate for the cameras that PSE uses, regardless of manufacture, such as pendent mount, j-box etc.
 - 3. Manufacturers' current installation standards and recommendations shall be followed.
 - 4. All work performed shall be in compliance with the local authority having jurisdiction (AHJ), applicable codes, and standards referenced within this document.
 - 5. All wall or ceiling mounted equipment (enclosures, power supplies, wire management, surge protectors, cameras, etc.) shall be fastened to a stud or must include a wall anchor. Screw fasteners in drywall without anchors shall not be permitted.
 - 6. All equipment mounted to concrete, cinder block, or stucco shall have utilize anchors rated for the application.
 - 7. Where devices are mounted to metal structures or enclosures
 - i. All holes shall be drilled and tapped (self-tapping screws may be utilized for camera and IR mounting)
 - ii. Only appropriately sized machine screws shall be utilized
 - iii. Sheet metal screws shall not be permitted

8. Where connectors or conduits are utilized to connect cable path to a metal structure (stanchion, fence post), the mounting hole shall be drilled and tapped to the size of the connector.
9. All device or equipment mounting holes must be utilized and have fasteners installed.
10. All machine screws used for mounting devices on stanchions, gate posts or any other exterior location, shall be tamper proof stainless steel type that is intended for the purpose
11. All devices with spliced connections shall require a back box or low voltage box.
12. All ceiling mount devices shall include a back box with support, or manufacturer provide ceiling mount.
13. Terminations to screw terminals shall have crimp on spade connections. No bare wire connections shall be permitted
 - i. This includes but is not limited to shielding drain wires, grounding conductors, transformer terminals and key switch terminals
14. All wire connections shall use gel filled compression type connectors (blue beans).
15. All wall mounted equipment must be installed on appropriately rated backboard
16. All wall mounted equipment must include finger duct for cable routing, sized appropriately (3" typical")
17. All connections shall be labeled at head-end equipment, to include:
 - i. Every circuit pair (PTZ cameras power, IR power, etc.)
 - ii. Every data connection (network camera connections, network cables)
 - iii. Every power circuit pair (device power, etc.)
18. All head-end equipment enclosures must be labeled, to include labeling for each input and output module located within enclosures.
19. All similar devices must be mounted at consistent elevations throughout the project (cameras 15' AFF, IR 12', etc.)
20. All cameras shall be "aimed" and "focused" per PSE direction. This may require multiple adjustments as needed
21. All cabling in camera poles requires strain relief at the top of the pole for access purposes
22. All camera pole bases shall be grouted or covered with a pole base covers. This is to close the gaps between pole bases and the foundations
23. See attached specifications for additional installation requirements
 - i. Camera pole detail

B. Cable Installation

1. Contractor shall install cable in compliance with applicable codes and standards referenced within this document.
2. All outdoor cable must be rated for direct burial and for use in wet locations
3. All cabling shall be sized and rated for the application. Doubling of conductors to increase capacity shall not be permitted
4. Device cable runs will include a 10' service loop at each device location
5. All cable runs will include a 10' service loop at the head end location, service loop to be routed via cable management systems.
6. All cabling shall be labeled during pre-wire, utilizing a matrix or key for cable identification.
7. All cabling in cable trays, hooks, or bridal rings must be neatly bundled and tied with zip ties or velcro.
8. All cable entering security equipment room (Com Rm IDF, MDF) on cable management systems shall be neatly combed, bundled, and uniform. Where required, cable shall be installed within cable sleeve (mesh sock).
9. Where cable enters equipment enclosures
 - i. Cable jacket/sheathing shall be continuous from cable management system into enclosure. When removing cable jacket/sheathing, 2"-3" shall remain at entry point of enclosure; all cable shall be prepared in the same way, so as to provide a consistent result.
 - ii. All individual wire pairs (input circuits, output circuits, data connections, etc.) shall be braided/twisted.
10. All cabling within enclosures must be managed. Cable to be secured with zip ties affixed to "screw down" type saddles (stick on zip tie bases shall not be permitted). "Screw down" saddles must utilize machine screws (not sheet metal screws). Mounting holes must be drilled and tapped. Screws must not exceed ¼" in length
11. Plastic bushings or chase nipples must be utilized where cables penetrate enclosures or housings (per code)
12. All connections within Video Surveillance System enclosure or other enclosures must be soldered and insulated with heat shrink (These connections include but are not limited to Tamper Switches, Battery Fail outputs, AC Fail outputs, etc.)
13. Where cables terminate to power supplies or external connections
 - i. Cable jacket/sheathing shall be continuous to equipment locations, jacket/sheathing shall be removed at the point where the cable transitions from the cable management to the equipment.
 - ii. All individual wire pairs (device power, lock power, aux power, etc.) shall be braided/twisted.
14. Where conductors are terminated to devices in the field
 - i. When terminating conductors on terminal strips, conductor should be stripped such that minimal or no exposed copper is visible beyond the terminal connection.

- ii. Where conductor splicing is required for device connections, conductors shall be twisted, and terminated with gel filled crimp on connector (blue beans)
 - iii. Conductors and connections should be finished by neatly wrapping with electrical tape
15. Cable must be continuous from device location to terminating equipment. No field splicing shall be permitted, without prior written authorization.

C. Programming and Configuration

- 1. Contractor shall perform all necessary programming and configuration required to deliver a fully operational and functional system, consistent with other owner sites. To include:
 - i. Hardware configuration
 - 1. Video Surveillance System network configuration
 - a. Configure NVR interfaces
 - i. Public interface
 - ii. Private camera network interface
 - b. Network Switch
 - i. Management interface
 - ii. MAC address locking
 - c. Network cameras
 - i. Network interface
 - 2. Input and Output module addressing
 - ii. Programming logic
 - 1. Perform all NVR programming
 - a. Network configuration, public and private networks
 - b. User accounts
 - c. SMTP configuration
 - d. NTP configuration
 - e. Recording schedules
 - f. Network camera configuration
 - i. Network configuration
 - ii. Compression
 - iii. Motion detection
 - 1. Areas
 - 2. Sensitivity
 - iv. Text descriptions
 - 2. Network camera configuration

- i. Network interface
 - ii. Frame rate, Resolution, Quality
 - iii. Compression
 - iv. Color and lighting correction
 - 3. Input and output programming
 - a. Video fail output
 - b. PTZ preset inputs
 - c. Video Snapshot inputs (with email distribution)
- iii. Characters & Naming Requirements for Everbridge
 - 1. Our PSIM, Everbridge has some very specific requirements which must be adhered to
 - a. No Illegal Characters
 - i. There are several characters which should never be used when naming devices, points or Cameras. These names are illegal to Everbridge and should not be used. These characters are:
 - ii. <
 - iii. >
 - iv. ‘
 - v. “
 - vi. &
 - b. No Duplicate Naming
 - i. Everbridge can't manage duplicate names. All naming for input or output points or cameras must be unique. For example if multiple slots if there are multiple camera slots which are identified as future:
 - 1. It causes Everbridge to fail out when attempting to upload the equipment.
 - 2. A simple solution is to use unique names, such as “Future 1”, “Future 2” etc.
 - ii. Everbridge cannot tell if cameras or equipment are connected or not. If the ports are open and assigned, they will be imported.

D. Testing

1. Contractor shall complete a full test of the Video Surveillance System and all associated equipment and components to verify proper functionality, and resolve discrepancies before requesting to test with PSE Corporate Security.
2. Contractor shall perform all testing based on manufactures recommended test procedures, to include utilizing manufacturer recommended testing equipment and methods.
3. Where systems are monitored by owner or third part, all pre-testing shall include signal verification and accuracy with owner or third party.

E. Final Acceptance

1. Final acceptance testing may only be scheduled after inspection and pre-testing has be completed as previously defined.
2. Once vendor has completed security installation and a full test of security systems, final acceptance inspection and testing can be scheduled with owner:
 - i. A full on-site review of Video Surveillance System by owner is required
 - ii. A full test of all Video Surveillance System and integrated devices shall be conducted with owner. This may be performed by the vendor under supervision, or direction and remote monitoring by owner
 - iii. Contractor to provide all tools and equipment necessary to perform testing.
 - iv. All test results shall be documented with owner approved test report
3. Owner reserves the right to reject any portions of work that are found to be deficient or not in compliance with contract documents. In the event that work is rejected, contractor shall be required to correct deficiencies, then perform testing and acceptance procedures as necessary until work is approved.
4. Contractor shall create and provide termination schedules using the owner provided template identifying all devices and programming points per owner standard.
5. Project termination schedules shall include:
 - i. All input points
 - ii. All output points
 - iii. All device terminations
 - iv. All power supply terminations
 - v. All equipment types including model & part numbers
 - vi. All IP addresses
 - vii. All configuration data

6. Contractor shall provide owner with project "As-Builts", "As-Built" drawings shall:
 - i. Be in AutoCAD format
 - ii. Include all device locations
 - iii. Devices shall be named and numbered as defined in termination schedules
 1. All device naming shall be consistent across all systems

F. Training

1. Contractor shall provide training on system operation, maintenance, and functionality as requested by owner. Training time not to exceed 8 hours.

G. Warranty

1. Contractor shall warrant assemblies, components, parts, materials, cabling, and labor against defects in materials and workmanship, for a period of 12 months from date of substantial completion.
2. Warranty service response shall not exceed 6 hours.
3. Repair or replacement of defects in materials or workmanship shall be completed at no charge to the owner during the warranty period.
4. Contractor shall correct system defects within 5 business days of receipt of request from owner.

Section 283100 – INTRUSION DETECTION

PART – 1 GENERAL

1.1 RELATED DOCUMENTS

- A. General provisions of contract and drawings, including general and supplemental conditions, and Division 1 specification sections apply to this section

1.2 SUMMARY

- A. Provide and install Intrusion Detection System for this improved facility, and site; to include perimeter fence detection, perimeter gates and doors, building doors and intrusion detection devices. Provide all devices and equipment necessary, to include, but not limited to, control panels, keypad, input and output modules, intrusion detection sensors, as well as system programming, commissioning, and testing.
 - 1. Intrusion Detection System shall use Napco hardware, and components. No substitutions shall be permitted.
 - 2. Intrusion Detection system shall integrate with Access Control System, see section 281000.
 - 3. Intrusion Detection system shall integrate with Video Surveillance system, see section 282000.
- B. Related Sections
 - 1. Division 26 – Electrical
 - 2. Division 27 – Communications
 - 3. Section 281000 – Access Control System
 - 4. Section 282000 – Video Surveillance

1.3 STANDARDS AND REFERENCES

- A. National Electric Code, NEC (NFPA 70)
- B. National Fire Alarm Code, NFPA
- C. American National Standards Institute (ANSI)
 - 1. ANSI/TIA -568-C.0,568-C.1,568-C.2 Telecommunications Cabling Standards
 - 2. ANSI/TIA -569-D Telecommunications Pathways and Spaces

3. ANSI/TIA -607-C Generic Telecommunications Bonding and Grounding
4. ANSI/TIA -862-A Building Automation Systems Cabling Standard
5. ANSI/TIA -1005-A Building Automation Systems Cabling Standard

D. International Organization for Standardization (ISO)

1. ISO 9001 Quality Management Systems
2. ISO/IEC 11801 Generic Cabling for Customer Premises

E. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 802.3af Power over Ethernet (PoE) Standard
2. IEEE 802.3at Power over Ethernet+ (Plus) Standard

F. Underwriters Laboratories, Inc. (UL)

1. UL 50 Enclosures for Electrical Equipment, Non-Environmental
2. UL 50E Enclosures for Electrical Equipment, Environmental
3. UL 294 Standard for Intrusion Detection System Units
4. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Intrusion Detection Systems
5. UL 639 Standard for Intrusion-Detection Units

1.4 SUBMITTALS

A. Product Data/Specifications for each product indicated

B. Equipment layout

1. Rack layouts
2. Wall mount equipment layouts

C. Shop Drawings

1. Provide shop drawings showing cable routing and wiring in conduits and raceways.
2. Shop drawing will show all equipment, enclosures, and junction box locations.
3. Shop drawings will be provided in AutoCAD 2016 format, and in PDF format

1.5 QUALIFICATIONS

- A. Contractor must be an authorized dealer of the following systems, for a period of no less than 2 years:

- a. Napco Security
 - b. Southwest Microwave Intrepid I and Intrepid II
 - c. Optex Redscan
- B. Contractor must have at least two EL-06 Journeyman Specialty Electricians on staff who are Southwest Microwave and Optex Redscan factory trained and certified technicians with a minimum of 2 years of experience installing and servicing Southwest Microwave and Optex Redscan equipment and applications.
- C. Bidding contractors must have at least 5 years of experience installing, and servicing systems of the type specified, and have completed at least ten projects of similar size and scope within the last 5 years.
- D. Contractor is required to have at least one certified EL-06 Journeyman Specialty Electrician on the job site at all times when work is being performed.

1.6 SUBSTITUTIONS

- A. No substitutions shall be permitted, except were expressly permitted by owner in writing. Substitution requests shall be submitted in writing, and shall include product descriptions, model numbers, and pricing for item specified and requested substitution, as well as price variances.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall be responsible for storage and handling of all materials and equipment
- B. Materials and equipment shall be delivered in manufacturers original unopened and undamaged packaging
- C. Products shall be stored in manufactures unopened packaging and protected from environmental conditions and physical damage
- D. Products shall be handled in accordance with manufacturers recommendations
- E. Any products or materials showing signs of misuse, mishandling, or damage shall be replaced with new at no additional charge to the owner

F. Waste management

1. Excess materials shall be discarded in an appropriate manner
2. All hazardous materials shall be handled appropriately, and disposed of within compliance of applicable codes and regulations.

1.8 PROJECT CONDITIONS

- A. Contactor shall not install products where environmental conditions are outside the manufactures recommendations.
- B. Contractor shall be aware of project and site conditions that may impact scheduling or quality of work and materials specified. The Contractor shall be responsible for coordination of work as site conditions change to optimize installation for owner.
- C. Lack of awareness of project conditions resulting in additional effort by Contractor shall not require additional compensation by owner.

PART – 2 PRODUCTS

2.1 MANUFACTURER

- A. All equipment and materials shall be of manufacturer's current production, to include revision and firmware where applicable
- B. Intrusion Detection System control panels, keypads, input and output modules shall be Napco Security, no substitutions shall be permitted.
- C. Perimeter fence detection system shall be Southwest Microwave, no substitutions shall be permitted.
- D. Laser detectors shall be Optex Redscan, no substitutions shall be permitted.
- E. See appendix B for complete listing of approved equipment

2.2 PRODUCTS

A. Intrusion Detection System Hardware (Sec 283100)

1. Provide all equipment and materials required to deliver a fully operational Intrusion Detection System. To include, all enclosures, control panels, keypads, detection devices, power supplies, cabling, and programming. Additionally, the Intrusion Detection System shall be integrated with the Access Control System and Video Surveillance systems via physical I/O hardware and interconnects, as well as programming logic.

a) Manufacturer, Napco

- 1) Control Panel, P9600 and X255
 - a. NAP-GEM-9600
 - b. NAP-GEM-X255
- 2) 2 line large custom LCD Keypad,
 - a. NAP-GEMRP1CAE2
- 3) 8 zone EZM Input Module,
 - a. NAP-GEMEZM8
- 4) 8 Output Relay Expander Module,
 - a. NAP-RB3008
- 5) Net Link Internet Communications (NL) Module
 - a. NAP-NLMODUL
- 6) Enclosure Lock
 - a. NAP-Lock8

b) Manufacturer, Honeywell (Note: custom aluminum plates required to adapt Napco modules)

- 1) Wall Mount Enclosure,
 - a. PRO22ENC1
- 2) Rack Mount Enclosure,
 - a. PRO22ENC2
- 3) Enclosure,
 - a. PRO22ENC3
- 4) Power Supply,
 - a. PRO32E1PS
- 5) Daisy Chain Cable,
 - a. PRO22DCC

c) Manufacturer, STI

- 1) Enclosure, (for aux equipment, terminal strips, Intrepid modules, etc)
 - a. STI-STIEM151804

d) Manufacturer, Southwest Microwave

- 1) Control Module, CM II-N

- 2) Processor Module, PM II
- 3) Relay Output Module, ROM II
- 4) MicroPoint Cable, MC115-220 and MC115-100
- 5) Termination Unit, TU II
- 6) Splice Unit, SU
- 7) Power Supply
 - a. Not Recommended
 - i. Southwest Microwave PS48 (does not have battery backup)
 - b. Recommended
 - i. ALT-ALT600ULPD8 – Set to 24VDC, for smaller systems, 2 PMs Max.
 - ii. Vertiline563 – 56VDC Power Supply
 1. Must use RE2 battery tray for backup
 - iii. Altronix RE2 – Rack mount battery tray for use with Vertiline 563 PS
- 8) Lightning Surge Protector, JB70A
- 9) Battery Back-up Rack system for Vertiline563
 - a. RE2
- e) Manufacturer, Optex
 - 1) Redscan Laser Detector, RLS-3060SH
2. Quantity of equipment (control panels, input modules, output modules, enclosures, etc.) shall be determined by contractor based on device quantities identified on security plan.
3. All equipment enclosures require door tamper switch.
- B. Gate Position Sensors (Door Contacts)
 1. Gate contacts should be mounted on the center leaf utilizing Interlogix brackets 1941-L and/or 1942-L
- C. Perimeter Fence Detection System
 1. Perimeter Fence Detection system design shall be based on the length and configuration of the perimeter fence system. It shall be the contractor's responsibility to determine cable lengths and quantities required. Contractor shall not rely exclusively on project drawings to make this determination.
 2. The system shall be designed and installed based on manufacturers recommendations.
 3. The system shall include at least two relay outputs for each perimeter fence section.

4. The system shall include a test tool for each project, which shall remain on site after project completion.
5. The system shall include a splice unit for each project, which shall remain on site after project completion.
6. Where Intrepid cable must be installed in conduit; conduit shall terminate to a PVC outdoor rated 4" x 4" x 2" PVC box. Intrepid cable shall penetrate the box through watertight squeeze connectors. Squeeze connectors shall be appropriately size so as not to damage the Intrepid cable
7. Where data and power cable is required between the Intrepid system (on fence) and the building, all cable shall be installed within a conduit
8. Power supplies used for the purposes of powering the Fence Detection system, shall include battery backup.
9. Where Intrepid MC115 cable is required to be installed in a conduit, a dedicated conduit shall be used.
10. For the purposes of footprint reduction, and serviceability, the Southwest Microwave Intrepid controller module and relay modules are to be removed from their factory enclosures, and are installed at the head end using appropriate standoffs in a 15" X 18" x 4" UL approved enclosure along with the other ancillary devices like terminal blocks, interconnects, RTU connections, etc...
11. Fence Detection system shall be configured for network connectivity.
12. Fence Detection system shall include surge protection per manufacturers recommendations.
13. Manufacturer is Southwest Microwave
 - a) Intrepid II Universal Installation Service Tool,
 - 1) UCST II
 - b) Intrepid II Controller Setup Tool II, Software (N/C)
 - 1) CSTII
 - c) Intrepid II Control Module II-Networked,
 - 1) CM II-N
 - d) Intrepid II Micropoint Processor Module w/ABS weatherproof enclosure,
 - 1) PM II
 - e) Intrepid II Link Unit II with ABS weatherproof enclosure
 - 1) LU II
 - f) Intrepid II 8 Relay Output Module,
 - 1) ROM II
 - g) Intrepid II 220m Cable (722') roll,
 - 1) MC115-220
 - h) Intrepid II 100m Cable,

- 1) MC115-100
- i) Intrepid II Termination Unit,
 - 1) TU II
- j) Intrepid II Splice Unit,
 - 1) SU
- k) Intrepid II Lightning Suppression Module,
 - 1) JB70A
- l) 56 VDC Power supply
 - 1) Manufacturer Vertiline
 - a. Vertiline563
 - b. Altronix
 - i. ALT600ULP D8 – set to 24DC for smaller systems, 2 PMs max.
 - 2) Intrepid Power Supply NOT RECOMMENDED!
 - a. Southwest Microwave PS48 (does not have battery backup)
- m) Cable Ties
 - 1) Manufacturer Southwest Microwave
 - a. 62A1010
- n) Cut Simulator Tool
 - 1) Manufacturer Southwest Microwave
 - a. 26D14875-A01
- o) Spring Clip for Ameristar fence,
 - 1) SWC100
- 14. Manufacturer is SenStar – LM100
 - a) Senstar LM1—Gateway/Luminaire AP Set
 - 1) E8FG0301
 - b) Senstar LM100 Luminaire 1 PK
 - 1) E8FG0211
 - c) Senstar LM100 Luminaire 20 PK
 - 1) E8FG0401
 - d) Senstar LM100 Product Documentation - CD
 - 1) E8DA0120
 - e) PVC Coated MC Cable, 12/2
 - 1) 23044200
 - f) Bag of 1000 UV Resistant Cable ties
 - 1) GH0916
 - g) UCM (Universal Configuration Module)
 - 1) 00SW0100

- h) Interface Cable – for use with Universal Configuration Module (UCM) software
 - 1) GE044
- i) Ethernet card, 10/100BASE-TX on RJ45, PoE, G2 Silver
 - 1) 00BA2200
- j) Network Manager on USB
 - 1) 00FG0220
- k) Altronix 24vdc Power Supply
 - 1) AL1024ULX
- l) UltraLink processor module, 8 outputs, 8 inputs
 - 1) 00EM1400
- m) UltraLink expansion module, 32 relay outputs
 - 1) 00EM1600
- n) UltraLink rack-mount swing-out DIN rail, 4RU
 - 1) 00MA0100
- o) DIN Rail DC Power Supply for UltraLink I/O modules
 - 1) GP0151

D. Perimeter Laser Detector

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Laser detectors shall be configured for network connectivity.
- 3. Laser detectors shall be configured with physical alarm outputs for alarm, tamper, and trouble conditions.
- 4. Laser detectors shall not be POE powered, and shall be powered directly via DC power supply.
- 5. Laser detectors shall include integrated heater where recommended by manufacturer.
- 6. Manufacturer is Optex Redscan
 - a) Laser Scan Detector,
 - 1) RLS-3060SH

E. Videofied Security System

- 1. Videofied Extreme Temp Panel with Enclosure, XTO IP 630
- 2. Videofied 4 D-Cell Lithium Batteries LSH 20 (XT Panels), PP1
- 3. Videofied Alpha Keypad, XMA 621
- 4. Videofied Prox Card Arming Station (includes 1 prox tag), BR 651
- 5. Videofied Outdoor motionviewer (includes mounting bracket), OMV601MB
- 6. Videofied Magnetic base for MB 601 mounting base, PAN 864
- 7. Videofied Extreme Temp Panel with Enclosure, XTO IP 630
- 8. Videofied 4 D-Cell Lithium Batteries LSH 20 (XT Panels), PP1

9. Videofied Alpha Keypad, XMA 621
- F. Door Position (Door Contacts)
 1. Quantities and locations shall be indicated on security drawings.
 2. Door position sensors shall be included on all doors identified within the security plan.
 3. Door position sensor shall be DPDT with closed loop function.
 4. Recessed door position sensors shall be 1" diameter for metal or wood doors and frames, and shall be rated for 1" gap.
 5. Surface mount door position sensors shall be or armored type, and terminations shall be within an electrical back box.
 6. Manufacturer is Interlogix
 - a) 1" Recessed door position sensor, 1076D
 - b) Surface mount armored door position sensor, 2507ADL
- G. Motion Detectors
 1. Quantities and locations shall be indicated on security drawings.
 2. Motion detectors shall be installed per manufacturers recommendations.
 3. Motion detectors shall utilize multiple technologies(TriTech) to ensure accurate and reliable detection, while minimizing false alarms.
 4. Motion detectors shall interface directly with the access control system. The access control system shall output alarm signals from motion detectors to the intrusion system.
 5. Motion detectors shall utilize double end-of-line resistors for supervision.
 6. Manufacturer is Bosch
 - a) ISCPDL1WA18G
 - b) ISCPDL1W18G
 - c) DS720i
- H. Glass Breakage Detectors
 1. Quantities and locations shall be indicated on security drawings.
 2. Glass breakage detectors shall be installed per manufacturer's recommendations.
 3. Glass breakage detectors shall utilize multiple technologies (DualTech) to ensure accurate and reliable detection, while minimizing false alarms.
 4. Glass breakage detectors shall interface directly with the access control system. The access control system shall output alarm signals from motion detectors to the intrusion system.
 5. Glass breakage detectors shall utilize double end-of-line resistors for supervision.
 6. Manufacture is Honeywell,

- a) Glass Break Detector with Auto Reset,
 - 1) CK-FG730

I. Panic Button

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Panic buttons shall be installed per manufacturer's recommendations.
- 3. Panic buttons shall be dual action type, where two buttons must be depressed to initiate an alarm.
- 4. Panics shall be connected directly to Intrusion Detection System.
- 5. There shall be an output from the Intrusion Detection System to the Access Control System for each panic alarm. Panic alarms will be active 24/7.
- 6. Panic buttons shall include end-of-line supervision.
- 7. Manufacturer is Amseco,
 - a) HUSD-15B

J. Panic Strobe

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Panic strobes shall be mounted in the location with the highest visibility to the occupant of the protect space. While also not being visible to a potential intruder from outside of the protected space
- 3. Panic strobes shall be configured to trigger upon a panic alarm signal, initiated by a panic button. The panic strobes will not time out once activate, until the Intrusion Control Panel is reset.
- 4. Manufacture and model TBD, application specific.

K. Arm/De-Arm Key Switch

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Key Switch will provide arm and de-arm functionality for the Intrusion Detection System.
- 3. Key Switch will include a Best key switch cylinder configured to accept small format 7 pin interchangeable lock cores, and will include a Red and Green LED indicators. The Red LED will indicate that the Intrusion Detection System is armed. The Green LED will indicate that the Intrusion Detection System is De-armed.
- 4. Key Switches will include a tamper switch.
- 5. Manufacturer is Best,
 - a) 1W7B1

L. Push-to-Arm Button

- 1. Quantities and locations shall be indicated on security drawings.
- 2. Push-to-Arm button will provide arming functionality only for the Intrusion Detection System. Once the system is armed, the Push-to-Arm button shall not continue to function.

3. Push-to-Arm button will include a single Red/Green bi-color LED indicator. The Red LED will indicate that the Intrusion Detection System is armed. The Green LED will indicate that the Intrusion Detection System is De-armed.
4. Manufacturer is Securitron
 - a) SEM-PB4

M. Alarm Controls indicator plate (LEDs)

- a) ALC-RP9

N. Sirens and strobes

1. Sirens shall be included on each project.
2. Exterior sirens shall include an integrated strobe.
3. There shall be at least one exterior siren per system.
4. There shall be at least one interior siren per system. Where there are multiple floors, or divisions of space, there shall be a siren in each.
5. Where there are camera poles within substations, each pole shall include a strobe only.
6. Strobe & Siren time out programming
 - a) Substations
 - 1) Sirens shall be programmed to time out (stop sounding) after 4 minutes.
 - 2) Strobes shall be programmed to time out (stop flashing) after 1 hour.
 - b) Service Centers and Business Offices
 - 1) Sirens shall be programmed to time out (stop sounding) after 4 minutes.
 - 2) Strobes shall be programmed to time out (stop flashing) after 15 minutes.
7. Manufacturer is Amseco
 - a) Outdoor Siren w/blue strobe,
 - 1) 4150023 (SSX-51S – Blue?)
 - b) SL-401 Blue Strobe,
 - 1) POT-SL401B

O. Siren Bypass

1. Stainless steel flush mount siren bypass buttons required. A separate siren bypass button is required for each alarm area. Connections to be soldered and heat shrink required

P. Reset Button

1. Stainless steel flush mount power reset button required, connections to be soldered and heat shrink required
2. Power reset function shall use a relay to interrupt both AC power and Battery power in the same operation
3. Intrusion Detection System must be configure to reset on output from Access Control System

4. Manufacturer is Securitron,
 - a) Momentary push button,
 - 1) SEM-PB4

Q. Relays for Alarm System Controls

1. Elk Relay, 4-pack
 - a) ELK-9244

R. Alarm Inputs and Outputs – (Input Modules and Output Modules)

1. The Intrusion Detection System is fully integrated with site Access Control System (see sec 281000)
 - a) Intrusion System Status – There is an output circuit from the Intrusion Detection System to the Access Control System for Arm/De-arm status.
 - b) Auto Arm – There is an output from the Access Control System to the Intrusion Detection System for auto arming. The output is triggered, on a programmed time schedule or manually. The output arms the Intrusion Detection System when the output is momentarily energized.
 - c) The Auto Arm output from the Access Control System cannot disarm the Intrusion Detection System.
 - d) Valid Access Disarm – There is an output from the Access Control System to the Intrusion Detection System that disarms the system.
 - e) Valid Access Disarm output to Intrusion Detection System must not be able to arm the alarm system
2. The intrusion detection system shall include a minimum of two EZM (zone expansion modules) providing a total of 16 additional alarm zones. The first 16 alarm zones (8 panel and 8 EZM) shall be utilized for system monitoring and integration.
3. All intrusion detection and monitoring devices are connected to the Access Control system via input points. There is an Access Control System output configured for each device, each output is connected to an input on the Intrusion Detection System.
4. All intrusion detection and monitoring devices shall be configured with double end-of-line supervision.
5. The Intrusion Detection system shall include outputs to the Access Control System for arming status, AC failure, battery failure, communications failure, siren bypass.
6. Contractor shall link inputs and outputs via programming, such that an input results in an output.
7. Outputs from the Intrusion Detection System shall be configured and interconnected to the Video Surveillance System for PTZ callup, and image snapshots.

8. All inputs shall be wired via interconnects to outputs on the Access Control System, see Section 281000.
9. The Intrusion Detection System is fully integrated with the Video Surveillance System.
 - a) The Intrusion Detection System is configured to send outputs to the Video Surveillance system for intrusion alarms. Outputs shall be wired via interconnects to inputs on the Video Surveillance system, see Section 282000.

S. POWER SUPPLIES

1. The Intrusion Detection System shall include power supplies for input and output modules.
2. The Intrusion Detection System shall include power supplies with adequate capacity to provide an individually fused or protected output per powered device (i.e., each detector (glass breakage, motion, etc.) shall have a dedicated output)
3. The Intrusion Detection System shall include power supplies for detection devices, shall be rack mounted unless otherwise specified, and shall have the following specifications:
 - a) Sixteen (16) Class 2 Rated PTC protected outputs
 - b) 6-15VDC @ 6 amp total output current (0.375 amp per device, 2.5 amp max.)
 - c) Filtered and electronically regulated outputs
 - d) Short circuit and thermal overload protection
4. Rack mount Intrusion Detection power supply manufacturer is Altronix
 - a) Model R615DC616ULCB
 - b) DC Power Supply, 12/24 VDC
 - 1) ALT-R1224DC16CB
5. Approved wall mount power supply (where applicable) manufacturer is Altronix; with the following specifications
 - a) 12VDC or 24VDC selectable output.
 - b) 6A continuous supply current.
 - c) Sixteen (16) Class 2 Rated PTC protected power limited outputs (auto-resettable).
 - d) Outputs are rated @ 2.5A.
 - e) Filtered and electronically regulated output.
 - f) Short circuit and thermal overload protection. Wall mount power supply manufacturer is Altronix

T. CABLING

1. Contractor shall provide all necessary power and control cable per manufacturers recommendation.
2. All cable and head end patch panels shall be CommScope brand and be UL listed, class II, power limited, and rated for the application
3. All interior cable shall be CommScope brand, such as 2071E SG 4/23 W1000, and have a continuous "Green" jacket
4. All underground cable shall be CommScope brand, such as 1571A BK 4/24 R1000
5. Network cable shall be CommScope brand and meet the following minimum specifications
 - a) Non-plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMR, meets or exceeds TIA/EIA 568B-C-1
 - b) Plenum: Cat6, UTP, 23 AWG, 4 pair, 300 V, CMP, meets or exceeds TIA/EIA 568B-C-1
 - c) Outdoor locations shall utilize direct burial cable rated for wet locations. No substitutions permitted.
6. Intrusion Detection System Cabling, indoor locations shall be CommScope brand
 - a) Cabling shall be riser rated (CMR), or plenum rated (CMP) as applicable
 - b) Cabling shall have minimum 300 V rating
 - c) System Keypad, Input, and Output Modules
 - 1) Minimum 22 AWG, 4 Conductor, Non-Shielded, Stranded
 - d) Door Position Sensor
 - 1) Minimum 22 AWG, 4 Conductor, Non-Shielded, Stranded
 - e) Motion Detectors
 - 1) Minimum 22 AWG, 4 Conductor, Non-Shielded, Stranded
 - f) Glass Break Detector
 - 1) Minimum 22 AWG, 4 Conductor, Non-Shielded, Stranded
 - g) Interior and Exterior Siren
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
 - h) Arm/De-Arm Key Switch
 - 1) Minimum 22 AWG, 6 Conductor, Non-Shielded, Stranded
 - i) Push-to-Arm Button
 - 1) Minimum 22 AWG, 6 Conductor, Non-Shielded, Stranded
7. Intrusion Detection System Cabling, outdoor locations shall be CommScope brand
 - a) All cables must be rated for direct burial, and for wet locations, no substitutions permitted
 - b) Cabling shall have minimum 300 V rating

- c) Arm/De-Arm Key Switch
 - 1) Minimum 18 AWG, 6 Conductor, Non-Shielded, Stranded
- d) Door Position Sensor
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
- e) Motion Detectors
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
- f) Glass Break Detector
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded
- g) Interior and Exterior Siren
 - 1) Minimum 18 AWG, 4 Conductor, Non-Shielded, Stranded

U. RTU Terminations (Substations Only)

- 1. Only one Napco output board is designated for RTU interface
 - a) Zone types in Napco programming are matched up to each output, to correspond with the associated RTU connection, IE: "Fence", "Door", Arm Status", etc...
 - b) The Napco Output board #1 is always for the Napco AC Fail, Low Batter, Area Arm, and Napco Comm Fail
 - c) The Napco Output board #2 is always for the RTU's
 - d) Napco Out boards #3 & #4 (16 camera NVR), and if necessary #5 & #6 (Over 16 camera NVR), are always for Salient
 - e) The terminal blocks to use are Phoenix Contact UK-5-Twin
 - 1) Blue for Common or SIC
 - a. SIC loops through each output common on the Napco Output board
 - b. Blue was previously used for arm / disarm control.
 - i. We no longer allow arm/disarm via RTU per Dave Foster 7/22/2019
 - 2) Grey for outputs from Napco
 - a. Napco output board outputs connect 1 to 1 on the gray terminals
 - 3) Phoenix Contact Terminals
 - a. 1923021 – Phoenix UK 5-Twin (width 6.2mm) – Gray (50 per box)
 - b. 1923047 – Phoenix UK 5-Twin (width 6.2mm) – Blue (50 per box)
 - c. 1923034 – Phoenix Contact Terminal Block End Cover for D-UK 5-Twin – Gray
 - d. 1201662 – Phoenix Contact End Bracket Aluminum (10 per bag)
 - f) Also see photos:

- 1) RTU_2019.12.27-Final.png
 - 2) RTU Typical Terminals wiring. Jpg
 - 3) Phoenix Contact Terminals.pdf
- g) Alarm outputs should be programmed:
- 1) All except "General Alarm" – 15 seconds
 - a. This will force any alarm to register on the operations EMS system as an alarm for 15 seconds
 - 2) General Alarm – set to "0" (zero)
 - a. This will stay in an alarmed state until the system is disarmed.
 - b. This helps them not to lose track of alarms. General Alarm will stay in alarm, prompting them to scroll back in the history to look at what actually happened. Once they work the alarm, an inspector can go to the site to investigate and disarm the system. Once disarmed, the "General Alarm" will go back to normal condition.

Part – 3 EXECUTION

3.1 GENERAL

- A. The contractor is responsible for verifying all project requirements with owner or owner's representative prior to commencing work. Including system configuration, programming, and installation standards. Lack of knowledge or awareness of requirements resulting in additional effort by Contractor shall not require additional compensation by owner.
- B. Contractor shall provide all necessary equipment, materials, and labor to perform the work specified.
- C. Contractor shall provide a complete and fully operational system, to include all necessary configuration, programming, and integration with other systems as specified.
- D. System configuration and programming shall be consistent with other owner sites.

3.2 INSTALLATION

- A. Equipment and Materials
 1. Installation of equipment and materials shall be performed with quality workmanship

2. Manufacturers current installation standards and recommendations shall be followed.
3. All work performed shall be in compliance with the local authority having jurisdiction (AHJ), applicable codes, and standards referenced within this document.
4. All wall or ceiling mounted equipment (enclosures, power supplies, wire management, surge protectors, keypad, motion detectors, etc.) shall be fastened to a stud or must include a wall anchor. Screw fasteners in drywall without anchors shall not be permitted.
5. All equipment mounted to concrete, cinder block, or stucco shall have utilize anchors rated for the application.
6. Where devices are mounted to metal structures or enclosures
 - i. All holes shall be drilled and tapped
 - ii. Only appropriately sized machine screws shall be utilized
 - iii. Sheet metal screws shall not be permitted
7. Where connectors or conduits are utilized to connect cable path to a metal structure (stanchion, fence post), the mounting hole shall be drilled and tapped to the size of the connector.
8. All device or equipment mounting holes must be utilized and have fasteners installed.
9. All machine screws used for mounting devices on stanchions, gate posts or any other exterior location, shall be tamper proof stainless steel type that is intended for the purpose
10. All devices with spliced connections shall require a back box or low voltage box.
11. All ceiling mount devices shall include a back box with support, or manufacturer provide ceiling mount.
12. Terminations to screw terminals shall have crimp on spade connections. No bare wire connections shall be permitted
 - i. This includes but is not limited to shielding drain wires, grounding conductors, transformer terminals and key switch terminals
13. All wire connections shall use gel filled compression type connectors (blue beans).
14. All wall mounted equipment must be installed on appropriately rated backboard
15. All wall mounted equipment must include finger duct for cable routing, sized appropriately (3" typical")
16. All connections shall be labeled at head-end equipment, to include:
 - i. Every circuit pair (door position, request to exit, glass break detector, motion detector, etc.)
 - ii. Every data connection (Reader cable, RS485 data, network cable)
 - iii. Every power circuit pair (device power, lock power, etc.)

17. All head-end equipment enclosures must be labeled, to include labeling for each input and output module located within enclosures.
18. All alarm key switches and "Push to Arm buttons" must be distributed via terminal strips as needed. Terminal strips shall be installed in a 15" x 18" x 4" enclosure
19. All similar devices must be mounted at consistent elevations throughout the project (keypads at 60" AFF, motion detectors at 78" AFF, etc.)
20. See attached specifications for additional installation requirement
 - i. Door Detail
 - ii. Typical Stanchion Detail
 - iii. High/Low Stanchion Detail

B. Cable Installation

1. Contractor shall install cable in compliance with applicable codes and standards referenced within this document.
2. All outdoor cable must be rated for direct burial and for use in wet locations
3. All cabling shall be sized and rated for the application. Doubling of conductors to increase capacity shall not be permitted
4. Device cable runs will include a 10' service loop at each device location
5. All cable runs will include a 10' service loop at the head end location, service loop to be routed via cable management systems.
6. All cabling shall be labeled during pre-wire, utilizing a matrix or key for cable identification.
7. All cabling in cable trays, hooks, or bridal rings must be neatly bundled and tied with zip ties or velcro.
8. All cable entering security equipment room (Com Rm IDF, MDF) on cable management systems shall be neatly combed, bundled, and uniform. Where required, cable shall be installed within cable sleeve (mesh sock).
9. Where cable enters equipment enclosures
 - i. Cable jacket/sheathing shall be continuous from cable management system into enclosure. When removing cable jacket/sheathing, 2"-3" shall remain at entry point of enclosure; all cable shall be prepared in the same way, so as to provide a consistent result.
 - ii. All individual wire pairs (input circuits, output circuits, data connections, etc.) shall be braided/twisted.
10. All cabling within enclosures must be managed. Cable to be secured with zip ties affixed to "screw down" type saddles (stick on zip tie bases shall not be permitted). "Screw down" saddles must utilize machine screws (not sheet metal)

screws). Mounting holes must be drilled and tapped. Screws must not exceed ¼" in length

11. Plastic bushings or chase nipples must be utilized where cables penetrate enclosures or housings (per code)
12. All connections within Intrusion Detection System enclosure, Access Control System or other enclosures must be soldered and insulated with heat shrink (These connections include but are not limited to Tamper Switches, Battery Fail outputs, AC Fail outputs, etc.)
13. Where cables terminate to power supplies or external connections
 - i. Cable jacket/sheathing shall be continuous to equipment locations, jacket/sheathing shall be removed at the point where the cable transitions from the cable management to the equipment.
 - ii. All individual wire pairs (device power, lock power, aux power, etc.) shall be braided/twisted.
14. Where conductors are terminated to devices in the field
 - i. When terminating conductors on terminal strips, conductor should be stripped such that minimal or no exposed copper is visible beyond the terminal connection.
 - ii. Where conductor splicing is required for device connections, conductors shall be twisted, and terminated with gel filled crimp on connector (blue beans)
 - iii. Conductors and connections should be finished by neatly wrapping with electrical tape
15. Cable must be continuous from device location to terminating equipment. No field splicing shall be permitted, without prior written authorization.

C. Programming and Configuration

1. Contractor shall perform all necessary programming and configuration required to deliver a fully operational and functional system, consistent with other owner sites. To include:
 - i. Hardware configuration
 1. Input and Output module addressing
 2. Motion and Glass Breakage detector configuration
 3. Keypad configuration
 4. Network Devices
 - ii. Programming logic
 1. Contractor to perform all necessary Intrusion Detection System control panel, Intrepid Fence Detection, and Optex Redsan programming (based on existing customer template) necessary to provide the desired functionality

- a. Input to output interconnect programming
 - b. Intrusion alarm input programming
 - c. Key Switch zones for Alarm Status, Auto Arm, Valid Access Disarm
 - d. Alarm status, AC fail, battery fail, and communications fail outputs
 - e. Intrepid Fence Detection system parameters, calibration, and configuration
 - f. Optex Redscan system parameters, calibration, and configuration
- iii. Characters & Naming Requirements for Everbridge
- 1. Our PSIM, Everbridge has some very specific requirements which must be adhered to
 - a. No Illegal Characters
 - i. There are several characters which should never be used when naming devices, points or Cameras. These names are illegal to Everbridge and should not be used. These characters are:
 - ii. <
 - iii. >
 - iv. ‘
 - v. “
 - vi. &
 - b. No Duplicate Naming
 - i. Everbridge can't manage duplicate names. All naming for input or output points or cameras must be unique. For example if multiple slots if there are multiple camera slots which are identified as future:
 - 1. It causes Everbridge to fail out when attempting to upload the equipment.
 - 2. A simple solution is to use unique names, such as "Future 1", "Future 2" etc.
 - ii. Everbridge cannot tell if cameras or equipment are connected or not. If the ports are open and assigned, they will be imported.

2. The Intrusion Detection System control panel and keypad(s) must be programmed with text descriptions approved by the owner. All device descriptions must be consistent throughout the integrated system.

D. Testing

1. Contractor shall complete a full test of the Intrusion Detection System and all associated equipment and components to verify proper functionality, and resolve discrepancies before requesting to test with PSE Corporate Security.
2. Contractor shall perform all testing based on manufactures recommended test procedures, to include utilizing manufacturer recommended testing equipment and methods.
3. Where systems are monitored by owner or third part, all pre-testing shall include signal verification and accuracy with owner or third party.

E. Final Acceptance

1. Final acceptance testing may only be scheduled after inspection and pre-testing has be completed as previously defined.
2. Once vendor has completed security installation and a full test of security systems, final acceptance inspection and testing can be scheduled with owner:
 - i. A full on-site review of Intrusion Detection System by owner is required
 - ii. A full test of all Intrusion Detection System and integrated devices shall be conducted with owner. This may be performed by the vendor under supervision, or direction and remote monitoring by owner
 - iii. Contractor to provide all tools and equipment necessary to perform testing.
 - iv. All test results shall be documented with owner approved test report
3. Owner reserves the right to reject any portions of work that are found to be deficient or not in compliance with contract documents. In the event that work is rejected, contractor shall be required to correct deficiencies, then perform testing and acceptance procedures as necessary until work is approved.
4. Contractor shall create and provide termination schedules using the owner provided template identifying all devices and programming points per owner standard.
5. Project termination schedules shall include:
 - i. All input points
 - ii. All output points

- iii. All device terminations
- iv. All power supply terminations
- v. All equipment types including model & part numbers
- vi. All IP addresses
- vii. All configuration data

6. Contractor shall provide owner with project "As-Built", "As-Built" drawings shall:

- i. Be in AutoCAD format
- ii. Include all device locations
- iii. Devices shall be named and numbered as defined in termination schedules
 - 1. All device naming shall be consistent across all systems

F. Training

- 1. Contractor shall provide training on system operation, maintenance, and functionality as requested by owner. Training time not to exceed 8 hours.

G. Warranty

- 1. Contractor shall warrant assemblies, components, parts, materials, cabling, and labor against defects in materials and workmanship, for a period of 12 months from date of substantial completion.
- 2. Warranty service response shall not exceed 6 hours.
- 3. Repair or replacement of defects in materials or workmanship shall be completed at no charge to the owner during the warranty period.
- 4. Contractor shall correct system defects within 5 business days of receipt of request from owner.

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. Refer to Division 28, Section 280500, "Common Work Results for Electronic Safety and Security," for general requirements that apply to this section. Comply with all requirements of Section 280500.
- C. Refer to Division 28, Section 280513, "Conductors and Cables for Electronic Safety and Security."

1.02 DEFINITIONS

- A. LED: Light-emitting diode
- B. NICET: National Institute for Certification in Engineering Technologies

1.03 SYSTEM DESCRIPTION

- A. Noncoded addressable system with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission dedicated to fire alarm service only.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7. 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."

1.05 SUBMITTALS

- A. General:
 - 1. Comply with Division 28, Section 280500, "Common Work Results for Electronic Safety and Security."
 - 2. Submittals shall be approved by Authorities Having Jurisdiction prior to submitting them to Architect.
 - 3. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Licensed or certified by Authorities Having Jurisdiction.
- B. Product Data: Submit for each type of product indicated.
- C. Shop Drawings:
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include battery-size calculations.
 - 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - 6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

1.06 SEQUENCING AND SCHEDULING

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of fire alarm service.
 2. Do not proceed with interruption of fire alarm service without Owner's written permission.
 3. Provide a fire watch.
- B. Existing Fire Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- C. Equipment Removal: After acceptance of new fire alarm system, remove existing disconnected fire alarm equipment and wiring.

1.07 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with final project acceptance, provide software support for two years.
- C. Upgrade Service: Update software to latest version at project completion. Install and program software upgrades that become available within two years from the date of Substantial Completion. Upgrading software shall include the operating system. Upgrade shall include new or revised licenses for use of software. Provide 30 days notice to Owner to allow scheduling and access to system, and to allow Owner to upgrade computer equipment if necessary.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Edwards
 2. Notifier
 3. Simplex Grinnell

2.02 RACEWAYS

- A. Only devices and underground raceways have been shown on the drawings. The Contractor shall provide a complete, dedicated, design-built raceway system.
- B. Do not combine systems within the same raceways.
- C. Install all wiring in continuous metallic raceways.
- D. Provide metallic raceways for cables installed in walls, above inaccessible ceilings, exposed or subject to physical damage.

2.03 CABLE

- A. General: Provide according to manufacturer's requirements.
- B. Interior: Provide nonplenum-rated cabling, except cabling running between floors which shall be riser rated. Interior: Provide plenum-rated cabling in spaces used to handle environmental air, including ceiling plenums.
- C. Underground: Provide cable UL listed for direct burial and fire alarm service.

2.04 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. Verified automatic alarm operation of smoke detectors
 - 6. Automatic sprinkler system water flow
 - 7. Heat detectors in elevator shaft and pit
 - 8. Fire-extinguishing system operation
 - 9. Fire standpipe system
 - 10. Flame detectors.
- B. Fire alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Release fire and smoke doors held open by magnetic door holders.
 - 5. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 6. Record events in the system memory.
 - 7. Record events by the system printer.
 - 8. Unlock electric door locks in designated egress paths.
 - 9. Activate voice/alarm communication system.
 - 10. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 - 11. Activate emergency shutoffs for gas and fuel supplies.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 - 3. Elevator shunt-trip supervision.
- 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 primary power at fire alarm control unit.
 - 4. Ground or a single break in fire alarm control unit internal circuits.
 - 5. Abnormal ac voltage at fire alarm control unit.
 - 6. Break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at fire alarm control unit or annunciator.
 - 9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
 - 10. Fire-pump power failure, including a dead-phase or phase-reversal condition.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire alarm control unit and remote annunciators. Record the event on system printer.

2.05 FIRE ALARM CONTROL UNIT (PANEL)

- A. General Requirements for Fire alarm Control Unit:
 - 1. Field programmable, microprocessor based, modular, power limited design with electronic modules complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. 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, two lines of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
1. Initiating Device, Notification Appliance and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D and Style E.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 2, Style 5, Style 6 and Style 7.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 2. Initiating Device, Notification Appliance and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuits: Style A, Style B and Style C.
 - b. Notification Appliance Circuits: Style W, Style X and Style Y.
 - c. Signaling Line Circuits: Style 0.5, Style 1, Style 3, Style 3.5, Style 4 and Style 4.5.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 3. Serial Interfaces: Two RS-232 ports for printers.
- D. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire alarm control unit.
 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire alarm control unit indication and system reset if the alarm is not verified.
- E. Notification Appliance Circuit: Operation shall sound in a temporal tone pattern.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire alarm system.
- G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their 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 and print out the final adjusted values on system printer.
- H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory and trouble signals to a remote alarm station.
- I. Printout of Events: On receipt of signal, print alarm, supervisory and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

- J. Primary Power: 24-volt dc obtained from 120-volt ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals shall be powered by 24-volt dc source. Alarm current draw of entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- K. Secondary Power: 24-volt dc supply system with batteries, automatic battery charger and automatic transfer switch. Batteries shall be sealed and lead calcium type.
- L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm and trouble conditions.
- M. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.
 - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire alarm control unit.
 - 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 - 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

2.06 MANUAL PULL STATIONS

- A. General Requirements for Manual Fire alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, 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.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.07 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268, operating at 24-volt dc, nominal.
 - 2. Detectors shall be the four-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 analog-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 shall be selectable at fire alarm control unit for 15- or 20-degree F per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire alarm control unit to operate at 135- or 155-degree F.
 - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. The detector's 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.)
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. The detector's 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.
 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: Rated to interrupt fan motor-control circuit.
- D. Ionization Smoke Detector:
1. The detector's address shall be accessible from the 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.)

2.08 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135-degree F or a rate of rise that exceeds 15 degree F per minute unless otherwise indicated.
 - 1. 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.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190-degree F.
 - 1. 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.

2.09 NOTIFICATION APPLIANCES

- A. 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. 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.
- B. Horns: Electric-vibrating-polarized type, 24-volt dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971 with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum one-inch-high letters on the lens.
 - 1. Rated Light Output: 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
- D. Voice/Tone Notification Appliances:
 - 1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 - 2. High-Range Units: Rated 2 to 15 W.
 - 3. Low-Range Units: Rated 1 to 2 W.
 - 4. Matching Transformers: Tap range matched to acoustical environment of speaker location.
 - 5. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
 - 6. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

2.010 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 - 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - 3. Rating: 24-volt ac or dc.
 - 4. Rating: 120-volt ac.
- B. Material and Finish: Match door hardware.

2.011 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.
- 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.

2.012 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

2.013 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture 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, the 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. Transmitters 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.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address Zone of the trouble-initiating device.
 - 4. Loss of ac supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.014 SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire alarm system.

2.015 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of device.

2. Finish: Paint of color to match the protected device.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire alarm equipment.
- B. Equipment Mounting: Install fire alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.
- C. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.
 1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the supervising station.
 3. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- D. Smoke- or Heat-Detector Spacing:
 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than three feet from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- H. Audible Alarm-Indicating Devices: Install not less than six inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Provide flush-mounted weatherproof back boxes for exterior-mounted devices.
- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least six inches below the ceiling.
- J. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- K. Fire alarm Control Unit: Surface mounted with tops of cabinets not more than 72 inches above the finished floor.
- L. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.02 CONNECTIONS

- A. Coordination:
 1. Provide all connections to fire sprinkler tamper, flow and pressure switches as shown on the fire sprinkler shop drawings.
 2. Provide all required connections as shown on the elevator shop drawings.

3. Refer to civil drawings for locations of post indicator valves (PIV) and double-check valve assemblies.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than three feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 1. Door hardware connections as specified in Division 8 and as shown on the architectural drawings.
 2. Smoke dampers in air ducts of designated air-conditioning duct systems.
 3. Supervisory connections at valve supervisory switches.
 4. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 5. Supervisory connections at fire sprinkler flow switches.
 6. Supervisory connections at post indicator valve (PIV) switches.
 7. Supervisory connections at smoke damper end limit switches.
 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 9. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 10. Supervisory connections at fire-pump engine control panel.

3.03 IDENTIFICATION DEVICES

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26, Section 260553, "Identification."
- B. Install framed instructions in a location visible from fire alarm control unit.

3.04 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.

3.05 COMMISSIONING

- A. Field tests shall be witnessed by Authorities Having Jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 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 of Fire Alarm Systems" Chapter.
 - b. Comply with "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 "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 of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire alarm system will be considered defective if it does not pass tests and inspections.
- G. Annual Test and Inspection: One year after date of final acceptance, test fire alarm system complying with visual and testing inspection requirements in NFPA 72.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

3.07 AS-BUILT DRAWINGS

- A. Comply with Division 28, Section 280500, "Common Work Results for Electronic Safety and Security Systems."

3.08 SPARE PARTS

- A. Provide the following spare parts:

<u>Item</u>	<u>Quantity</u>
Addressable Sensor Bases	12
Addressable Photoelectric Head	12
Addressable Horn/Strobe	6
Duct Smoke Detector	4
Manual Station with Guard	4

- B. Spare devices shall include 75' of conduit and wiring as required for complete installation. Location of these units to be determined by the Owner's Representative at the site. The Contractor shall assume that these devices will be installed after all other work is completed. Installation shall occur on an accelerated (night/weekend) schedule. Unused units are to be turned over to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 EXTENT OF WORK IN THIS SECTION

- A. Preparing subgrades for foundations, slabs-on-grade, walks, pavements and walls.
- B. Excavating and backfilling for buildings, structures, and walls.
- C. Subbase course for concrete walks and pavements.
- D. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- E. Sawcutting, removal, and disposal of asphalt and concrete.
- F. Construct stormwater detention pond and pond wall.
- G. Coordinate with separate contractor obtained by owner for contaminated soils removal.
- H. Surcharge program in coordination with Geotechnical Consultant.
- I. Gas containment perimeter including impermeable liner and pipe penetrations.
- J. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Project Plans & Specifications, WSDOT Standard Specifications, City of Puyallup Standards for Public Works Engineering and Construction, and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.2 REFERENCE DOCUMENTS

- A. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction (also referred to as "Standard Specifications"), current edition
- B. City of Puyallup Standards for Public Works Engineering and Construction Manual, current edition
- C. Geotechnical Report, PSE Operational Training Center, Terra Associates, Inc. August 28, 2023
- D. Detention Pond Retaining Wall Design, Terra Associates, Inc. December 21, 2023
- E. Heavy Duty Traffic Areas Memo, Terra Associates, Inc. April 6, 2023 & Revised June 8, 2023
- F. Response to City Comments, Terra Associates, Inc. August 28, 2023
- G. Critical Aquifer Recharge Evaluation, Terra Associates, Inc. April 6, 2023

1.3 RELATED SECTIONS:

- A. Clearing and Grubbing – 31 01 00
- B. Erosion and Sedimentation Control – 31 25 00
- C. Rigid Paving – 32 13 00
- D. Subdrainage – 33 46 00

1.4 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Warning tapes.
- B. Samples for Verification for the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches.
 - 2. Warning Tape: 12 inches long; of each color.

- C. Qualification Data: For qualified testing agency.
- D. The Contractor shall provide samples of materials proposed for import fill or backfill to the geotechnical consultant at least one week prior to anticipated use.
- E. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 1557.
- F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earthwork operations. Submit to architect before earthwork begins.
- G. Contractor shall fill in, apply and obtain General Right of Way Permit with City of Puyallup prior to any construction activities. In addition, Contractor shall provide City of Puyallup with required financial guarantee. Approved total financial guarantee amount was calculated using Establishment of Amount for Construction Guarantee form.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork in compliance with requirements of Geotechnical Report, Standard Specifications, City of Puyallup, and Standard Plans, unless otherwise specified.
- B. Testing and Inspection Service: The Owner will engage a professional geotechnical consultant to test site materials proposed for use in the work and for quality control testing during earthwork operations. The Contractor shall provide the geotechnical consultant a minimum of 48 hours notice and organize the work to allow the geotechnical consultant to perform the following minimum services:
 - 1. Field density tests of all earthwork as necessary to verify that compaction requirements are met. At the geotechnical consultant's sole discretion, the contractor shall supply a loaded dump truck for proof rolling subgrade as an alternative or additional test of subgrade bearing capacity.
 - 2. Contractor shall allow and coordinate inspection for all structural fill as required by the Engineer. For each strata of soil on which footings and slabs will be placed the geotechnical consultant shall verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison or each subgrade with related tested strata, when acceptable to Engineer.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthwork operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways. Coordinate and schedule all work with owner.
 - 3. No Contractor parking in City of Puyallup right-of-way.
- B. Utility Locator Service: Notify "Call Before You Dig," 1-800-424-5555, for area where Project is located before beginning earthwork operations.
- C. Notify Utility Companies including but not limited to Puget Sound Energy (gas and electric), Comcast, Century Link, Zayo, City of Puyallup (Water and Sewer) and Architect, Owner's Representative and Geotechnical Engineer 48 hours before excavation to verify utility locations.

- D. Pothole or use other appropriate means to locate existing underground utilities in areas of work prior to excavation. If utilities are not found in the locations marked by the utility company, contact the appropriate utility company for verification of location prior to continuing with excavation. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
- E. Should unmapped, or incorrectly surveyed piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- F. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
- G. Existing subsurface conditions were investigated by the geotechnical consultant. The Contractor is responsible for reading the Geotechnical Report and understanding the site conditions as described in this report. Subgrade preparation and treatment recommendations as described in this report will be required when the soil's moisture content is too high to meet the required compaction criteria.
- H. Do not commence earthwork operations until temporary erosion and sedimentation control measures are in place.
- I. The following practices are prohibited outside construction fence:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Erection of sheds or structures.
 - 4. Impoundment of water.
 - 5. Excavation or other digging unless otherwise indicated.
 - 6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated

PART 2 – MATERIALS

2.1 GENERAL

- A. All materials used for subgrade, trench backfill or other site fill shall be free of debris, roots, wood, scrap material, vegetation, refuse, organic materials, frozen, deleterious or objectionable materials.

2.2 MATERIALS: Shall meet the requirements of the following Sections of the WSDOT Standard Specifications.

- A. Gravel Backfill for Walls 9.03.12(2)
- B. Gravel Backfill for Drains 9.03.12(4)
- C. Gravel Borrow Section 9-03.14(1) with the additional requirements that:
 - 1. Not more than 75% of the material passes the standard U.S. #4 sieve.
 - 2. The percent passing the U.S. No. 200 sieve shall be limited to 5 percent based on that fraction of the soil passing the #4 sieve.
- D. Building Slab Drainage Course:
Capillary break material shall consist of ¾-inch clean crushed rock, pea gravel, or Standard Specifications Section 9-03.1(4)C AASHTO Grading No. 67. The material shall contain less than 3 percent fines.

- E. Structural fill is defined as non-organic predominantly granular soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 95 percent of the modified Proctor maximum density using ASTM:D 1557 as the standard. Majority of native and existing fill soils observed at the site contain a sufficient percentage of fines (silt and clay size particles), which will make them difficult to re-compact as structural fill if they are too wet or too dry. Ability to use the soils from site excavations as structural fill will depend upon their moisture content and weather conditions when site grading activities take place. Soils that are too wet to properly compact can be dried by aeration during dry weather conditions. Contractor must coordinate re-use of native or existing fill soil with project geotechnical consultant prior to use and monitoring during re-use.
- F. If grading activities are planned during wet winter months, or if they are initiated during the summer and extend into fall and winter, the contractor should be prepared to import wet weather structural fill meeting:

U.S. Standard Sieve Size	Percent Passing, by Wt.
6"	100
No. 4	75 maximum
#200	5 maximum (based on $\frac{3}{4}$ fraction)

- G. Gravel Backfill for Pipe Zone Bedding 9-03.12(3)
Except PVC and Polyethylene piping shall be pea gravel as specified.
- H. Bankrun Gravel Trench Backfill 9.03.19
- I. Pea Gravel Bedding shall be clean mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422:

U.S. Standard Sieve Size	Percent Passing, by Wt.
$\frac{3}{4}$ "	100
$\frac{3}{8}$ "	95-100
#8	0-10
#200	0-3

2.3 STRUCTURAL FILL

- A. Structural Fill shall be used for construction of subgrade for parking lots and buildings as necessary to develop the subgrade surface in pavement areas and all fill shall be compacted to at least 95 percent MDD.
- The work under this item consists of the performance of all work required to perform all hauling or materials, placing, compaction and all other incidentals required to construct subgrade as shown in the Contract Drawings or as directed by the Engineer. All work and materials required to complete this item, including soil amendments and/or operations to reduce subgrade moisture content, as required to prepare an approve subgrade considered incidental to this item.
 - The work under this item consists of the performance of all work required to perform all hauling of materials, placing, compaction and all other incidentals required to furnish and place Structural Fill as shown in the Contract Drawings or as directed by the Engineer. All work and materials required to complete this item as required to prepare an approved subgrade is considered incidental to this item. No structural fill shall be placed over newly constructed utility trenches until the utilities have been inspected and approved by the appropriate utility company.

3. After re-compaction of the exposed ground is tested and approved by geotechnical consultant, or a free-draining rock course is laid, structural fill may be placed to attain desired grades.

2.4 CRUSHED SURFACING

- A. Crushed Surfacing shall be used for construction of the base beneath pavement. Walkway surfacing is not included in this item.
- B. Crushed surfacing shall conform to Standard Specifications 9-03.9(3), Crushed Surfacing Top Course. The delivered material shall be incorporated into the work or placed into an approved aggregate stockpile.

2.5 UTILITY EXCAVATION

- A. All utility excavation and backfilling shall conform to the Standard Specifications. Suitable excavated materials from utility excavation may be used for backfill of trenches with Engineer's approval.
- B. The Contractor shall determine location of underground utilities and perform work in a manner which will avoid all possible damage. Hand excavate, as required. Any utilities, structures, or other facilities damaged due to work on this project shall be restored, equal to their original condition at the Contractor's expense.

2.6 QUARRY SPALLS

- A. Riprap, including quarry spalls shall conform to Section 9-13.6 of the Standard Specifications.

2.7 CONTROL DENSITY FILL (CDF)

- A. Control density fill (CDF) shall conform to Section 2-09.3(1)E of the Standard Specifications. Place CDF at locations as shown on the plans. Controlled density fill, as approved by the geotechnical consultant, may be used, as a submitted substituted per section 01 33 00 in lieu of structural fill.

2.8 GEOTEXTILES

- A. The pavement section shall be underlain by a minimum thickness of structural fill. A layer of woven stabilization geotextile fabric with a grab tensile strength of 200 pounds (e.g. Mirafi 500X) may be needed to provide separation at the interface between the gravel base and the native subgrade soils as determined by the Geotechnical Engineer. Geotextile properties shall conform to WSDTOT Standard Specs 9-33.2(1) Tables 1 through 3.
- B. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288. Geotextile properties shall conform to WSDTOT Standard Specs 9-33.2(1) Tables 1 through 3.

2.9 BLOCK WALL

- A. Block wall to be StoneTerra precast concrete units or approved equal.

2.10 IMPERMEABLE LINER

- A. Impermeable liner to prevent gas migration shall be VaporBlock Plus or equal.

2.11 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3- EXECUTION

All work shall be performed in accordance with the Geotechnical Report.

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect and maintain erosion and sedimentation controls during earthwork operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. The portions of the site to be occupied by proposed foundation, floor slabs, pavement and/or sidewalks shall be prepared by removing any existing pavements, topsoil, existing fill, deleterious material and significant accumulations of organics from the area to be developed. Based on subsurface soil explorations, between 6 inches and 12 inches of top soil and loose, organic upper portions of the Undifferentiated Glacial Deposits shall be removed as part of the site stripping activities. Stripping depths (and therefore the volume of stripped materials) may be influenced by variations in the amount of topsoil encountered and the size/type of equipment used to remove the top soil. These variables should be considered when exporting these materials.

3.2 DEWATERING

- A. Ground water was encountered in exploratory borings. "Perched" ground water may be also encountered. Contractor is required to provide a dewatering plan and obtain jurisdictional approval.
- B. Protect subgrades from softening, undermining, washout, and damage by rain, snow or water accumulation. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 PROTECTION

- A. Barricade open excavations occurring as part of this work and post with warning lights. Pre-engineered approved trench excavation safety systems shall be used in conformance with applicable safety codes. Slope sides of excavations 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. Maintain sides and slopes of excavations in safe conditions until completion of backfilling.

- B. Maintain traffic control measures as necessary to ensure traffic safety during all construction activities. All construction signing and temporary pavement markings shall conform to the Manual for Uniform Traffic Control Devices (MUTCD). All traffic control measures shall be subject to the approval of the City of Puyallup Engineer.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- D. Adequately protect all work and materials. Damage caused by the work or by exposure to weather shall be repaired to the original condition by methods approved by the Engineer at no expense to the Owner.
- E. Protect persons and adjacent property from damage and discomfort caused by dust. Water as necessary to quell dust.
- F. Provide and maintain Stabilized Construction Exits as necessary to prevent dirt from being carried onto public roads. If dirt is tracked from the site the contractor shall clean the roadways and improve the Stabilized Construction Entrance as necessary to prevent dirt tracking from the site.
- G. Protect undisturbed portions of the site and adjacent property from water runoff, erosion, and siltation. Implement all erosion and sedimentation control measures as shown in the Stormwater Pollution Prevention Plan.
- H. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- I. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and re-compact.
- J. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- K. A gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeters be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent shall be provided, unless provisions are included for collection and disposal of surface water adjacent to the structures.

3.4 MAINTENANCE OF CONSTRUCTION ACCESS AND STAGING AREA

- A. Furnish and place gravel base, crushed rock, or asphalt treated base as required to maintain free and easy access for vehicles during course of construction.

3.5 PUBLIC RIGHT-OF-WAY

- A. Work in public rights-of-way is to be done to the satisfaction of the applicable authorities. All work within the right-of-way site is under the jurisdiction of City of Puyallup Public Works.

3.6 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered.
- B. A topsoil layer shall be stripped beneath all building and pavement.

C. Depth of Excavation

1. Drawings and elevations shown govern contract quantities for building excavation.

D. Rock Defined: Any stone, boulder, or formation which cannot be removed or broken up using conventional D-8 caterpillar tractor, or equivalent, equipped with ripper teeth; or which cannot be removed or broken up using a conventional one-half cubic yard bucket and power backhoe without continuous drilling or jack hammering.

E. Subgrade

1. All top soil, loose soils and uncontrolled fill encountered near the surface shall be removed from below foundation and pavement areas. New foundations and pavements shall be placed on properly prepared, firm and unyielding native site soils or on properly placed and compacted Structural Fill placed above suitable inorganic, firm and unyielding native soils. Anticipate that approximately 6 to 12 inches of top soil will be removed as part of initial site stripping. It is possible that exposed subgrades will require remedial densification or additional overexcavation of unsuitable material to expose firm and unyielding soil conditions below foundation, floor slab, and pavement areas.

F. Top Soil Excavation

1. Prior to placement of any structural fill, the exposed subgrade under all areas to be occupied by soil-supported concrete slabs and foundations shall be re-compacted to a firm and unyielding condition and proof rolled with a loaded dump truck, large self-propelled vibrating roller, or equivalent piece of equipment applicable to the size of the excavation. The purpose of this effort is to identify possible loose or soft soil deposits and re-compact the soil exposed during site preparation and excavation activities. The silty nature of the near surface soil has an increased risk, especially during extended periods of wet weather, of becoming disturbed after initial site preparations.

Proof rolling should be carefully observed by Geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be over excavated to firm soil. Overexcavated areas should be backfilled with compacted granular material place in accordance with subsequent recommendations for structural fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, Geotechnical personnel shall observe subgrade conditions to determine if proof rolling is feasible.

G. Excess Excavation

1. Where excavation, through error or without specific instruction by the Owner, is carried to levels lower than those shown on drawings, the Contractor shall fill and compact to proper levels with structural fill within the load prism of all structures, or parking lots at the Contractor's sole expense.

H. Asphalt and Concrete Removal

1. All asphalt and concrete surfaces at utility trench locations shall be removed to a straight line by spading, sawing or other approved methods.
2. The Contractor shall exercise extreme care to confine his pavement cuts to the immediate trenching area. The Owner will allow removal up to 3 feet each side of the trench center line. Care shall be taken to prevent marring or scraping of the surface of the existing pavement by treaded excavation machinery or other construction equipment. If, in the opinion of the Engineer, damage, in any form, is done to pavement or other constructed feature outside the immediate trenching area as a result of the Contractor's work, such damage shall be repaired to the satisfaction of the Engineer, by the Contractor at his own expense. Failure to do so will result in the cost of repairs being withheld from moneys due to the Contractor. The Contractor will also be responsible for maintaining paved streets and driveways in serviceable condition until repaving operations are completed. The contractor may use crushed surfacing as a temporary patch surface for private pavement re-

pairs. Temporary repairs within the public right-of-way shall conform to City of Puyallup Public Works Standards.

3. Existing asphalt paving is 4 to 6 inches thick.
- I. Any excavation required to maintain positive drainage or to form drainage ditches or swales as shown on the plans or as directed by the Engineer will be considered incidental to the work. All work and materials required to maintain positive drainage is considered incidental to the work.
- J. Unless otherwise directed by the Engineer, or otherwise provided by the Specifications, all unsuitable excavated materials shall be disposed of at a Contractor furnished waste site. No additional payment will be allowed for disposal of surplus material.
- K. Use of explosives is not permitted.

3.7 EXCAVATION FOR STRUCTURES

- A. Do not disturb bottom of excavation. Excavate to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Structural Fill used to obtain final elevations for footings, soil-supported floor slabs, pavements, and/or sidewalks must be properly placed and compacted. In general, non-organic, predominantly granular soil may be used as Structural Fill provided the material is properly moisture conditioned prior to placement and compacted to at least 95 percent of the maximum dry density, as determined using test method ASTM D1557. Material containing topsoil, wood, trash, organic material, or construction debris will not be suitable for reuse as Structural Fill and should be properly disposed offsite or in nonstructural areas.
- C. Excavate 24" minimum depth below bottom of slabs and footings. Footings shall be installed on 24" minimum compacted structural fill extending one foot laterally from edge of footing.

3.8 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. The pavement subgrade shall be re-compacted with a large self-propelled roller a firm and unyielding condition. Fill or backfill shall be compacted to at least 95 percent of the MDD in accordance with ASTM D1557.
- C. See Paragraph 2.2c for fill material.

3.9 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 1. For drain and underdrain pipes, trench width = I.D. + 12-inches.
 2. For pipes 15-inches and under, trench width = I.D. + 30 -inches.
 3. For pipes 18-inches and over, trench width = (1.5 x I.D.) + 18-inches.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.10 SURCHARGE PROGRAM

- A. Surcharge program to be in accordance with Project Documents, Geotechnical Report and supporting documents.
- B. Contractor must coordinate surcharge program with geotechnical consultant and surveyor for appropriate monitoring.

3.11 FOUNDATION

- A. Interior concrete slab-on-grade floors shall be underlain by a minimum of 4 inches of compacted, clean, coarse sand or fine gravel that has less than 3 percent passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No 4 sieve). The purpose of this layer is to provide uniform support for the slab, provide a capillary break, and act as a drainage layer. Material conforming to Washington State Department of Transportation Standard Specification 9-03.1(4)C, "AASHTO Grading No. 67".
- B. A continuous impermeable membrane of 10- to 15-mil polyethylene sheeting with tape sealed joints should be installed below the slab. A 2 inch thick layer of sand shall be placed over the membrane.
- C. A minimum of 24 inches of structural fill shall be placed under the capillary break material and beneath footings. Base fill material shall extend a distance past each edge of the base of the footing equal to the depth of structural fill placed below the footing.

3.12 SUBGRADE INSPECTION

- A. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.
- F. If earthwork takes place during freezing conditions, all exposed subgrades shall be allowed to thaw and then be re-compacted prior to placing subsequent lifts of structural fill or foundation components. Alternatively, the frozen material can be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill or foundation components. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.
- G. After stripping, planned excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer, the upper 12 inches of exposed ground in areas to receive fill should be re-compacted to a firm and unyielding condition as determined by the geotechnical consultant.

3.13 UNAUTHORIZED EXCAVATION

- A. Unauthorized excavations consist of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.
- B. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.14 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover all stockpiles to prevent windblown dust and to provide erosion protection in rainy season. Place erosion control measures to protect against erosion and transport of sediment. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.15 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash, debris, asphalt, concrete, organic matter, topsoil, uncompacted fill or other unsatisfactory soil materials, obstructions, or deleterious materials.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.16 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill voids with satisfactory soil while removing shoring and bracing.
- C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.17 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Place backfill and fill materials evenly adjacent to

structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against material uniformly around structure, piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

- B. All fill placed on the site shall be placed and compacted as structural fill. All structural fill material shall be free of organic matter, debris, and other deleterious material. The maximum particle size diameter shall be the lesser of either 5 inches or one half of the loose lift thickness.
- C. The capillary break shall be at least 6 inches thick beneath the building.
- D. The slab subgrade shall be compacted with a large self-propelled roller to at least 95 percent of the MDD in accordance with ASTM D1557.
- E. All building slabs on grade shall be underlain by a capillary break layer and supported on bedrock or structural fill.
- F. A vapor barrier shall be placed between the floor slab and the capillary break.

3.18 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to meet required compaction.

3.19 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place and compact fill in layers of not more than 8 inches loose depth for material to be compacted by mechanized compaction equipment, and not more than 6" to 8" inches loose depth for material compacted by hand-operated tampers. Place all fill in accordance with the Standard Specifications. Backfill excavation as promptly as work permits.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Any basement or utility areas should be backfilled with structural fill in accordance with compaction requirements below.
- D. Compact soil materials to not less than the following percentages of maximum density according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, walkways, utility trenches, and pavements, re-compact existing subgrade to a firm and unyielding condition and each layer of backfill or fill soil material to 95%.
 - 2. Under walkways, re-compact subgrade to a firm and unyielding condition and compact each layer of backfill or fill soil material at 92 percent.

3.20 GRADING

- A. All grading shall conform to Standard Specifications. Slope ground and provide temporary ditching as necessary to provide positive drainage during construction. Grade to uniform levels or slopes between points where grades are given. Contact the Architect if abrupt changes in level are encountered.

3.21 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material and maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
 4. Observe and perform backfill and footing subgrade special inspection.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- E. Testing agency will test compaction of soils in place according to ASTM D 1557 and ASTM 6938. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

3.22 BLOCK WALL

- A. Block wall to be constructed in accordance with Project Drawings and Detention Pond Retaining Wall Design Letter prepared by Terra Associates, Inc. and dated December 21, 2023.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus materials and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

PART 1 GENERAL

1.1 STANDARD SPECIFICATIONS

- A. All work, materials and equipment shall conform to Standard Specification 2-01, Clearing, Grubbing and Roadside Cleanup.

1.2 SUMMARY

- A. Extent of site clearing shall be limited to the minimum necessary to construct the improvements as shown on the drawings. Unless otherwise noted, trees and brush more than ten feet outside the proposed contouring of the site shall be protected from damage.
- B. Site clearing, grubbing, and cleanup work includes, but is not limited to:
 - 1. Installation of temporary erosion and sedimentation control measures, and temporary fencing in accordance with the Plans.
 - 2. Protection of existing landscaping and paving that is to remain within limits of construction.
 - 3. Removal of vegetation as necessary to construct the facilities.
 - 4. Clearing and grubbing and roadside cleanup.
 - 5. All incidental work required to prepare the site for earthwork operations.
 - 6. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Project Plans & Specifications, WSDOT Standard Specifications, City of Puyallup Standards for Public Works Engineering and Construction, and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.3 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

- A. Earthwork – 31 01 00

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-construction Conference: Conduct conference at site.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as shown on the plans.
- C. Utility Locator Service: Notify Call Before You Dig, 1-800-424-5555, for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- D. The following practices are prohibited outside construction fence:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.

- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. The Contractor shall at all times be responsible for the work site conditions including, without limitation, assuring that the construction area remains workable. The Contractor shall bear the cost for stabilizing the site, maintaining temporary erosion and sediment control measures, and following the Stormwater Pollution Prevention Plan such that site is workable and offsite discharges are in compliance with Department of Ecology requirements throughout the year regardless of delays in the project schedule or weather conditions.
- B. Best Management Practices per City of Puyallup and the Department of Ecology shall govern the procedures and installation requirements for temporary soil protection and stabilization, erosion controls, stormwater runoff controls, and sedimentation controls. See plans for minimum requirements.
- C. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- D. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- E. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. Existing trees and vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing. Provide protection for roots over 1-1/2" diameter cut during construction operations. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
- B. Repair or replace in kind trees and vegetation indicated to remain, which are damaged by construction operations.

3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Chip removed tree branches and dispose of off-site.
 - 5. Open burning is not allowed.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Topsoil shall be stockpiled on site as directed by the architect for use as Topsoil, Type B per Standard Specification 8-02.3(4)B.
- C. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
- D. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. Geotechnical Report, PSE Operational Training Center, Terra Associates, Inc. August 28, 2023

1.2 SUMMARY

- A. Section includes construction dewatering. Groundwater is expected to be encountered. Refer to Geotechnical Report and supporting information regarding specific depths to groundwater.
- B. Related Sections:
Earthwork – 31 01 00

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

- A. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Qualification Data: For qualified installer land surveyor and professional engineer.
- C. Field quality-control reports.
- D. Other Informational Submittals:
 - 1. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Preconstruction Conference: Conduct conference.
 - 1. Review methods and procedures related to dewatering including, but not limited to, the following:
 - a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
 - b. Geotechnical report.
 - c. Proposed site clearing and excavations.

- d. Existing utilities and subsurface conditions.
- e. Coordination for interruption, shutoff, capping, and continuation of utility services.
- f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- g. Testing and monitoring of dewatering system.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified on the plans during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing ditches, temporary sedimentation pond, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- E. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

- A. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Install and maintain temporary erosion and sedimentation control facilities through project completion including, but not limited to: construction entrance, silt fence, catch basin insert, plastic covering, check dams and erosion control blankets.
- B. Review, coordinate and manage SWPPP.
- C. Coordinate permittee transfer and manage DOE NPDES Permit (Construction Stormwater General Permit).

1.2 REFERENCE STANDARDS

- A. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, current edition.
- B. WSDOT Standard Plans, current edition.
- C. Geotechnical Report, PSE Operational Training Center, Terra Associates, Inc. August 28, 2023
- D. DOE NPDES Permit (Construction Stormwater General Permit).

1.3 JOB CONDITIONS: Submit a Temporary Erosion and Sedimentation Control and Spill Prevention Control and Countermeasures for approval prior to commencing work.

1.4 CERTIFIED EROSION AND SEDIMENTATION CONTROL LEAD (CESCL)

- A. The CESCL shall be identified by the Contractor at the preconstruction meeting. The CESCL shall have, for the life of the contract, a current Certificate of Training in Construction Site Erosion and Sediment Control signed by the WSDOT Water Quality Program Manager or equal. The Certification of Training is valid for 3 years from the issue date on the certificate.
- B. The CESCL shall implement the Temporary Erosion and Sedimentation Control (TESC) and Spill Prevention Control and Countermeasures (SPCC) plans. Implementation of the TESC and SPCC plans shall include, but is not limited to:
 - 1. Installing, maintaining, inspecting and repairing all temporary erosion and spill control Best Management Practices (BMPs) included in the TESC and SPCC plans. All BMP's shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. All on-site erosion and sediment control measures shall be inspected at least once every seven days and within 24 hours after any storm event of greater than 0.5 inches within a 24-hour period. All spills shall be responded to as outlined in the SPCC Plan. Damaged or inadequate TESC measures shall be corrected within 24 hours of the inspection. A Temporary Erosion and Spill Control Report shall be prepared for each inspection and shall be included in the TESC and SPCC files. The inspection report shall include, but not be limited to:
 - a. When, where and how BMPs were installed, removed, or modified;
 - b. Repairs needed or made;
 - c. Observations of BMP effectiveness and proper placement;
 - 2. Preparing and maintaining a TESC and SPCC file on site that includes, but is not limited to:
 - a. TESC and SPCC file on site that includes, but is not limited to:
 - b. Stormwater site plan;
 - c. Temporary Erosion and Sediment Control (TESC) Plan;
 - d. Contractors addendum to the TESC;

- e. National Pollutant Discharge Elimination System construction permit (Notice of Intent);
- f. Grading permit;
- C. Upon request, submit the file to the Architect for review.

1.5 SUBMITTALS

- 1. Manufacturer's literature and data.
- 2. Shop Drawing (CAD).
- 3. Certificate of Training.
- 4. TESCP, SWPPP and SPCC Plans for review.
- 5. CESCL Certification

PART 2 MATERIALS

2.1 SILT FENCE

- A. Filter fabric material shall meet the following:
 - 1. AOS (ASTM D4751) = 50-100 sieve size (0.30-0.15 mm)
 - 2. Water Permittivity (ASTM D4491) = 0.02 sec-1 min.
 - 3. Grab Strength (ASTM D4632) = 100 lbs min.
 - 4. UV resistance (ASTM D4335) = 70% min.

2.2 CATCH BASIN INSERTS

- A. Provide catch basin inserts in accordance with DOE requirements. Insert shall be appropriately sized for the structure in which it is installed per the manufacturer's recommendation.

2.3 STABILIZED CONSTRUCTION ENTRANCE

- A. Geotextile fabric shall be woven polypropylene geotextile, Mirafi 500X or approved equivalent.
- B. Quarry spalls per WSDOT Section 9-13.6.

2.4 CHECK DAMS

- A. Rock for check dams shall be 2"-4" quarry spalls per WDOT Section 9-13.6.

2.5 PLASTIC SHEETING

- A. Shall be in accordance with WSDOT Section 9-14.5(3) for 6 mil clear plastic covering.

2.6 SAND BAGS

- A. Provide ½ to 1 cubic foot capacity sand bags constructed of UV stabilized synthetic woven material of sufficient strength to support the weight of the bag capacity in mineral aggregate.

2.7 EROSION CONTROL BLANKET

- A. Shall be in accordance with WSDOT Section 9-14.5(2) for biodegradable erosion control blanket.

2.8 SEDIMENT SETTLING

- A. Shall be Baker Tank or equal for sediment settling unless stormwater pond is used as a temporary sediment pond.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Construct erosion control ditch lining and temporary silt fences in accordance with Sections 2-12.3(4) and 8-01.3(9) of the Standard Specifications. Field adjust locations as necessary to prevent sediment laden water from being transported off site. Locations indicated on the drawings are schematic.
- B. Place rip-rap in accordance with Section 8-15.3(6) of the Standard Specifications.
- C. Furnish and place construction geotextile in accordance with the details shown in the Plans and in accordance with Section 2-12 of the Standard Specifications.
- D. Furnish and place riprap protection of the type specified at the locations and in conformity with the lines and dimensions shown in the Plans in accordance with Section 8-15 of the Standard Specifications.
- E. Clean and remove all debris and obstructions from existing culvert pipes, storm sewer pipes, catch basins, or other drainage features within the project limits in accordance with Section 7-07 of the Standard Specifications.
- F. Place rolled erosion control products in all exposed areas in accordance with Section 8-01.3(3).
- G. The Contractor shall hydroseed all exposed areas in accordance with Section 8-01.3(2)B.
- H. During the construction period the erosion control measures and facilities may need to be upgraded as needed for unexpected rain events and to ensure that sediment and sediment-laden water does not leave the site. The upgrading, addition and modification of erosion control measures is to be done at the expense of the Contractor.
- I. Phased clearing, grubbing and stripping of the site shall be utilized to minimize disturbance to soil and minimize erosion potential.
- J. Install Construction Entrances as shown on the plans. Provide 12" minimum geotextile overlap at each joint and extend 24" beyond limits of construction access. Place quarry spall material to compacted depth of 12 inches minimum. Obtain approval from Owner's representative to modify construction entrance locations. Modifications to construction entrance locations shall be at the expense of the Contractor.

3.2 CONSTRUCTION STORMWATER GENERAL PERMIT

- A. The Developer has obtained Permit coverage under the Construction Stormwater General Permit through the Department of Ecology. Following the Notice to Proceed, the Contractor shall file a Transfer of Coverage form (ECY 020-87a, revised 12/2014) with the Department of Ecology, and shall provide a copy to the Engineer. With this submittal, the Contractor shall take over responsibility as Operator/Permittee for this Project. As part of the transfer of responsibilities, the Contractor also shall take over responsibility for the preliminary SWPPP that has been submitted to City of Puyallup. The Contractor shall have full responsibility for modifying the SWPPP as necessary to address the Contractor's means and methods as well as to address site specific conditions that are noted during the Contractor's inspections. All work associated with the compliance for Construction Stormwater General Permit (NPDES Permit) and SWPPP shall be considered part of the contract. The Contractor shall provide the required source control measures, Best Management Practices and stormwater treatment measures

such that stormwater discharges from the site comply with the Construction Stormwater General Permit and City of Puyallup requirements.

- B. The Erosion Control facilities shown on the drawings are the minimum requirements to obtain permit coverage in City of Puyallup. The Contractor shall create their own erosion control plan and provide it to engineer for approval. The Contractor is responsible to update and modify the plan in accordance with the Construction Stormwater General Permit.
- C. The Contractor shall meet all conditions of the Construction Stormwater General Permit and is responsible for payment of all fines related to failure to comply. Maintenance, upgrades, modifications or additions to the erosion control facilities in order to be in compliance with the Construction Stormwater General Permit and City of Puyallup Standards are at the expense of the contractor.
- D. Coordinating, conducting and submitting the required City of Puyallup inspections, monitoring, testing and recording shall be the Contractor's responsibility.
- E. Coordinating, conducting and submitting the required Department of Ecology inspections, monitoring, testing and recording shall be the Contractor's responsibility.
- F. The Contractor shall be responsible for meeting the turbidity requirements per the NPDES Permit and City of Puyallup requirements. A Turbidity Monitoring Plan shall be the responsibility of the Contractor to maintain. The Contractor is responsible for obtaining baseline data and/or upstream data prior to clearing and grading or other site disturbance in accordance with NPDES Permit requirements. Additional measures may be required to achieve discharge requirements of less than 25 NTU. These measures shall be at no additional expense to the Owner.
- G. The proposed project shall will implement a turbidity monitoring program in compliance with the NPDES Permit. A qualified CESCL, retained by the Contractor, shall perform the turbidity measuring using an approved turbidity monitoring device. The person providing the turbidity monitoring shall be familiar with the monitoring equipment, and the regulations and requirements associated with the turbidity monitoring program regulated by Department of Ecology. Monitoring shall occur weekly between May 1 – September 30 and daily October 1 – April 30. The Contractor shall be responsible for coordinating the monitoring plan with the CESCL and to aide them in the testing as necessary. The CESCL shall record the monitoring results on the Turbidity Monitoring Data Sheet and shall provide a copy of the record to the Owner's Representative and the Contractor. The Contractor shall have these results posted immediately after tests are performed. The CESCL will provide monthly summaries (Discharge Monitoring Report) to the Contractor for signature and the Contractor is responsible for submitting the summaries to DOE and shall report any monitored turbidity exceeding 250 NTU to DOE within 24 hours including corrective actions that have been taken.
- H. If during construction, the monitoring reports show that the turbidity threshold of less than 25 NTU has been exceeded, the Contractor shall take immediate corrective action to bring the discharge within compliance. The Contractor shall pay for all additional testing required beyond the weekly testing to determine if the site is in compliance.
- I. The Contractor shall be responsible for meeting the pH requirements per the NPDES permit and City of Puyallup requirements. Additional measures may be required to achieve pH discharge requirements of between 6.5 and 8.5. These measures shall be at no additional expense to the Owner. Sampling and monitoring shall occur during the phase of construction when concrete pouring will be conducted until fully cured (3 weeks from pour).
- J. If during construction, the monitoring reports show that the pH threshold of greater than 8.5 has been exceeded, the Contractor shall take immediate corrective action to bring the threshold within compliance. The Contractor shall pay for all testing required beyond the weekly testing to determine if the site is in compliance.

- K. Upon completion of the project, the Contractor shall prepare and submit Notice of Termination documentation to the Department of Ecology to formally close the project.

3.3 DRAINAGE COLLECTION AND CONVEYANCE

- A. Surface runoff and discharge shall be controlled at all times during and following development. Under no circumstances shall the Contractor allow concentrated discharges over slopes.
- B. The plan locations of temporary interceptor swales are schematic. Field adjust, move, and reconstruct as necessary during construction to maintain drainage to sediment facilities and to allow construction of improvements to proceed. Provide rock check dams along interceptor swales at 25 feet on center.
- C. Provide additional sumps, pumps, culverts or swales beyond those indicated on plans as required to maintain unobstructed conveyance of surface flows to sediment traps and sediment storage facilities throughout grading operations.
- D. Additional collection structures shall be installed as necessitated by land clearing activities to ensure that sediment laden water does not enter the natural or public drainage system.

3.4 REMOVAL

- A. Remove stabilized construction entrance as quickly as possible following the conclusion of transport of bulk materials and demobilization of heavy equipment, with prior approval of the Owner's representative.
- B. Any process water or sediment laden water accumulated on-site at the completion of construction shall be trucked off-site and disposed at an approved dump site.
- C. Remove temporary silt fences at the direction of the Owner's Representative, but in no case prior to establishment of the Contract as Substantially Complete. The Owner reserves the right to take ownership and control of temporary siltation control facilities following thorough maintenance by the Contractor and immediately prior to acceptance of the Contract as Physically Complete.
- D. Complete site restoration as directed by the Owner's Representative as part of the removal operation.

END OF SECTION

PART 1 DESCRIPTION

1.01 WORK INCLUDES

- A. Traffic Control
- B. Crushed Surfacing Base Course
- C. Asphalt Concrete Pavement
- D. Furnish materials and apply pavement marking on asphalt surfaces.
- E. Furnish and install truncated domes as indicated.

1.02 RELATED SECTIONS

- A. Excavation and Fill – 31 01 00

1.03 REFERENCES

- A. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, current edition hereafter referenced as Standard Specifications.
- B. WSDOT Standard Plans, current edition.
- C. Manual on Uniform Traffic Control Devices, current edition.
- D. City of Puyallup Standards for Public Works Engineering and Construction Manual
- E. Geotechnical Report, PSE Operational Training Center, Terra Associates, Inc. August 28, 2023

1.04 SUBMITTALS

- A. Submit the following.
 - 1. Traffic Control Plan.
 - 2. Sieve analysis for Crushed Surfacing Base Course from WSDOT approved pit.
 - 3. 50-lb sample of Crushed Surfacing Base Course material.
 - 4. Pavement Marking Paint product information
 - 5. WSDOT General Permit for work on state highway.
 - 6. Phased paving plan coordinated with owner and architect.

1.05 REGULATORY REQUIREMENTS

- A. Contractor is required to schedule pre-construction meetings and follow all WSDOT and City of Puyallup procedures as necessary including submittals and inspections.
- B. 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.

PART 2 MATERIALS

2.01 MATERIALS

- A. Shall meet the requirements of the City of Puyallup and the following Sections of the Standard Specifications:
 - 1. Crushed Surfacing 9-03.9(3)
 - 2. Asphalt Cements 5-04.2

3. Signing 8-21.2

2.02 PAINT

- A. Paint shall be white or yellow traffic paint (or compound suitable for paved surfaces), for parking stalls and lane markings conforming to the requirements of WSDOT Section 8-22 and 9-34.2. Paint shall be lead free.
- B. Paint shall be delivered and stored in sealed containers that plainly show the designated name, formulation, or specification numbers, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be printed legibly at time of use. The paint shall be homogeneous, easily stirred to a smooth constancy, and shall show no hard settlement or other objectionable characteristics.

2.03 TRUNCATED DOMES

- A. Truncated domes shall be per WSDOT Specifications and Standard Plan F-45.10-00.

2.04 PLASTIC PAVEMENT MARKING

- A. Plastic pavement marking shall be per WSDOT Specifications 9-34.3(2).

2.04 JERSEY BARRIER

- A. Jersey barrier shall be per WSDOT Specifications and Standard Plan C-70.15-00.

PART 3 EXECUTION

3.01 TRAFFIC

- A. Furnish all personnel for flagging and for the setup and removal of all temporary traffic control devices and construction signs necessary to control traffic during construction operations. Temporary traffic control shall be provided by the Contractor in accordance with Section 1-10 of the Standard Specifications.
- B. Contractor shall prepare traffic control plans for all work along Todd Road NW, 7th Street NW and for the intersections with Valley Ave NW, 4th Street NW and Spencer Street N. Contractor shall submit for approval to City of Puyallup.

3.02 ASPHALT CONCRETE PAVING

- A. Verify that the existing subgrade for paving is in accordance with Section 2-06 of the Standard Specifications and prepared in accordance with Specification 31 23 00 – Excavation and Fill.
- B. Place crushed surfacing base course over the subgrade in conformity with the lines, grades, depth, and typical cross-sections shown in the Plans in accordance with Section 4-04 of the Standard Specifications.
- C. The Contractor shall place one or more courses of plant mixed asphalt concrete on a prepared base course in accordance with Section 5-04 of the Standard Specifications and in conformity with the lines, grades, thickness, and typical cross-sections shown in the Plans or established by the Engineer.
- D. Furnish and install permanent signing in accordance with the Plans and Section 8-21 of the Standard Specifications.
- E. Remove and replace defective work not conforming to the plans and specifications at no additional

cost to the Owner.

3.03 PAINT

- A. All surfaces to be marked shall be thoroughly cleaned before application of the paint. Dust, dirt and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of the methods as required. Rubber deposits, surface laitance, and other coating adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals or mechanical abrasion as directed.
- B. Paint shall be applied uniformly at a rate specified in WSDOT Section 8-22. All markings shall be protected from traffic until the paint is thoroughly dry. All markings shall present a clean cut, uniform, and workmanlike appearance. All marking which fail to have a uniform, satisfactory appearance shall be corrected by the Contractor at their expense.
- C. Paint Application:
 - 1. Apply pavement marking to clean, dry pavement surfaces and in accordance with manufacturer's recommendations.
 - 2. Application thickness shall be in accordance with WSDOT Section 8-22.3(3)F. A minimum of two applications of paint will be required to complete all paint markings.
 - 3. Apply paint evenly to the pavement surface to be coated at the rate of 105, plus or minus 5, square feet per gallon. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are 50 degrees F and rising and less than 95 degrees F. Maintain paint temperature within these same limits. Apply paint pneumatically with approved equipment.
 - 4. Provide guide lines and templates as necessary to control paint application. Take special precautions in marking letters and symbols.
 - 5. The top of pavement markings shall be smooth and uniform. Line ends shall be square and clean. Sharply outline edges of marking.
 - 6. The maximum drying time requirement of the paint specifications and manufactures recommendations shall be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic.
 - 7. Discontinue painting operations if there is a deficiency in drying of the marking, until cause of the slow drying is determined and corrected.
 - 8. Tolerances shall be in accordance with WSDOT Section 8-22.3(4).
- D. Striping width shall be 4-inches wide painted yellow or white as indicated on plans.
- E. Stripping on gravel areas shall be 4-inches wide yellow HDPE (60 mil) nailed to ground with 12-inch stakes. Stakes to be minimum 0.25 inch diameter galvanized with 0.75 inch minimum top.

3.04 TRUNCATED DOMES

- A. Install truncated domes in accordance with manufacturer's recommendations.

3.05 PLASTIC PAVEMENT MARKING

- A. Install plastic pavement marking be per WSDOT Specifications 9-34.3(2) and manufacturer's recommendations.

END OF SECTION

PART 1 GENERAL

1.1 EXTENT OF WORK IN THIS SECTION

- A. All Portland cement concrete cast in place paving for curbs, gutters, and sidewalks.
- B. Base preparation is specified in "Earthwork" section.
- C. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Standard Specifications and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

Earthwork – 31 01 00

1.3 SUBMITTALS

- A. Provide samples, manufacturer's product data, test reports, and materials certifications for concrete mix, joint fillers and sealers.
- B. Provide WSDOT submittals as necessary to comply with WSDOT General Permit.
- C. Phased paving plan for loading dock ramp. Allow 6 separate pours with 3 weeks of cure time between pours in order to ensure no disruption to existing working facility.

1.4 QUALITY ASSURANCE

Codes and Standards: Comply with Standard Specifications.

1.5 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities and conform to Traffic Control.
- B. Work in public rights-of-way is to be done to the satisfaction of the applicable authorities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All materials shall be in accordance with the Standard Specifications and City of Puyallup Public Works Standards.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with requirements of the Standard Specifications.

3.2 TESTING AND QUALITY CONTROL

- A. Line and grade subgrade and subsequent courses will be checked by the Owner for conformance to elevations and dimensions shown on the approved final design drawings and shall be within the tolerance of referenced Standard Specifications.
- B. Slump samples shall be taken by the Contractor from each batch or ready-mix truck load as soon as possible after mixing and shall be tested under direction of the Owner's testing agency in accordance with ASTM C-143. Concrete that does not pass the slump test shall be removed from the site.
- C. The Contractor shall take one sample from each 50 cubic yards of consecutively placed concrete for compressive testing in accordance with ASTM C31 and C39. Compressive tests will be performed by the Owner's testing agency. A minimum of four samples shall be taken daily. Concrete that fails the compressive test shall be removed from the site.

- D. Surface finish of completed sidewalks will be tested by the Owner and shall show no variation more than 1/4 inch from the lower edge of a 10 foot straight edge.
- E. At the request of the Engineer, the Contractor shall core drill pavement for concrete thickness tests as called for in the Standard Specifications. Core drilled holes shall be filled with concrete.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDES: All portland cement concrete walks, stairs, and curbs and gutters as shown on drawings.

1.2 RELATED SECTIONS

A. Rigid Paving – 32 16 00

1.3 REFERENCES

- A. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, current edition hereafter referenced as Standard Specifications.
- B. City of Puyallup Standards for Public Works Engineering and Construction, current edition.
- C. WSDOT Standard Plan, current edition.

1.4 SUBMITTALS: The Contractor shall provide tests in accordance with Sections 9-01.3 and 6-02 of the Standard Specifications.

PART 2 MATERIALS

2.1 FORMWORK: Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Coat forms with non-staining form release agent that will not discolor or deface surface of concrete.

2.2 CONCRETE AND REINFORCING

- A. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, AASHTO M 221 or ASTM A-185.
- B. Concrete Materials: Comply with requirements of applicable portions of Division-3 and standard specifications sections 8-14.2 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- C. Curbs and Gutters: Meeting requirements of Section 8.04 of the Standard Specifications and the Project Documents.
- D. Sidewalks: Meeting requirements of the Standard Specifications and the Project Documents.
- E. Ramps: Meeting requirements of the Standard Specifications and the Project Documents.

2.3 ACCESSORY MATERIALS

- A. Curing and Sealing Compound: AASHTO M 171 for sheet material, Section 9.23.2 for chlorinated rubber type curing compounds and AASHTO M182 Class 4 for Burlap cloth or ASTM C-309, Type 1, Class A.
- B. Expansion Joints: Comply with Section 9-04 of the Standard Specifications.
- C. Geotextile Filter Fabric: Woven Geotextile fabric as described in Section 02300 of these specifications.
- D. Gravel Base (Structural Fill): As described in Section 32-0050 of these specifications and Standard Specifications Section 9-03.10.

PART 3 INSTALLATION

3.1 PREPARATION

- A. Surface Preparation: Remove loose material from compacted subgrade surface immediately before placing concrete.
- B. Proof-roll prepared subgrade surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 CONCRETE WORK

- A. Form Construction: Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement. Check completed formwork for grade and alignment. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Exterior Concrete Stairs: Construct per details. Slope all treads to drain.
- C. Reinforcement: Locate, place and support reinforcement as specified in Section 9-07 of the Standard Specifications, unless otherwise indicated. Provide 6 x 6 W1.4 x W1.4 steel mesh for all slabs.
- D. Concrete Placement: Comply with requirements of Sections 5-05, 6-02, 8-04 & 8-14 of the Standard Specifications for mixing and placing concrete, and as herein specified.
 - 1. Do not place concrete until subgrade and forms have been checked for uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
 - 2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 - 3. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.
- E. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness by grooving top portion with a recommended cutting tool and finishing edges with a jointer. Provide at all walks as shown. 10'-0" maximum.
- F. Construction Joints: Place concrete joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints. Use standard metal keyway-section forms.

3.3 CONCRETE WORK

- A. Expansion Joints: Provide expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated, and as shown on the drawings.

Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

- B. Concrete Finishing: After striking-off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface. Tool joints in pattern shown on drawings. Tape edges of panels to provide smooth edge adjacent to joint with light broom finish.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, broom finish by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture.

- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

3.4 PROTECTION AND CLEANING

- A. Protect and cure finished concrete paving, complying with applicable requirements of Sections 5-05, 6-02, 8-04 & 8-14 of the Standard Specifications. Use curing and sealing compound or approved moist-curing methods.

Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

- B. Provide slope to drain for all slabs.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Special Provision includes providing Coarse Ground Wood Chip Mulch in all areas described on the Drawings.

1.2 SUBMITTALS

- A. One cubic foot sample.
- B. Product description and testing information confirming source material.

PART 2 PRODUCTS

2.1 COARSE GROUND WOOD CHIP MULCH

- A. Wood chip mulch shall be coarse ground waste by-product wood chips (approximately 1/2"-6" along the longest dimension) derived from the mechanical grinding or shredding of whole trees or portions of trees. Tree species shall be mixed hardwood and softwood species such as hemlock and alder. Mulch may contain ground or shredded wood, wood fiber, roots, root wads, branches, leaves, etc.
- B. Wood mulch shall be free from weeds, weed seed, deleterious materials, and foreign materials, resin, salts, or other compounds detrimental to plant life. Mulch containing any amount of cedar wood over 70% by volume is unacceptable. Submit sample for approval by the Engineer.
- C. No dyes or synthetic ingredients are allowed.

PART 3 EXECUTION

3.1 PREPARATION

- A. Do not install mulch until the finish grade has been approved by the Engineer.
- B. Prepare finish grade at all pavement and hardscape edges to accommodate installation of the full, compacted depth specified for Topsoil Type A and the full, compacted depth of the type of mulch specified for that area.
- C. Finished elevation of all mulches at pavement and hardscape edges shall be 1/2 inch below top of paved surface, as described on Drawings.

3.2 COARSE GROUND WOOD CHIP MULCH INSTALLATION

- A. Install mulch to a 4-inch compacted depth in all areas described on Drawings and herein. Mulch depth shall be a uniform depth and shall be graded per plan. All planting beds shall receive Coarse Ground Wood Chip Mulch. Review planting details for level of mulch relative to plant crowns.

3.3 MAINTENANCE

- A. Contractor shall be responsible to weed and maintain all mulched areas to be free of weeds and to assure a full design depth of mulch up to and at the time of Final Acceptance.
- B. Contractor shall replace, recompact, and regrade as necessary, mulch material disturbed by stormwater runoff, wind, vehicles, or animals up to and at the time of Final Acceptance.
- C. After placement, Contractor shall remove all mulch material spilled on all paving and hardscape surfaces, grassed areas, and other areas where mulch is not specified.
- D. Maintain all paving, hardscape surfaces, grassed areas, and other areas where mulch is not specified mulch free at all times up to and at the time of Final Acceptance.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This work includes but is not necessarily limited to the following:
 - 1. Furnish and install all labor, materials, and appurtenances necessary for complete installation of the chain link cantilever and sliding gate systems defined herein.
 - 2. Bidder designed and engineered post footings including stamped drawings.

1.2 RELATED WORK

- A. Divisions 26 - 28: Electrical requirements: controls and operators
- B. Divisions 03, 31 - 32: Structural and Civil requirements: Concrete Mix, Surveying, Clearing, Grubbing, Grading, and Pavements
- C. Section 11 14 00 Pedestrian Control Equipment, for turnstile pedestrian gates
- D. Section 32 31 00 Fences and Gates

1.3 SYSTEM DESCRIPTION

- A. The manufacturer shall supply the following, or equal: A total high security cantilever gate system of the Ameristar® TransPort Link® with barb-wire extension design. The system shall include all components (i.e., tracks, uprights, bracing, hardware, fittings, and fasteners) required.

1.4 QUALITY ASSURANCE

- A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.5 REFERENCES

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- C. ASTM B221 - Aluminum and Aluminum Alloy Extruded Bars, Shapes and Tubes
- D. ASTM D523 - Test Method for Specular Gloss.
- E. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- F. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- G. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- H. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- I. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- J. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.6 SUBMITTAL

- A. The manufacturer's submittal package shall be provided prior to installation which will include shop drawings, installation requirements, and specimen warranty.
- B. Electrical components and integration with security system. See 2.1 below and reference electrical drawings and specifications.
- C. Post footing, Concrete Mix, and post spacing shop drawings: Stamped engineered drawings by an Engineer licensed in the State of Washington. See project manual to reference Geotechnical information, and fence and gate manufacturers for wind load data.
- D. Fence and Gate Installer Qualification Statement.
- E. Drawings for coordination with Owner's Representative to show how high security gate max. openings are provided at bottom of gates relative to finished grades and pavements. This can be a plan with notes.

1.7 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

PART 2 MATERIALS

2.1 MANUFACTURER

- A. Chain link cantilever gates shall conform to the following, or equal: Ameristar TransPort Link gate system with barb-wire extension design, manufactured by Ameristar Perimeter Security USA Inc., in Tulsa, Oklahoma. <https://www.ameristarperimeter.com/>

2.2 MATERIAL

- A. The materials used for cantilever gate framing (uprights & diagonal bracing) shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort™ enclosed tracks shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.
- B. Material for gate in-fill shall be chain link fabric meeting the wire mesh material and size specified for corresponding chain link fence.
- C. Material for gate uprights and diagonal bracing shall be 2" square x 1/4" wall aluminum. The cross-sectional shape of the enclosed-track shall confirm to the manufacturers Fast-Trak™ design with as a single extrusion consisting of a 2" x 5" channeled support with integrated 2" x 2" enclosed-track raceway.
- D. Steel material for fence posts shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90. Material for gate support posts shall be 4" square x 11 Ga. tubing.
- E. Suspension Rollers for top and bottom tracks shall be used at each support post to track connection. Each truck assembly shall be capable of being adjusted vertically via threaded rod for fine-tune adjustment. Truck assembly shall be constructed in a way so that the primary housing for the truck rollers shall pivot via ball-bearing connection to threaded rod.

- F. Gate frame uprights and diagonal bracing shall be pre-fabricated and pre-punched to accept frame fasteners. Enclosed track shall be pre-punched to accept gate uprights. Posts shall be pre-cut to specified lengths.
- G. Top and bottom enclosed track extrusions shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Diagonal bracing shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Chain link fabric shall be attached to gate uprights with tension-bands.

2.3 VEHICULAR SLIDE GATE OPERATOR

- A. Basis of Design: HySecurity Slide Driver 40, 222EST <https://hysecurity.com/>
- B. The slide gate operator as provided by HySecurity shall open and close cantilever and sliding gates, to provide convenience and security. This model is adapted to function with most accessories including radio controls, electro-mechanical locks, single and three button control stations, digital keypads, coded cards, sensing loops, telephone entry systems, and revenue control equipment. The operator utilizes 115 Volt AC single phase power. Control voltage in each case is 5 Volt DC.
 - 1. Include all safety features and accessories, UL325 compliant.
 - 2. Power will be 3 phase either 208/230/460V 60Hz.
 - 3. Provide base extender, heater kit, snow brush and scraper kit, photo eyes, edge sensors, amber strobe beacon, edge transmitter 300 mhz multicode and receiver, loop detectors (10-30VAC 11 pin base), 1-exit loop and 2-reversing loops
 - 4. NO Substitutions.
- C. The gate operator includes an APeX Controller with integrated radio receiver, plug-in loop detector capability, surge protection, and easy to read labeling standard.
- D. Capacity:
 - 1. The gate operator shall be rated to operate a gate weighing minimally 1000 lbs or higher if necessary.
- E. The gate operator shall be UL 325 compliant for Class I, II, III, and IV.
- F. Design Criteria:
 - 1. Operation shall be by means of a ½ horsepower single phase instant reversing motor, transferring power to a four inch diameter pulley, to a right angle oil bath gear reducer using another four inch diameter pulley and V-belt. Power is then transferred through a sliding collar disconnect system to the output drive shaft equipped with a #40 drive sprocket and roller chain which attaches to the gate with heavy-duty gate attachment brackets. Intermediate chain supports with anti-catch design shall also be supplied.
 - 2. The operator shall open the gate at a rate of approximately 11 inches per second.
 - 3. The #40 chain shall be coated with "Armor Coat" corrosive resistant chain coating. Corrosive resistance exceeds nickel plating.
- G. Components:
 - 1. Standard mechanical components shall include as a minimum.
- H. 3/16 inch thick, weather resistant UV-stabilized polyethylene one piece cover which is fully removable and lockable.
- I. Heavy-duty, plated frame with mounting legs for pad mounting standard.
- J. Pedestal to raise operator from ground level and protect from high water.
- K. 20:1 right-angle oil bath gear reducer.

- L. Arctic package with immersion heater.
- M. One inch solid steel output drive shaft.
- N. Spring loaded manual disconnect.
- O. Steel "critter" plate to prevent entry of ground pests.
 - 1. Standard electrical components shall include as a minimum:
- P. ½ HP motor with thermal overload protection in 115 VAC single phase.
- Q. Solid state logic controls featuring 15 diagnostic L.E.D. indicators and auto-close timer (one second to 9 minutes).
- R. Inherent, fully adjustable motor over-current sensing to detect obstructions via precision 24 turn potentiometer, with separate adjustments for opening and closing directions.
- S. Controller housed in zinc plated control box with separate box provided for connection of field power.
- T. Power On/Off switch; 115 VAC duplex outlets included.
- U. Contacts for opening, closing, and reversing accessories, as well as contact and
- V. non-contact obstruction sensing devices. 24 VAC and 24 VDC available on terminal strip to power accessory devices, provided by non-circuit board mounted transformer with minimum 40VA rating.
- W. Four adjustable limits with precision snap-action type limit switches to control gate position, mounted inside a separate four switch limit box.
- X. Master/slave or stand-alone capable with dip switch selection. Three wire twisted pair shielded cable required.
 - 1. Optional accessories, contact, non-contact, and control devices:
- Y. Provide the following control devices: pushbuttons, radio controls, keypads, card readers, telephone entry systems, photoelectric sensors, vehicle detectors, proximity sensors, contact edges, flashing strobe lights, and intercom systems.
- Z. Factory Inspection and Testing
 - 1. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
 - 2. Manufacturer shall test all control inputs to ensure proper function.

2.4 FABRICATION

- A. Gate frame uprights and diagonal bracing shall be pre-fabricated and pre-punched to accept frame fasteners. Enclosed track shall be pre-punched to accept gate uprights. Posts shall be pre-cut to specified lengths.
- B. Top and bottom enclosed track extrusions shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Diagonal bracing shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Chain link fabric shall be attached to gate uprights with tension-bands.
- C. The manufactured gate components shall be hot-dipped galvanized.

PART 3 EXECUTION

3.1 PREPARATION

- A. All new installation shall be laid out by the contractor in accordance with the construction plans. Inspection: Installer must examine the installation location and advise the Contractor of any site conditions inconsistent with proper installation of the product. Gate must be installed on a level concrete pad.
- B. Inspection: Installer must examine the installation location and advise the Contractor of any site conditions inconsistent with proper installation of the product. Gate must be installed on a level concrete pad.

3.2 GATE INSTALLATION

- A. Cantilever support posts shall be set in concrete footers having a minimum depth per approved shop drawings. The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer.
- B. Gate to be installed per manufacturers gate installation instructions. Gate shall be installed in compliance with ASTM F2200 standards.

3.3 GATE INSTALLATION MAINTENANCE

- A. When cutting/drilling posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; et dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non- Ameristar parts or components will negate the manufactures' warranty.

3.4 GATE INSTALLATION

- A. Gate posts shall be spaced according to the manufacturers' drawings, depending on clear opening. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.
- B. Install post footings per approved footing submittal 1.6, C, this section.
- C. At completion of installation confirm operation is smooth and controls are working properly.
- D. Demonstrate and train Owner on gate controls and features.

3.5 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This work includes but is not necessarily limited to the following:
 - 1. Furnish and install fences and gates, and miscellaneous site construction items assembled and installed with all hardware, as described in the Contract Documents.
 - 2. Bidder designed and engineered post footings including stamped drawings.

1.2 RELATED WORK

- A. Section 11 14 00 Pedestrian Control Equipment, for turnstile pedestrian gates
- B. Section 32 31 00 Chain Link Cantilever Gate System
- C. Divisions 26 - 28: Electrical requirements: controls and operators
- D. Divisions 03, 31 - 32: Civil requirements: Concrete Mix, Surveying, Clearing, Grubbing, Grading, and Pavements

1.3 SUBMITTALS

- A. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware.
- B. Shop drawings: Site plan showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence and gates, details of attachments and footings.
- C. Drawings for coordination with Owner's Representative to show how high security fencing max. openings are provided at bottom of all fencing and gates relative to finished grades and pavements. This can be a plan with notes.
- D. Post footing and post spacing shop drawings: Stamped engineered drawings by an Engineer licensed in the State of Washington. See project manual to reference Geotechnical information, and fence and gate manufacturers for wind load data.
- E. Fence and Gate Installer Qualification Statement.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.
- C. Tolerances: Current published edition of ASTM specifications tolerances apply. ASTM specification tolerances supersede any conflicting tolerance

1.5 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion..
- B. Provide five year manufacturer warranty for all fencing components.

1.6 PROTECTION

- A. Protect all work installed under this section from any cause whatsoever, including subsequent construction activities and vandalism until final acceptance.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Posts, Rails, and Frames: Type 2 and 3 Fence: Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, HSLAS, Grade 50, with G90 (Z275) zinc coating.
- B. Type 1 Fence: Round steel pipe and rail: ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083.
- C. Wire Fabric: ASTM A392 zinc coated steel chain link fabric.
- D. Barbed Wire: Zinc-coated steel, complying with ASTM A121 Type Z Coating Class 1; 3 strands of 0.099 inch diameter wire, with 2-pointed barbs at 4 inches on center.
- E. Concrete: See Section 03 30 00 and approved footing drawing submittals.

2.2 COMPONENTS

- A. Line Posts: 2.38 inch diameter.
- B. Corner and Terminal Posts: 4.0 inch diameter.
- C. Gate Posts: 3.5 inch diameter.
- D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
- E. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
- F. Gate Frame: 2.38 inch diameter for welded fabrication.
- G. Type -1 Fence Fabric: 3/8 inch diamond mesh interwoven wire, 9 gauge, 0.1620 inch thick, top selvage twisted tight, bottom selvage twisted tight.
- H. Type -2 and 3 Fence Fabric: 2 inch diamond mesh interwoven wire, 6 gauge, 0.1620 inch thick, top selvage twisted tight, bottom selvage twisted tight.
- I. Tension wire: 6 gauge, 0.1620 inch thick steel, single strand.
- J. Tension Band: 1/4 inch thick steel.
- K. Tension Strap: 1/4 inch thick steel.
- L. Tie Wire: Aluminum alloy steel wire.

2.3 MANUAL GATES AND RELATED HARDWARE

- A. Hardware for Double Swinging Gates: 180 degree hinges, (3) for gates higher than 60 inches; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp.

2.4 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners, and fittings; steel.
- C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, vertical.

2.5 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 oz/sq ft.
- B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris and rough grading has been done.
- B. Site soil conditions, local frost depth, fence height and wind load may require larger diameter or deeper footings and modify fence post spacing. Install footings and fence post spacing per approved footing submittal 1.3, D, this section.

3.2 PREPARATION

- A. Removal: Obstructions or debris.
- B. Ground Preparation:
 - 1. Surveying, Clearing, Grubbing, and Grading per Civil.

3.3 INSTALLATION

- A. Install framework, fabric, accessories, and gates in accordance with ASTM F567.
- B. Top of post concrete footing to be crowned to shed water away from the post.
- C. Line posts installed at intervals not exceeding 10 ft. (3.05 m) on center, and per approved footing drawing submittals.
- D. Place fabric on outside of posts and rails.
- E. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- F. Line Post Footing Depth Below Finish Grade: ASTM F567, and per approved footing submittal 1.3, D, this section.
- G. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567, and per approved footing drawing submittals.
- H. Do not stretch fabric until concrete foundation has cured 28 days.
- I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- J. Maximum opening at the bottom of the fence shall be three-inch (3") maximum.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- M. Install support arms sloped outward and attach barbed wire; tension and secure.
- N. Do not attach the hinged side of gate to building wall; provide gate posts.
- O. Install hardware and gate with fabric type to match fence.
- P. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
- Q. Ground fence.
- R. Peen all bolts upon installation.
- S. Perform three random field inspections confirming proper installation.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.

- C. Do not infringe on adjacent property lines.

3.5 FIELD QUALITY CONTROL

- A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- B. Post Settings: Randomly inspect three locations against design for:
 - 1. Hole diameter.
 - 2. Hole depth.
 - 3. Hole spacing.
- C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of conformance against design.
- D. Barbed Wire: Randomly inspect three locations against design for:
 - 1. Spacing of barb wire.
- E. Gates: Inspect for level, plumb, and alignment.
- F. Workmanship: Verify neat installation free of defects.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. The work of this Section shall be to provide a complete and operable, underground, automatic irrigation system with complete and uniform water coverage as described in the Drawings and this Section.
- B. The items of work to be performed include, but are not limited to:
 - 1. Provide trenching and backfilling for piping/wiring.
 - 2. Provide and install irrigation sleeving.
 - 3. Provide and install pipe, sprinkler heads, fittings, valves, and valve boxes.
 - 4. Provide and install valve control wire.
 - 5. Provide and install controllers, backflow, and sensors and related cabinets.
 - 6. Guarantee, maintenance, protection, and system testing.
 - 7. All other related items required to complete the work in the best-accepted trade practices.

1.2 COORDINATION

- A. Coordinate work of this section with civil, mechanical, and electrical contractors.
- B. Prepare and provide construction records and equipment catalog information.
- C. Obtain and pay for all permits and approvals required by the local jurisdictional authorities for the full operation of the system.

1.3 REFERENCES

- A. ASTM B53 – Standard Specification for Brass Pipe and fittings
- B. ASTM D1785 – Standard Specification for Schedule 40 PVC Pipe
- C. ASTM D2241 – Standard Specification for PVC Plastic Pipe
- D. ASTM D2466 – Standard Specification for Schedule 40 PVC fittings
- E. ASTM 2466-78 – Schedule 80 PVC fittings
- F. ASTM D2564 – Standard Specification for PVC Solvent Cements
- G. ASTM D2855 – Standard Recommended Practice for making Solvent Cemented Joints with PVC Pipe and Fittings
- H. ASTM D3139 – Swing Joint Pipe and fittings
- I. ASTM F656 – Standard Specification for PVC Primers

1.4 QUALITY ASSURANCE

- A. Contractor must be a Washington State licensed irrigation contractor with a minimum of 5 years documented experience with design and installation of automatic irrigation systems of a similar nature.
- B. Provide at least one person who shall be present at all times during execution of this portion of the Work, and who is thoroughly familiar with the type of materials being installed and the manufacturer's recommend methods of installation, and who shall direct all work performed under this Section.
- C. Except where more stringent requirements are specified, conform to the "Uniform Plumbing Code" as adopted and modified by the State of Washington and all legally constituted

authorities having jurisdiction. If more restrictive than those specified herein, notify Owner's Representative prior to starting work.

- D. All materials and equipment in the system to be new and be brands and types as shown in the Drawings or as specified herein, or as accepted by the Owner's Representative.
- E. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves etc. that may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his-her work and plan accordingly. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation system, planting, and architectural features.

1.5 SYSTEM COVERAGE

- A. Provide full coverage in all planted areas per plan. Exercise professional judgment in selection, spacing and location of emitters. Zones, lawn areas, and differing sun exposures are to be valved separately (Full coverage is defined as minimum 100% minimum overlap coverage of all areas.) Irrigation heads shall be located and adjusted to avoid over-spray on paved surfaces.
- B. Contractor shall inform the Owner of any and all problems with pressure and/or flow to the point of connection

1.6 GUARANTEE

- A. The purpose of guarantee/warranty is to ensure that Owner receives irrigation materials of prime quality, installed, and maintained in thorough and careful manner.
- B. Contractor is responsible for providing guarantee/warranty of irrigation materials, equipment, and workmanship against defects for period of one (1) year from formal written acceptance by Owner's Representative. Fill and repair depressions. Restore landscape, utilities, structures, and site features damaged by settlement of irrigation trenches or excavations. Repair damage to premises caused by defective items. Make repairs within seven (7) days of notification from Owner's Representative.
- C. Line flushing is to be completed on an on-going basis as needed throughout the warranty period.
- D. Replace damaged items with new and identical materials, using methods specified in contract documents or applicable codes. Make replacements at no additional cost to contract price.
- E. Guarantee/warranty applies to originally installed materials and equipment, and replacements made during guarantee/warranty period.

1.7 SUBMITTALS

- A. As-Built dwgs as listed in Part 3 below
- B. Catalog Cuts: Manufacturer's description of all proposed materials.
- C. Make submittals to Owner's Representative for review prior to construction. Approval of plans and materials by Landscape Architect does not change the Contractor's responsibility of providing full coverage in all planting areas.
- D. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

1. Zone Map: Submit a laminated plan sized to fit inside the controller enclosure indicating by varying colors the area of coverage for each control valve.
2. Guide Manuals: Operations and Maintenance Manuals: It shall be the responsibility of the Contractor to identify any and all maintenance requirements that will affect proper function of the temporary irrigation system. Instructions for system weatherization are to be included. Maintenance tasks shall be submitted in writing to the Architect at time of substantial completion and shall identify special needs, time requirements, and duration of maintenance to the Owner.
3. Irrigation schedule: Submit 8.5 inches x 11 inches copies of an irrigation schedule. On the schedule, indicate the day(s) of the week each area is watered, and duration each area/zone is watered (in minutes) in order to sustain plant and lawn health and vigor.
4. Testing Certificates: Test water pressure at point of connection after installation of meter. Hydrostatic pressure test of mainline piping to automatic valves. Submit written results of test to Architect at project closeout.
5. Record Drawings: The Contractor shall maintain a current record of all pipe and equipment placement and shall record any variations approved by the Architect. Upon completion of the system and prior to release of final payment, the Contractor shall provide the Owner with a neat and legible record drawing of the completed system (reproducible bond or Mylar only). Any pipe not installed in accordance with the plans as originally contracted shall be sufficiently dimensioned to a permanent structure for location after burial. Record drawings shall be updated DAILY.
6. Preventative Maintenance Plan: Preventive maintenance plan consists of a checklist of tasks that are performed at manufacturer-recommended intervals, to sustain the performance of the irrigation system.

1.8 SUBSTITUTIONS

- A. Substitutions to the equipment specified will be permitted only with the express written approval of the Landscape Architect or Owner's Representative and when the substituted item is equal or better in quality than the item originally specified. The final determination for equal rests with the Landscape Architect or Owner's Representative.

1.9 FLUSHING AND TESTING

- A. Schedule testing with Owner's Representative a minimum of three (3) days in advance of testing.
- B. Provide clean, clear water, pumps, labor, fittings, and equipment necessary to conduct line flushing and testing procedures.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Use all means necessary to protect irrigation system materials from damage, theft, and vandalism before, during, and after installation.
- C. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Owner's Representative, and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS – GENERAL

- A. Provide and install specified equipment and materials, delivered new to the site in unopened containers and confirmed to be without flaws or defects.
- B. Rainbird products are Owner's preference.
 - 1. Rainbird contact:
Chris Padget, (760) 403-4019 mobile
Regional Sales Manager - Specification
California and Southwest Regions
Rain Bird Corporation
6991 East Southpoint Rd
Tucson, AZ 85756
www.rainbird.com

2.2 PIPE AND FITTINGS

- A. Schedule 40 conforming to dimensions and tolerances established by ASTM Standard D1785: UV radiation resistant.
- B. Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.
- C. PVC Schedule 80 nipples and PVC Schedule 40 or 80 threaded fittings for threaded pipe connections as specified on the drawings and details.
- D. Threaded joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by pipe fitting or valve manufacturer.
- E. PVC Pipe, General:
 - 1. Material used in the manufacture of the pipe shall be domestically produced rigid PVC 1120 compound, Type I Grade I, with Cell Classification of 12454 as defined in ASTM D-1784.
 - 2. Pipe shall continuously bear the National Sanitation Foundation seal of approval for potable water usage and comply with the following requirements for product marking ASTM D-2241, D-1785 and D-2665 as applicable. Markings shall include manufactures name, nominal pipe size; outsize diameter system, material designation code; applicable Standard thermoplastic pipe Dimension Ratio designation code (SDR number) or pipe schedule, and corresponding pressure rating in PSI for water at 73 degrees Fahrenheit.
 - 3. Belled-end pipe shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D-2672.
- F. PVC Mainline: ASTM D-1785, Schedule 40.
- G. PVC Lateral Line, Pressure-Rated Pipe, ASTM D-2241, SDR 21, 200 PSI minimum ASTM D-1785, Schedule 40.

H. PVC Nipples and Fittings:

1. PVC Socket Fittings, Schedule 40: ASTM D-2466; and Schedule 80: ASTM D 2467.
2. PVC Pipe Nipples: ASTM D-1785, PVC 1120 compound, schedule 80.
3. PVC Threaded Fittings, Schedule 80. ASTM D2464, pressure.
4. PVC Threaded Fittings, Schedule 40: ASTM D-2466, non-pressure.

I. PE Tubing Fittings:

1. All insert barbed fittings shall be constructed of molded, ultra-violet-resistant, brown, or black colored plastic having a nominal inside dimension (I.D.) of 0.54 inch. Each fitting shall have a minimum of two ridges or barbs per outlet. All fittings shall be of same manufacturer as drip tubing and shall be available in one of the following end configurations.
2. Barbed insert fittings
3. Male pipe threads (MPT) with barbed insert fittings; or
4. Female pipe threads (FPT) with barbed insert fittings.

J. Sleeves: PVC pipe under all paving, sized to accommodate required sizes and numbers of pipes and wires, 4-inch minimum diameter, in no case less than twice the diameter of the pipe being sleeved.

1. Schedule 40 PVC, ASTM D-1785 or Plastic Sewer Pipe ASTM D-3034, SDR-35, PVC conforming to ASTM D-1784, N.S.F. approved pipe.

K. Swing Joints

1. Swing joint nipples – Schedule 80 PVC
2. Prefabricated swing joints - Rain Bird, Lasco or Spears PVC swing joint rated to 315 psi.

L. Other pipes, tubes, and fittings

1. Steel Pipe: ASTM A-53, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
2. Steel Pipe Nipples: ASTM A-733, made of ASTM A-53, or ASTM A-106, Schedule 40, galvanized, seamless pipe with threaded ends.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
5. Cast-Iron Flanges: ASME B16.1, Class 125.
6. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
7. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
8. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
9. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
10. Brass Pipe: ASTM B584 Alloy C84400 Standard Specification for copper alloy sand casting for general applications,:
11. Brass Pipe Nipples: ASTM B-43, seamless red brass pipe with threaded ends.
12. Brass Pipe Fittings: ANSI B16.15 cast copper alloy threaded fittings.

13. Brass Unions: ANSI B16-15, Federal Specification WW-U-516 for Type III, Class A and Class B cast copper alloy threaded unions.

2.3 GENERAL-DUTY VALVES

- A. Double check valve assembly, see irrigation schedule
- B. Shut-off Valve (Point-of-Connection), see irrigation schedule
- C. Isolation Valve (Mainline as needed), see irrigation schedule
- D. Valves 2-inches and smaller shall be equipped with stainless steel tee handle and nut; and 2-1/2-inch valves shall be equipped with stainless steel lever and nut.
- E. Automatic Valves, see irrigation schedule

2.4 SPECIALITY VALVES

- A. Flow Sensor: see irrigation schedule. Flow sensor wires to be run in a dedicated conduit.

2.5 VALVE BOXES AND VAULTS

- A. Valve Boxes: HDPE plastic boxes. Carson Industries rectangular box with tee-style locking top and 6-inch extensions to facilitate required depth of installation where applicable. Lids shall be green unless otherwise noted.
 - 1. Electric valves shall be installed in jumbo boxes.
 - 2. Isolation valves shall be installed in standard boxes.
 - 3. Quick couplers shall be installed in 10-inch round valve boxes.
 - 4. Drain valves shall be installed in 5-1/4 inches round adjustable valve boxes.
 - 5. Grounding rods shall be installed in 7-inch round valve boxes with black covers.
 - 6. Flow meters shall be installed in standard valve boxes
 - 7. Air Release Valves, Air and Vacuum Valves, Combination Air Release and Air and Vacuum Release Valves shall be installed in jumbo boxes with black covers.
 - 8. Pull boxes and splice boxes shall be standard boxes with black covers.
 - 9. Combination Valve: shall be installed in a 24-inch x 24-inch x 24-inch deep.
 - 10. Water Hammer Arrestor: Shall be installed in a 24-inch x 24-inch x 24-inch deep.
- B. Valve Box and Vault Accessories
 - 1. Stainless steel 'penta' bolts for bolt-down covers.
 - 2. Drain Rock: 3/4-inch to 1/4-inch clean and washed pea gravel, no fines.
 - 3. Filter Fabric: Woven geotextile for use in separating drain rock from subgrade in valve box and vault installations while providing adequate drainage.
 - 4. Brick or Concrete Block Supports: (2)-4-inch by 8-inch by 4-inch bricks or (1) 8-inch by 8-inch by 4-inch concrete paver at each corner of valve box.

2.6 SPRINKLERS

- A. Spray Sprinkler Heads, Nozzles, see irrigation schedule

2.7 AUTOMATIC-CONTROL SYSTEM

- A. Control System: The control system assembly consists of a completely pre-assembled control system that is tested for operation and is housed within a weatherproof cabinet The

components are pre-wired in the cabinet, which is to be temporarily mounted on a vertical 10'x6"x6" PT treated post, buried 3' minimum in with concrete footing. Permanent mounting shall be per drawings and details. Provide 50-FT minimum coiled wire in jumbo box with black cover for future permanent vertical surface location. The only connections required are primary power, proper grounding, valve station wiring, and flow sensing. All conduits and wire runs are to be provided and installed by the Contractor.

- B. Controller: See irrigation schedule.
- C. Exterior Control Enclosures: NEMA Type 3R rated, UL listed, weather and vandal-resistant, louvered for ventilation, with 3-point locking system cover, removable backboard and two matching keys; include provision for grounding.
 - 1. Material: 100 percent stainless-steel sheet metal.
 - 2. Mounting: Post-mount as indicated.
 - 3. Post-Mounting Accessories: 12-gauge, galvanized steel slotted 'Uni-Strut' and mounting hardware recommended by enclosure manufacturer.
- D. Sensors:
 - 1. Flow Sensors: See irrigation schedule. Shall be able to detect leaks from 3/4 gpm to 200 gpm or more. Compatible with controller.
 - 2. Rain and Sensors: Rainbird Wired Rain Sensor compatible with controller.

2.8 GROUNDING RODS AND PLATES

- A. All ground rods shall be bare copper of 5/8" diameter or greater, and 9' length or greater
- B. All ground plates shall be 4 square feet, typically 4" by 96", as outlined in ASIC Earth Grounding Guideline 100-2002.

2.9 OTHER MATERIAL

- A. Identification Markers:
 - 1. Detectable Warning Tape: Minimum 3-inch wide, 5 mils thick inert plastic tape with continuous layer of aluminum foil encased in the plastic. Tape identification shall match the utility being marked on all mainline. 'Terra Tape' Detectable, or equal.
 - 2. Valve Identification Tags: Polyurethane tag with integral attachment neck and reinforced attachment hole. Tag shall be hot stamped alphanumeric lettering 1-1/8 inches in height. Christy (T. Christy Enterprises) or equal.
- B. Concrete for Thrust Blocking: All concrete for thrust blocks shall achieve minimum strength of 3000 PSI at 28 days.
- C. Drainage Backfill: Cleaned gravel or crushed stone, open graded from 1 inch to 1/2 inch minimum.
- D. Bedding Sand: Clean, crushed or naturally occurring river sand with no particle size larger than 1.4 inch, and no more than 6 percent passing the No. 200 sieve.
- E. Two Wire: Rainbird Wire or approved equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Locate and identify, with visible marking, existing underground utilities in the areas of work. Call Northwest Utility Notification Center (800) 424-5555. If utilities are to remain in place, provide adequate means of protection during excavation operations.
- B. Should uncharted piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner. The cost of repairing charted utilities shall be paid by the Contractor at no additional cost to the Owner.
- C. Protect buildings, equipment, utilities, sidewalks, paving, reference points, monuments, and markers on site. Take extreme caution when trenching at adjacent to aggregate base courses, sand-set unit pavers and around existing trees and their root systems. No root cutting is allowed without prior approval. Protect adjacent properties. Protect work by others. Replace or repair damaged items at no cost to the Owner and to the approval of the Owner's Representative.
- D. Coordinate with other trades affecting or affected by Work of this Section.

3.2 LAYOUT

- A. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.
- B. Layout to follow as closely as practicable the design as shown on the Drawings. Stake out locations of all proposed equipment for acceptance by Owner's Representative, prior to trenching.
- C. System shall meet minimum pressure at each quick coupler as shown on drawings. Notify Owner's Representative immediately if any modification of piping layout will be required to accomplish this. Do not proceed until layout has been verified in the field with the Owner's Representative.
- D. Follow pipe layout plan making modifications as necessary to avoid trenching through roots of existing trees or other obstructions. Take care in protecting all existing tree root zones.
- E. All valve boxes shall be located in shrub or ground cover beds. Mainline shall be run 24 inches from the edge of paving, or in lawn areas 24 inches from the edge of the adjacent shrub or groundcover bed.

3.3 TRENCHING

- A. Keep trenches free of debris, material, or obstructions that may damage pipe.
- B. Leave trench bottoms smooth so pipe will lay flat.
- C. Make trenches wide enough to allow 6 inches between parallel lines.
- D. Provide minimum cover over top of underground piping according to the following.
 - 1. Irrigation Mainline Piping: Minimum depth of 24 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
 - 2. Drain Piping: 18 inches.

3. Sleeves: 24 inches under paving; 36 inches under roads.
- E. Contact Owner's Representative for trench depth adjustments where utilities conflict with irrigation trenching and pipe work.

3.4 INSTALLATION

A. General:

1. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Pipe Installations:

1. Do not use solvent cement on threaded joints. Wrap joints with minimum three wraps of Teflon tape.
2. Ensure that the inside of the pipe remains absolutely clean. Pipe ends shall be protected and not left open. Removal all foreign matter and dirt from inside of pipe before lowering into trench.
3. Lay pipe in accordance with standard practices, on solid foundation, uniformly sloped, substantially supported at all locations. "Snake" pipe slightly from side to side in trench to allow for expansion and contraction. Keep pipe markings visible.
4. PVC pipe joints to be solvent welded except as indicated on the Drawings. Cut pipes square, deburr, wipe from surface all saw chips, dust, dirt, moisture, and all foreign matter which may contaminate the cemented joint. Clean pipe with pipe cleaner to remove dirt, oil, and grease. Apply primer and solvent cement. Make joints in accordance with manufacturer's recommendations.
5. For 90-degree turns in mainline pipe, install two 45-degree fittings.
6. For non-standard angles and bends, install double fittings to avoid stressing the pipe or fittings.
7. Underground lines shall have a minimum horizontal and vertical clearance of 12 inches from other utility lines. For lines crossing at angles from 45 degrees to 90 degrees with each other, maintain 6-inch vertical clearance. No line shall be installed parallel to and directly over another line.
8. Provide 6 inches clearance between pipes. Do not stack pipe unless accepted by Owner's Representative to avoid tree roots.
9. Do no solvent welding of pipe when raining or when temperature is below 40 degrees Fahrenheit.
10. No fittings are to be closer than 6 inches apart.
11. Obtain tight, inseparable joints. Allow 24-hour curing before testing.
12. Install concrete thrust blocks at all changes of direction for mainline pipe 2-1/2 inch or greater in diameter. Place a minimum of 1 cubic foot of fully mixed concrete against the pipe and firm undisturbed soil in accordance with the pipe manufacturer's recommendations.
13. Remove material not suitable for backfill.

3.5 IRRIGATION SLEEVES

- #### **A. Install piping and wiring in sleeves under sidewalks, roadways, and parking lots.**
1. Install piping sleeves by boring or jacking under existing paving if possible.

- B. Install separate sleeves for irrigation lines and control wires under pavement prior to placing pavement materials wherever possible.
- C. Extend sleeves beyond pavement edge a minimum of 12 inches. Install sleeves with minimum 24 inches depth of cover to the top of the pipe.
- D. If length of required sleeve is greater than the length of the unit of pipe, solvent weld joints. Otherwise, all sleeves shall be of one continuous length of pipe.
- E. Tape ends of sleeve closed to keep soil out of the sleeve until irrigation lines and control wire are installed.
- F. Permanently attach a single length of 14-gauge trace wire above the entire length of the sleeve.
- G. Stake both ends of sleeves a readily visible stake extended 12 inches above-grade and below-grade to the bottom of the sleeve. Mark the above-grade portion of the stake with the words "Irrig. Sleeve." Remove stakes after sleeves are recorded on As-Built Drawings and after irrigation lines and control wires are installed and accepted by Owner's Representative.
- H. Drive an 18-inch rebar stake above sleeve end locations and wrap trace wire around stake.

3.6 VALVES

- A. General:
 - 1. Install valve boxes plumb to grade in a neat and uniform pattern per manufacturer's directions, and as shown on the Drawings.
 - 2. Coordinate valve box locations to avoid conflicts with plant locations.
 - 3. Install valve with 3 inch of clearance between top of valve and underside of valve box cover, and with 3 inches minimum clearance between the valve assembly and all sides of the box.
 - 4. Valve boxes shall not rest directly on pipe.
 - 5. Install 1 cubic foot of drain rock in the bottom of all valve boxes.
 - 6. Provide 1-inch clearance between bottom of valve assembly and top of drain rock.
 - 7. Thoroughly flush supply lines before installing valves.
- B. Master Valves:
 - 1. Thoroughly flush the mainline prior to installation of master valves. Install per manufacturer's directions and as shown on the Drawings. Place in specified vault with adequate clearance for servicing.
- C. Drain Valves:
 - 1. Install manual drain valves at low points along mainline to ensure complete gravity drainage of all mainlines. Provide required number of drain valves at no additional costs to the Owner.
 - 2. Install one drain valve in vault immediately downstream of point of connection.
 - 3. Pipe drain valves into approved drainage structures. Install drain piping with minimum of 18 inches of cover to top of pipe.

4. Drain Pocket: Where no drainage structures exist, excavate [1] cubic yard of soil material at discharge to drain valves. Backfill with drainage backfill to 12 inches below grade. Wrap drainage backfill with drainage fabric and backfill remainder with amended topsoil.
- D. Quick Coupling Valves:
 1. Provide schedule 80 PVC threaded nipples and fittings at quick coupler and ball valves.
 2. Install quick coupler valves as shown on landscape plan/drawing.
 3. Stabilize quick coupler nipple with one 24-inch quick coupler stabilizing wing. Attach stake to nipple with 1/2 -inch stainless steel worm drive hose clamps.
- E. Isolation Valves: Install isolation valves along mainline at all points-of-connection and upstream of all road and drive aisle crossings. Install plumb to grade in a neat and uniform pattern as per manufacturer's directions, and as shown on Drawings.
- F. Combination Air Release and Air and Vacuum Release Valves: Install at high points along the mainline necessary. Install below grade in vault.

3.7 FLUSHING

- A. Flush lines with water for a minimum of 5 minutes each zone prior to installation of quick coupler.
- B. Cap risers immediately after flushing.

3.8 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Where there is more than one controller on the Project, install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
- B. Install valve identification tags on each automatic control valve per manufacturer's recommendations.
- C. Install control wire numbering labels on each control wire to correspond with the valve station number at both ends of the control wires. Label spare and trace wires.
- D. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape over underground piping, during backfilling of trenches.

3.9 TRACE WIRE

- A. Place one strand of trace wire for all mainlines and leave end at point of connection location. Tape wire to top of mainline at no less than 36-inch intervals. All trace wire shall be spliced together with water-tight splice connectors.
- B. Run a 12-inch loop of trace wire into each valve box for each detection.

3.10 CONTROLLER GROUNDING A

- A. Exterior Controller
 1. Ground rods and plates shall be located at a minimum distance to assure that the two-wire path is outside the electrode sphere of influence for the grounding rod. For an 8' grounding rod, this means that the grounding rod must be connected at least 9' away from the two-wire path, at a right angle to the two-wire path.

2. All connections to grounding rods shall conform to ASIC Earth Grounding Guideline 100-2002 and shall consist of either a Cadweld type or screw clamp type of connection.
3. Any wire extensions required to connect from a grounding rod to a lightning arrestor or enclosure ground lug shall be bare copper and shall not have any sharp bends or kinks.
4. Controller to be grounded to a minimum resistance of 5 ohms.

B. Two Wire Path

1. Grounding along two-wire path every 500' maximum.
2. Ground two-wire path with LSP-1 Surge Protection or Field Decoders with surge protection, per manufacturers recommendations.

3.11 RAIN SENSOR

- A. Locate per drawings.
- B. Install per manufacturer's recommendations.

3.12 ELECTRICAL CONTROL WIRE AND ACCESSORIES

A. Two-wire Path:

1. Install two-wire path in sleeves under pavement areas, per details.
2. Maximum 6, two-wire paths from controller to site irrigation valves. Max run for two-wire path dependent on size of wire, do not exceed recommended maximum run as determined by wire manufacturer.

B. Decoder to Solenoid:

1. Wire runs between decoder output and solenoid shall be twisted wire when in excess of 20ft., to assist surge protection.
2. All splices must be contained in Direct Burial, waterproof, strain-relieving connectors, and installed in 10" round valve box.
3. Leave adequate slack in the wires at all splices and connections, to prevent contraction of the wire from damaging the connections, and to allow the splices to be removed from the valve box for service or installation. Coil wire slack neatly inside valve box.

C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install wires in separate sleeve under paved areas.

D. All splices must be contained in plastic 10" round valve box

E. Tape control wires together at 10' intervals.

F. Two-wire Path: 14AWG or 12AWG twisted pair, solid-core, color-coded red/blue pairs, enclosed in color-coded PE sleeve for in-ground identification. A different color PE sleeve is to be used for each two-wire path.

G. Insulated, single strand copper designed for 24-50 volts and UL approved as UF (Underground Feeder). UL and UF designations clearly marked on the insulation jacket of the wire. Copper conductor must meet or exceed ASTM B-3 specifications. Minimum gauge #14 UF direct burial (UL approved).

- H. All wire under pavement shall be enclosed in Sch 40 PVC conduit, independent from irrigation line sleeving.
- I. Wire shall be run at the same time as all piping, including future expansion points.

3.13 TWO-WIRE DECODERS

- A. Sensor Decoders: Rainbird Sensor Decoder.
 - 1. The Sensor Decoder shall have 2 input Ports
 - 2. The Sensor Decoder shall install into the two-wire path exactly like the ICD station output decoders, have a single red/blue pair for connection to the two-wire path.
- B. Valve Decoders: Rainbird decoders.
 - 1. Decoders are available in four different station output configurations and shall be selected and placed to minimize the wiring distance from the decoder to solenoid.
 - 2. 18 AWG wire or larger shall be used for all decoder-to-solenoid connections.
- C. Surge Protection: Rainbird Lighting Surge Protector
 - 1. The installer shall provide adequate earth ground (in compliance with practices as defined in American Society of Irrigation Consultants Earth Ground Guideline 100-2002, available at www.asic.org) and connect it to one of the decoder ground leads every 1000ft, or every 12th decoder, whichever distance is shorter.
 - 2. Grounding connections from decoder ground lead to grounding hardware shall be made by joining the 12AWG decoder ground wire with a 10AWG solid copper lead in an approved wire nut of appropriate size, inserted in a DBRY-6 waterproof direct burial connector, or with an approved wire clamp. Ground hardware shall extend at right angles from the two-wire red/blue path, and ground hardware shall be located at least 6ft. from two-wire path.

3.14 AUTOMATIC CONTROLLERS

- A. Provide and install per manufacturer's recommendations.
- B. Locate as shown on Drawings with approval of Owner's Representative.
- C. Complete controller connection to power supply in PVC conduit in accordance with local electrical codes with watertight fittings.
- D. Provide lightning protection (ground rod and wire) to nearest available ground location.

3.15 PRESSURE TESTING

- A. Notify the Owner's Representative five days before pressure testing.
- B. Backfill trenches sufficiently to ensure the stability of pipe, leaving joints exposed.
- C. Mainline and lateral lines may be tested at different times to allow isolation of either
- D. Supply certified pressure gauge and force pump during tests.
- E. Mainline Testing:
 - 1. Thoroughly flush piping before testing. Cap all fittings on mainline fill with water. Do not install remote control valves prior to mainline pressure testing.

2. Test mainlines to control valves at 120 PSI for 1 hour. If pressure loss occurs, inspect the entire system, make water-tight, and retest until no pressure loss occurs for the testing period.
 3. Pressure test must show no pressure loss for the specified period and be accepted by the Owner's Representative before backfilling of trenches will be allowed.
- F. Lateral Line Testing:
1. Thoroughly flush piping before testing. Cap all fittings on lateral lines and fill with water.
 2. Adjust bleed screws to open remote-control valves to allow a downstream pressure of 80 PSI. Use motorized air compressor as need to achieve pressure.
 3. Maintain 80 PSI pressure for 1 hour before and during observation by Owner's Representative without the aid of air compressor.
 4. Installation may not leak or lose pressure during test period.
 5. Detect and repair leaks and retest system until acceptance is granted.
 6. Thoroughly flush piping before testing.
- G. Provide written notes on pressure test results for Owner's Representative to sign off and submit to the Landscape Architect.

3.16 PROJECT RECORD (AS-BUILT) DRAWINGS

- A. Document field changes from original design and construction documents. Maintain on-site and separate from original construction documents, one complete set of documents labeled "Project Field Documents." Keep documents current. Do not permanently cover work until accurate "as-built" information is recorded.
- B. Record pipe network alterations on a daily basis. Record work that is installed differently than shown on construction documents. Record accurate reference dimensions, measured from at least two permanent reference points of each control zone kit assembly, each dripline zone boundary, each air relief valve assembly, each flush point assembly, and other dripline irrigation components enclosed within valve box.
- C. Record any changes and show the following information at a minimum:
1. water meter with size indicated
 2. size and length of water service line
 3. Hydraulic calculations listing static water pressure at POC and elevation, available flow, and pressure at first valve and last valve on system.
 4. point of connection (POC)
 5. back flow preventer
 6. valve locations with size and flow notated
 7. pipe layout (dimension)
 8. pipe sizes
 9. location of all sleeving (dimension)
 10. an itemized equipment list included in legend format on drawings.
- D. Obtain from Owner's Representative one set of reproducible Mylar drawings or CAD files prior to construction completion. Duplicate information contained on "Project Field Documents"

maintained on-site using technical drafting pen or AutoCAD. Label each sheet "Record Drawing".

- E. Provide "Record Drawings" to Owner's Representative. Completion of Record Drawings is required prior to final construction review at completion of irrigation system installation.

3.17 CLEANUP

- A. Keep premises clean and neat.
- B. Replace and/or repair plant material, structures, and installations by others, damaged by work of this section.
- C. Remove from site machinery, tools, excess materials, and rubbish upon completion of work.
- D. Repair settling trenches. Include complete restoration of plantings, mulch, grades, pavements, or other improvements.

3.18 SYSTEM DEMONSTRATION

- A. Instruct Owner's personnel in operation and maintenance of system including adjusting of sprinkler heads. Use operation and maintenance material as basis for demonstration.
- B. Schedule and perform a follow up visit one month from the date of final completion to verify full coverage and adjust. Owner's personnel to be in attendance.

3.19 SYSTEM WINTERIZATION

- A. Winterize irrigation system in fall following completion, or partial completion, of irrigation system construction. Complete winterization without pressurization, if possible. Start-up irrigation system in spring following completion, or partial completion, of irrigation system construction. Repair any damage caused in improper winterization at no additional cost to Owner. Coordinate winterization and start-up with landscape maintenance personnel.

3.20 JOINING MATERIALS

- A. Copper Pipe Solder:
- B. Silver solder, 45 percent silver, 15 percent copper, 16 percent zinc, 24 percent cadmium and solidus at 1125 degrees Fahrenheit, and liquids at 1145 degrees Fahrenheit; conforming to ASTM B206-52T and Federal Specification QQB 00655.
- C. Pipe Solvent Cement:
 - 1. PVC Solvent Cement ASTM D-2564.
 - 2. 'Weld-On' I.P.S. 705 for pipe sizes up to 2-inch diameter.
 - 3. 'Weld-On' I.P.S. 711 cement with P70 primer for pipe sizes 2-1/2 inches and larger.
- D. PVC Primer
 - 1. 'Weld-On' I.P.S. P-70, ASTM F-656
- E. PVC Cleaner:
 - 1. 'Weld-on' I.P.S. C-65, SCAQMD 1168, Low V.O.C.
- F. Field assembled Swing Joints:

1. For Rotors and Quick Couplers: Schedule 40 PVC fittings and Schedule 80 PVC nipples required. Size to match inlet size of quick coupler. Use is acceptable for all flows.
- G. Prefabricated Swing Joint Assemblies:
1. Class 315 PVC construction with leak-proof "O-ring" seals. Size to match inlet size of quick coupler. Use for flows greater than 4 gpm. Length as required. Lasco tripe swing joint or equal.
 2. Flexible PE swing pipe flexible riser assembly: Minimum 18-inch length polyethylene piping with black Marlex spiral barb fittings. Use for flows under 4 gpm. Rainbird swing assemblies or equal.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation and finish grading of planting areas.
2. Furnish and install trees, shrubs, and groundcovers per drawings and details.
3. Cleanup.
4. Maintenance.

1.2 REFERENCES

- A. STANDARDS FOR PLANT GRADING: *Washington State Department of Agriculture Standards for Nursery Stock* (WAC 16-432-010 to WAC 16-432-130) and the *AAN American Standard for Nursery Stock* (latest edition). If a conflict arises, the most stringent standard applies.
- B. Standards for plant identification: *Hortus Third* (latest edition), The Staff of the L. H. Bailey Hortorium. 1976. MacMillan Publishing Co., New York.

1.3 SUBMITTALS

- A. Liability Insurance: Provide written proof of liability insurance as will protect the Contractor and the Contracting Agency from claims which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by the Contractor or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.
- B. Plant Documentation:
1. Within 30 days after award of Contract, submit documentation that all specified plant materials have been ordered. Include size and root condition, supplier's names, addresses, and phone numbers.
 2. If substitutions are requested, submit written documentation of 3 unsuccessful inquiries made to find specified plant material.
 3. If not submitted substitution benefits will be forfeited except for larger plants at no additional cost to the Contracting Agency.
- C. Planting Installation Schedule.
- D. Watering Schedule: The Contractor shall submit a written "watering schedule" to the Engineer to ensure adequate watering (summer, fall, winter & spring) of all plant materials during the one-year Guarantee Period.
- E. Maintenance Task Outline: Submit a maintenance task outline before final payment which identifies routine and special needs, time requirements, and duration of maintenance work that will affect the proper and healthy maturation of the project during the one-year Guarantee Period.
- F. Commercial Fertilizer product information, including product label, fertilizer analysis, release rate, release mechanism, etc. plus intended source for fertilizer.

1.4 CONDITIONS AT SITE

- A. Before proceeding with any work, the Contractor shall inspect the site, carefully check all grades, and verify all dimensions and conditions affecting the work.
- B. Contractor shall report to the Engineer all deviation and/or conflicts between Drawings, Specifications and Site Conditions. Extra work arising from failure to do so shall be done at the Contractor's expense.

1.5 QUALIFICATIONS OF INSTALLER

- A. Installer Qualifications: The Landscape Contractor shall be licensed in the State of Washington, shall have a minimum of 3 years of experience and shall have completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
- B. Contractor must be familiar and comply with American Standard for Nursery Stock published by the American Association of Nurserymen.

1.6 UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. 'DIAL BEFORE YOU DIG' 1-800-424-5555
- B. Existing known utilities have been shown on the Survey Drawing. The Contractor shall be responsible for the protection of known utilities. Promptly notify the Engineer of any conflict between proposed work and obstruction(s). Failure to follow this procedure places upon the Contractor the responsibility and expense of making any and all repairs for damage from work.
- C. In the event that undisclosed rock, soils contaminated with toxic substances, hardpan, or underground construction work and/or obstructions are encountered in any plant excavation work to be done under this contract, alternate planting locations may be selected by the Engineer. Where alternate planting locations are not approved, the obstruction shall be removed to a depth of not less than one (1) foot below the bottom of roots when planting is properly set at the required grade or other solutions to the planting problem will be reviewed with the Engineer. The Contractor shall be paid for work required to solve the planting problem, such as, the removal of such rock, contaminated soils, hardpan, or underground obstruction encountered at a unit price basis and agreed upon by a Change Order prior to commencement of work.

1.7 PERMITS, LAWS AND REGULATIONS

- A. Secure all necessary permits and licenses; give all notices; and comply with all laws, codes, ordinances, rules, and regulations bearing on the conduct of work as drawn and specified. (Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Engineer unless otherwise specified). Notify the Engineer in writing if it is observed that drawings and specifications are in conflict with permits, laws, and regulations. Without notice, all costs arising from work contrary to such laws, ordinances, rules, and regulations are the Contractor's responsibility.
- B. The Contractor shall obtain and pay for all necessary permits and fees as required by Local Authority and prevailing ordinances and/or codes to fully complete the Work described herein.

1.8 PROTECTION OF WORK, PROPERTY AND PERSONS

- A. Comply with safety and health standards established by the Washington Industrial Safety Health Act (WISHA).
- B. Take all necessary precautions to protect work in progress, all property, persons, walks, curbs, pavement, and buildings from any damage that might be incurred arising from this Contract. Do not mix planting soil directly on paved surfaces. The Contractor shall pay for any damage at Contractor's expense.

1.9 UTILITIES STORAGE AND PARKING

- A. Arrange with the Engineer for temporary use of utilities, storage areas, and parking as may be required.
- B. Provide proper care and protection of all materials, equipment, etc., delivered at the site. Materials and equipment may be stored at the site subject to approval by the Engineer. Contractor is responsible for any damage to work or materials from the date of Agreement to date of final acceptance of Contract and shall make good without cost to the Engineer any damage or loss that may occur during this period.

1.10 SUBGRADE

- A. It shall be the Contractor's responsibility to verify the existence of a proper subgrade prior to beginning finish grading, including elevation, positive drainage, and decompaction per the soil restoration details.

1.11 FINISH GRADING

- A. The Contractor shall be responsible for establishing a finished grade as indicated on the plans. The depths of planting soils will vary with existing conditions and as shown on the Drawings and/or as specified within these Specifications.

1.12 CONDUCT OF WORK

- A. The Contractor shall continuously maintain a competent superintendent or foreman during the progress of the work, with the authority to act for the Contractor in all matters pertaining to the work. The Contractor shall give personal attention to the fulfillment of the Contract and shall keep the work under control. Subcontractors shall not be recognized, and all persons engaged in the work will be considered employees of the Contractor and their work shall be subject to the provisions of the Contract and Specifications.
- B. The Contractor shall confine operations to the working areas allotted by the Engineer for operations, including material and equipment storage.
- C. The Contractor shall progressively clean the work site of debris and rubbish as the work proceeds.

1.13 QUALITY ASSURANCE

- A. Plant Material:
 - 1. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of the current edition of ANSI Z 60.1 "American Standard for Nursery Stock."
 - 2. All plants shall be shipped with certificates of inspection, as required by law.
 - 3. Each tree and shrub shall bear a securely attached waterproof tag bearing legible designation of botanical and common name.
 - 4. Plant names shall conform to the latest edition of Standard Plant Names as adopted by the American Joint Committee of Horticulture Nomenclature.
- B. Fertilizer: Conform to most current Washington State Department of Agriculture and Federal Specifications pertaining to commercial fertilizer.
- C. Measurements: Measure trees and shrubs according to the current edition of ANSI Z 60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurement 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- D. Field quality control and inspections: All plant material shall be inspected and approved by the Owner's Representative prior to planting. The Contractor shall give 48 hours' notice to the Engineer when an inspection is desired. These field observations are required for City of Puyallup permit close-out.
- E. Any plant material installed as part of this Contract not found to be in a healthy thriving condition shall be immediately replaced with healthy plants as specified and planted at no cost or expense to the Contracting Agency and guaranteed until active healthy growth is evident.
- F. The Contractor shall maintain all plants through the construction period until final acceptance of the project.

- G. Contractor's Responsibility: The Contractor shall not be responsible for replacing plants destroyed by vehicles other than the Contractor's, or Acts of God, after final inspection/acceptance. Should replacement become necessary during a non-planting season, the Contractor may request the Engineer's permission to defer planting until the proper season. However, the Contractor shall immediately remove and dispose of dead/dying plants and their roots, backfill the planting pit flush with surrounding grade. Plants used for replacement shall be the same species/variety, size, quality as that originally specified in the Special Provisions and they shall be planted as specified.
- H. Upon completion of all planting and all other work required under this Contract, the Contractor shall request a pre-final inspection.
- I. The Contractor shall request a final inspection upon satisfactory completion of all punch list items and any other work required under this Contract. Final inspection and final acceptance of the work shall establish the beginning of the guarantee period.
- J. Take all necessary precautions to protect work in progress, all property, persons, walks, curbs.
- K. Delivery, Storage, and Handling
 - 1. Packaged Materials: Deliver packaged materials including, but not limited to fertilizers, pesticides, herbicides, and lime in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
 - 2. Store packaged materials in secure separate structure or vehicle.
 - 3. Fertilizer. Packaged in new unopened waterproof 50-pound bags, clearly labeled as to weight, manufacturer, and ad content.

1.14 GUARANTEE / MAINTENANCE

- A. Final acceptance will be certified in writing by the Engineer.
- B. Contractor shall guarantee all material and workmanship for a period of one year following final acceptance. Contractor is not responsible for damage resulting from excessive climatological conditions during the guarantee/warranty period or stolen or vandalized material after final acceptance. Guarantee period commences on date of acceptance of project or portions of project unless stated otherwise herein.
- C. Contractor has the right to enter upon the property for inspection and curative treatment of any materials needing such which are still under warranty during the entire warranty period. The Engineer is to be notified in advance of any corrective or curative treatment measures to arrange for convenient access to the area.
- D. Replacements made by the Contractor shall be completed during the periods set out as planting periods and shall be subject to the same conditions and shall be made in the same manner as specified for the original planting area and shall be done at no extra cost to the The Engineer.

1.15 SITE OBSERVATION TRIPS

- A. Request the Landscape Architect observation when the greatest amount of work can be reviewed. Schedule trips at least forty-eight (48) hours in advance unless an emergency requires a special trip to the site. Keep an adequately protected (vinyl-coated or in plastic wrap) complete and current set of plans and specifications with addenda, etc., on site at all times.

1.16 RECYCLING AND REUSE

- A. Recycle waste materials as convenient and appropriate to the work to reduce solid waste disposal. Dispose of vegetative waste, asphalt, concrete, metal, and glass at area recycling facilities.

PART 2 PRODUCTS

2.1 PLANTS

- A. Provide sizes, conditions, and quantities for plants shown on plant list and/or on plans. Determine exact quantities from planting plans if in conflict with plant list. Plants not conforming to standards and requirements listed may be rejected at any time. Determine quantities in grouped planting areas by specified distance on center ("o.c.") rather than estimated number of plants.

2.2 QUANTITIES AND SPECIES/VARIETIES

- A. Compliance with Types and Quantities: The Contractor shall plant the specified plant species, varieties, quantities as shown on the Plans, the plant list and as described herein.
- B. Plants shall be from stock well acclimated to prevailing conditions at the project and which have been consistently cultivated in these conditions.
- C. Plants shall be First Quality, fresh, well foliated, in prime condition when in leaf, exhibiting normal habit of growth, having all buds intact, viable. Plants shall be free from disease, injury, insects, insect eggs, root and other types of weevils, larva, all seeds, weed roots, and defects such as knots, sun scald, injuries, abrasions, disfigurement, and irregular growth arising from frost damage.
- D. Encircling Roots: The Contractor shall not deliver any tree with encircling roots to the job site. Shrubs with roots encircling the root mass more than once shall be rejected.
- E. Container grown plants are required to have sufficient growth to hold the earth intact when removed from containers but shall not be root bound.
- F. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune or top the plant before delivery, except as approved by The Engineer. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.
- G. Root Crowns: Root crowns shall be above ground level. Plants delivered to the site with root crowns buried in root ball or nursery ground level shall be inspected by the Engineer to determine if removing the soil above the root crown is sufficient a measure to gain acceptance of the plant. If not, then the Contractor shall remove the plant from the site and replace it with another acceptable plant.
- H. Handle ball and burlap stock by the root ball, never by the main stem. Trees found to be handled by the main stem shall be rejected by the Engineer.
- I. Dry and/or broken root balls shall be rejected. Ball and burlap stock shall be dug with firm, natural balls of earth of sufficient diameter to encompass fibrous and feeding root systems necessary for the full recovery of the plant, in accordance with American Standard for Nursery Stock. Root ends shall have been cleanly cut flush with the sides of the root ball.
- J. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
- K. If planting is delayed more than 6 hours after delivery, set planting materials in a nursery area as approved by the Engineer.
- L. Protect from weather and mechanical damage.
- M. Set balled stock into heal-in in nursery area. Healing-in includes covering root ball with topsoil mix, coarse ground wood mulch or compost. Contractor shall maintain a moist condition in the healing mix for the time plants are healed in.
- N. Do not remove container-grown stock from containers before time of planting.
- O. Water as often as necessary with a fine-mist spray to maintain root systems in a moist condition.

P. Abbreviations:

1. BR Bare Root
2. B&B Ball and Burlap
3. Cont. Container
4. Cal. Caliper
5. Ea. Each
6. Gal. Gallon
7. Ht. Height
8. L.S. Lump Sum
9. M.S.F. Thousand Square Feet
10. S.F. Square Feet

Q. A list of specified plants, quantities, condition, and sizes can be found on the plans.

R. Substitutions are strongly discouraged. No substitutions shall be made without written approval by the Engineer. Requests for substitutions must be accompanied by written proof, on supplier letterhead, from no less than three sources that any plant is not available.

2.3 COMMERCIAL FERTILIZER

A. Trees, and Shrubs:

1. Per manufacturer's instructions: EB Stone Organics "All Purpose Plant Food 5-5-5". Apply 3 lbs. per 100 sq ft and mix into the top 6-8" of soil at the time of planting. Or approved equal product.

B. Lawn:

1. Per manufacturer's instructions: EB Stone Organics "Lawn Food". Apply 10 lb. per 1,000 sq. ft every other month during the growing season during the one-year guarantee period.

2.4 LIME

1. Acid-neutralizing agent in the form of ground, free-flowing dolomitic lime. "Pacific Calcium, Inc." manufacturer or equal.

2.5 TREE STAKING AND GUYING MATERIALS

- A. Stakes: (2) 3" diameter poles (for trees less than 3" caliper) or 4" diameter poles (for trees 3" caliper or larger and for guying) Douglas Fir, construction grade.
- B. Tree Tie: ArborTie flat, woven polypropylene, or equal. Rounded weave and lock stitch. Made in the USA. Strength per manufacturers recommendations.

PART 3 EXECUTION

3.1 GENERAL

- A. All products and materials noted herein or on drawings are to be installed per manufacturer's recommendations and per each appropriate trade's highest standards.

3.2 SUBGRADES AND TOPSOIL AND MULCH DEPTHS

- A. Contractor to determine subgrade depths to accommodate soil preparation, amendments, and compaction as shown on plans and details.

3.3 FINISH GRADE

- A. Finish grade shall include all soil preparation, amendments, and mulch. Allowance shall be made for compaction and settlement to achieve specified finish grade. After settling, finish grade in all trees, shrub, and groundcover areas shall be 0.5" below top of walks, curbs and other hard surfaces.

3.4 LIME

- A. Install per recommendations of Washington State University Extension Service Annual Testing (509)335-2811.
- B. In lieu of test; apply at 50 lbs. per 1,000 square feet in all planting areas, or bring pH factor to 6.5, following manufacturer's recommendation for application.

3.5 NOTIFICATION OF ADVERSE CONDITIONS

- A. Contractor is responsible for any adverse drainage conditions that may affect plant growth unless the Engineer is immediately notified indicating possible problems. Reference

3.6 PLANT LAYOUT

- A. Review layout for all plantings (trees, shrubs, and groundcovers), pathways, etc., with the Engineer prior to installation. Adjust locations as directed by the Engineer as appropriate to design intent and site conditions. Installation prior to approval shall be at Contractor's risk.
- B. Immediately notify the Engineer, in writing, of any variances between plans and actual site conditions and wait for instructions before proceeding.
- C. Set all trees, shrubs, and groundcover according to spacing on plans. If site position is more than 2 feet from plan position, consult with the Engineer before proceeding.
- D. For large blocks of identical plant material, Contractor has the option of staking boundaries of planting rather than individual plant locations. Set outside row of large planting areas parallel with adjacent edges. Space inside plants as specified by plans and specifications.

3.7 PLANT PROTECTION

- A. Protect plantings against harm from wind and unusual weather. Special planting techniques, defoliating, wilt-proofing, or spray-misting may be required for unseasonable planting, prolonged periods of drought, etc. Protect planting areas when performing adjacent work. Install plant materials immediately after delivery and acceptance. Balled and burlapped plants that cannot be planted within one day after arrival are to be stored per accepted horticultural practice using mulch, sawdust, or other approved protection.

3.8 PLANTING

- A. Plant at any time materials are available and weather conditions are consistent with good horticultural practice.
- B. Soak dried root balls prior to planting, cleanly prune broken roots ½" or more in diameter, and vertically cut ball of rootbound stock with sharp knife in three locations.
- C. Plant at sufficient depth that top of root crown will be level with finish grade, including mulch. Place specified fertilizer evenly around root ball at manufacturer's recommended rate while backfilling.
- D. Remove string ties, straps and remove untreated burlap from top 1/3 of root ball upon completion of planting. Remove treated burlap entirely.
- E. All plants shall be planted in upright and vertical position.

3.9 TREE AND SHRUB PRUNING

- A. Prune existing and new plant material only under the direct supervision of the Engineer. Under no circumstances shall any plant material be pruned prior to delivery or after planting until directed by the Engineer.

3.10 STAKING AND GUYING

- A. Stake or guy all trees and shrubs which are or may become loosened or tipped from their proper position during the first growing season, per details. Fasten ties loosely to prevent girdling. Verify staking of trees with large root balls with Landscape Architect.

3.11 MULCHING

- A. Contact Landscape Architect for a semi-final inspection of planting area grades, soil depth and plant location. Mulch installed before this inspection, will be at Contractor's own risk.
- B. Place uniform 4" layer of mulch over cleaned and graded planting beds. Mulch types per plan.

3.12 FINAL CLEAN UP OPERATIONS

- A. Clean up and remove all deleterious material and debris, rake all planting areas to an even fine grade, and wash clean all hard surfaces for final inspection.
- B. Provide written record of dates and rates of fertilizer any applications.

3.13 FINAL ACCEPTANCE

- A. Final acceptance of all landscaping work described in this Specification section, with the exclusion of possible replacements of plant materials under the Guarantee, shall be made by the Engineer to determine one hundred (100) percent completion of the Contract work. This review shall be made upon written request to the Engineer no less than forty-eight (48) hours prior to the anticipated date of inspection. the Engineer shall be the final judge for all work under this section.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Furnish and install all topsoil, amendments, mixing, subgrade scarification, finish grading, and mulching required for the performance of this Section and for determining the volume of topsoil and amendments required to fulfill all Contract obligations.

1.2 REFERENCES

- A. Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13, WDOE Stormwater Management Manual for Western Washington, (hereinafter "Manual"), as amended herein, most recent published edition at time of Bid applies.
- B. ASTM D 1557: Method for Laboratory Compaction Characteristics of Soil using Modified Effort
- C. United States Department of Agriculture (USDA) Soil Texture System of Classification.

1.3 DEFINITIONS

- A. Percent Compaction: The required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material determined by ASTM D1557-78 test procedure.
- B. Subgrade: The soil surface below the first scarified layer of soil.
- C. Finished Grades: The final grade elevations indicated on the Grading Drawings.
- D. Acceptance: Wherever the terms "acceptance" or "accepted" are used herein, they mean acceptance of the Engineer in writing.

1.4 SITE CONDITIONS

- A. Environmental Protection:
 - 1. Soil Moisture Content: Work soil only when within 2% of optimum moisture content.
 - 2. Do not work soil when it is so dry that dust will form in air or that clods do not break readily.
 - 3. Moderate and control moisture content of soil to maintain soil moisture conditions within 2% of optimum moisture content.
 - 4. Perform work in such a manner as to prevent overworking and over-saturation.
 - 5. Protection includes any/all precautions necessary throughout the entire work area (including access drives/haul roads/staging areas) to control surface water, to protect soils and subgrades from heavy vehicle loads, and to achieve soil moisture levels capable of achieving specified compaction.
 - 6. Correct unsatisfactory conditions at no additional cost to the Engineer.

1.5 SUBMITTALS

- A. Soil Management Plan: Per BMP T5.13, prior to commencement of site work, submit an approved copy of the project Soil Management Plant with an attached implementation schedule.
- B. Submit the following for City of Puyallup permit close-out per BMP T5.13,
 - 1. Landscape professional to inspect soil delivery tickets for compost, topsoil, and mulches. Copies of such to be provided to the City. Tickets shall include delivery location, total quantities for each soil product and mulch, and product descriptions and sources.
- C. Soil Test
 - 1. Soil test results indicating the soil physical properties and organic content of the imported topsoil meets the requirements for BMP 5.13.
 - 2. All soil test results shall be submitted at least three (3) weeks prior to soil placement.
 - 3. All soil test results shall include Contractor's certification that all amendments comply with BMP 5.13.

4. All soil test results shall include the project name, testing facility, date of test, contact information for testing facility, and the information listed above.
- D. Compost: Submit one-gallon sample, source, and letter of certification from the supplier for approval prior to installation.
- E. Topsoil: Submit one-gallon sample, source, and letter of certification from the supplier for approval prior to installation.

1.6 QUALITY ASSURANCE

- A. Coordinate the following City of Puyallup requirements for permit
 1. Pre-Grading Inspection: In conjunction with the soil preparation specified herein, meet with the City of Puyallup to discuss, and verify requirements, schedule, and proposed soil preparation methods.
- B. Qualifications of Contractor: The Contractor shall be active and experienced in work of the type specified, and upon request by the Owner and/or Owner's Representative, be able to show evidence of successful completion of projects of similar scope.
- C. Regulatory Requirements: Obtain and pay for all permits and testing related to the work of this section

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate work of other trades specified elsewhere.
- B. Do not perform soil preparation work in areas subject to the subsequent work of other sections, unless approved otherwise.
- C. Perform work in accordance with the approved schedule specified in paragraph 1.5 SUBMITTALS. If a schedule delay greater than three days occurs, immediately revise and resubmit schedule to reflect each schedule delay.

1.8 MAINTENANCE

- A. Maintain the work as specified in this section until final acceptance of the work.

PART 2 PRODUCTS

2.1 GENERAL

- A. The Contractor shall be responsible for whatever soil additives may be required, as recommended by the testing laboratory, and to meet the requirements of the Manual.
- B. Costs for testing and soil amendments shall be borne by the Contractor. Submit laboratory tests of for the Engineer's review and compliance verification prior to use on project site.

2.2 TOPSOIL

- A. A mixture of the compost specified herein, and sand or sandy loam per USDA soil texture classification.
 1. Organic matter content, percent dry weight
 - (a) 10% planting beds
 - (b) 5% in turf areas
- B. Topsoil shall have the following gradation
 1. 100% 3/4" screen
 2. < 25% #200 sieve
- C. pH from 6.0 to 8.0 or matching the pH of the original undisturbed soil.
- D. The sand or sandy loam shall be free of weeds, deleterious materials, rocks, and debris.

2.3 COMPOST

- A. Compost products shall be the result of the biological degradation and transformation of organic materials under controlled conditions designed to promote aerobic decomposition. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation. Compost shall be mature. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.
- B. Compost production and quality shall comply with WAC 173-350.
- C. Compost products shall meet the following physical criteria:
 - 1. Compost material shall be tested in accordance with U.S. Composting Council Testing Methods for the Examination of Compost and Composting (TMECC) 02.02-B, "Sample Sieving for Aggregate Size Classification."
 - 2. Compost shall meet the following gradation:
 - (a) 100% Passing 1" Sieve.
 - (b) 90-100% Passing 5/8" Sieve.
 - (c) 75-100% Passing 1/4" Sieve.
 - 3. The pH shall be between 6.0 and 8.5.
 - 4. Physical contaminants, defined in WAC 173-350 (plastic, concrete, ceramics, metal, etc.) shall be less than 0.5 percent by weight as determined by U.S. Composting Council TMECC 03.08-A "Classification of Inerts by Sieve Size".
 - 5. The compost shall have an organic matter content of 35% to 65% by dry weight basis as determined by U.S. Composting Council TMECC 05.07A "Loss-On-Ignition Organic Matter Method (LOI)".
 - 6. Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 "Electrical Conductivity."
 - 7. Maturity shall be greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, "Germination and Root Elongation".
 - 8. Stability shall be 7-mg CO₂-C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B "Carbon Dioxide Evolution Rate".
 - 9. The compost product shall originate from organic feedstocks as defined in WAC 173-350 as "Wood waste", "Yard debris", "Post-consumer food waste", "Preconsumer animal-based wastes", and/or "Preconsumer vegetative waste". The Contractor shall provide a list of feedstock sources by percentage in the final compost product.
 - 10. The Engineer may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E "Solvita® Maturity Index." Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and Coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Subgrade:
 - 1. Verification: Verify that the subgrades have been graded within the tolerances specified, minus the compost amended soil and topsoil depth, of the grades shown on the grading Drawings.
 - 2. Where Site Preparation Plan & Details call for compost mixed with existing soil, adjust subgrade elevations accordingly.
 - 3. Aesthetic Acceptance: Verify that the Engineer has accepted the subgrade. Do not commence placement of topsoil materials nor disturb the subgrade until the subgrade has been accepted for aesthetic correctness.
 - 4. Notification of Discrepancies: Notify the Engineer in writing of any discrepancies.

3.2 SURVEY REQUIREMENTS

- A. Lines and Levels: Establish lines and levels, locate, and lay out by instrumentation and similar appropriate means for all planting area finish grades.
- B. General Staking: Provide a sufficient quantity of grade stakes as required to provide minimum depth layer of topsoil.

3.3 SOIL MANAGEMENT PLAN

- A. The Soil management Plan (SMP) will be submitted as part of site development building permit application, and will include the following:
 - 1. An 11" X 17" or larger site map indicating:
 - (a) Option 1. Areas where native soil and vegetation will be retained in place
 - (b) Option 2. Areas where topsoil or subsoil will be amended in place
 - (c) Option 3. Areas that will be stripped and stockpiled prior to grading for reapplication
 - (d) Option 4. Areas where imported topsoil will be applied.
 - B. Calculations for volumes of soil to be stockpiled, and amounts of amendment or topsoil to be imported to achieve specified minimum organic matter content.
 - C. Specified organic amendments and topsoil products to be used, with organic matter content and carbon to nitrogen documented by producer supplied copies of laboratory analyses to demonstrate that requirements will be achieved, and that compost meets WAC Chapter 173-350 Section 220 definition of "Composted Material").
 - D. IF CALCULATED AMENDMENT RATES ARE TO BE USED, site soils to be amended and compost must be characterized for the following properties:
 - 1. Soil:
 - (a) Bulk density
 - (b) organic matter content
 - 2. Compost:
 - (a) Bulk density
 - (b) organic matter content
 - (c) carbon to nitrogen ratio
 - (d) moisture content.
 - 3. Soil samples must be gathered following the distribution plan outlined in the Post-Construction Inspection below, and be composed of material from the entire depth to be amended, excluding any surface mulch layers.
 - 4. Calculations by a Certified Soil Scientist, Crop Advisor or Agronomist must be provided showing that the organic content requirements will be met based on the organic contents and densities of both the site soil and amendments

3.4 PREPARATION

- A. General:
 - 1. Perform work in such a manner as to prevent overworking and over-saturation of on-site soils. This shall include any/all precautions necessary throughout the entire work area (including access drives/haul roads/staging areas) to control surface and groundwater, to protect soils and subgrades from heavy vehicle loads, and to achieve soil moisture levels capable of achieving specified compaction.
 - 2. No extra compensation will be paid to the Contractor due to work performed at non-optimum times or under non-optimum conditions resulting in unsatisfactory soil conditions.
 - 3. The Contractor shall correct unsatisfactory conditions at no additional cost to the Engineer.
 - 4. Contractor is responsible for managing the soil moisture conditions to maintain the constructability of soil in order to meet the construction contract schedule.
 - 5. No extra compensation will be paid to the Contractor for watering or aerating the subgrade, excavated areas, or fills to achieve specified compaction.

- B. Delays may occur due to inclement weather. It shall be the Contractor's responsibility to immediately notify the Engineer and request an extension of completion time for justified reasons.
- C. Do not allow or cause any of the Work performed or installed to be covered up or enclosed prior to all of the required reviews, tests, and approvals required by City of Puyallup Standard Notes for Landscape Plans. See Planting Detail Sheet.
- D. Should any of the Work be so enclosed or covered up before it has been approved, the Contractor shall uncover all such Work, at no additional cost to the Engineer.
- E. After the Work has been completely tested, inspected, and approved, make all repairs and replacements necessary to restore the Work to the condition in which it was found at the time of uncovering, all at no additional cost to the Engineer.
- F. Protection of Existing Conditions: Prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.
- G. Surface Preparation:
 - 1. Inspection: Inspect subgrade soil for stones over two (2) inches square, sticks, oils, chemicals, plaster, concrete, and other deleterious materials.
 - 2. Removal: Perform all Work necessary to remove the deleterious materials before and after subgrade preparation.

3.5 PREPARING SUBGRADE

- A. Prepare subgrade to meet the requirements of BMP T5.13. Subgrade to be scarified to a depth of 3"

3.6 COMPOST AMENDED SOIL

- A. Scarify an additional depth of subgrade soils and amend with 50% compost to achieve a final depth of compost amended soils per details.
- B. Compost to be evenly mixed with subgrade soils.

3.7 TOPSOIL PLACEMENT

- A. After the prepared and scarified subgrade and compost amended soil layer has been approved by the Engineer, Topsoil shall be placed carefully to avoid damage or displacement of other materials such as drainage components, pavements, trails, geotextile fabrics, etc.
- B. Verify method of transporting soil with Engineer. Take all precautions to avoid damage and deploy improvements necessary to protect the existing improvements.
 - 1. Topsoil shall be placed to the depths required.
 - 2. At curbs, pavement edges, edges of trails, and other hardscape material edges where grassing is specified, provide for the compacted full volume and depth of Topsoil and the specified grassing material combined, to achieve a finish grade surface 1/2 inch below all pavement surfaces.
 - 3. At curbs, pavement edges, edges of trails, and other hardscape material edges at landscape planting beds (for future tree and shrub installation) provide for the compacted full volume and depth of Topsoil at the specified compaction.
 - 4. Roll and compact Topsoil in accordance with the requirements for BMP T5.13.
 - 5. After compaction, place Topsoil to fill in low spots, fine grade to achieve finish grade, and obtain the Engineer's approval to proceed with grassing and/or mulching.
 - 6. Low settled areas shall be filled with additional soil, regraded, and recompact to achieve uniform prescribed final grade.

3.8 PROTECTION

- A. Protect all areas from oversaturation, and foot and vehicle traffic. Perform work in such a manner as to minimize vehicle crossings.
- B. Use all means necessary to prevent erosion of completed topsoiled and mulched areas during construction and until such time as permanent drainage and erosion control measures have been installed.
- C. Repair at Contractor's expense, all damage and unsatisfactory conditions including wheel ruts and vehicle/equipment tracks, humps, low spots/depressions, footprints, rills, erosion, washes, debris drift piles, which may develop for any reason between the time finish grading is accepted and permanent stabilization measures have completely stabilized the graded area.
- D. Settlement Repair: Correct settlement within the Warranty period at no cost to the Engineer.
- E. Drainage: Keep surface of topsoil and mulch in such condition that it will drain readily and effectively.
- F. Materials, Tools, and Equipment: In handling materials and operating tools and equipment, protect the topsoil from damage by laying down planks, plywood, or other accepted protective materials where required.
- G. Storage of Materials: Do not store or stockpile materials on topsoil.
- H. Dust Control: Use water trucks or temporary irrigation and take all precautions needed to prevent a dust nuisance to adjacent public or private properties.

3.9 CLEANUP

- A. Clean up and remove all deleterious materials and debris from the entire Work area daily and prior to Final Completion.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Section includes the following:
1. Soil preparation for seeding
 2. Installing seeding
 3. Watering and maintenance of seeding until Project Acceptance.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: The Landscape Contractor shall be licensed in the State of Washington, shall have a minimum of 5 years demonstrated experience on projects similar in scope and materials.

1.3 SUBMITTALS

- A. Seeding Schedule
- B. Statement of Disease-Free Certification for Seed Mix
- C. Complete analysis of the seed shall include the percent of pure seed, germination, other crop seed, inert and weeds, and the germination test data. All crop seed in excess of one (1) percent must be itemized. Contractor must submit original label to the Engineer.
- D. Commercial Fertilizer product information, including product label, fertilizer analysis, release rate, release mechanism, etc.
- E. Mulch for hydroseeding product information

PART 2 PRODUCTS

2.1 SEED MIX

- A. Lawn - Full Sun Mix shall be equal to shall be equal to the following:
Application Rate 8 lbs./1000 sq. ft.

Seed Type	% by Weight
Perennial Ryegrass, <i>Lolium perenne</i> var. (1/3 Palmer or Manhattan, 1/3 Saturn or Competitor, 1/3 Charger or Dandy)	60
Creeping Red Fescue, <i>Festuca rubra</i>	20
Chewings Fescue, <i>Festuca rubra commutata</i>	20

- B. Lawn - Shade Mix shall be equal to the following:
Application Rate 7 lbs./1000 sq. ft.

Seed Type	% by Weight
Chewings Fescue, <i>Festuca rubra commutata</i>	30
Creeping Red Fescue, <i>Festuca rubra</i>	30
Kentucky Bluegrass, <i>Poa pratensis</i>	20
Perennial Ryegrass, <i>Lolium perenne</i>	20

- C. Bioswale Mix shall be equal to Bioswale Mix as follows:
Application Rate 5 lbs./1000 sq. ft.

Seed Type	% by Weight
Tall or Meadow Fescue, <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	75-80

Seaside/ Creeping Bentgrass, <i>Agrostis palustris</i>	10-15
Redtop Bentgrass, <i>Agrostis alba</i> or <i>Agrostis gigantea</i>	5-10

D. Restoration Seeding Mix shall be equal to "Low Grow" Seed Mix as follows:

Application Rate 5 lbs./1000 sq. ft.

Seed Type	% by Weight
Dwarf Tall Fescue (several varieties), <i>Festuca arundinacea</i> var.	40
Dwarf Perennial Rye, <i>Lolium perenne</i> var. <i>barclay</i>	30
Creeping Red Fescue, <i>Festuca rubra</i>	25
Colonial Bentgrass, <i>Agrostis tenuis</i>	5

E. Seed Mixes - General

1. All seed shall be 98% pure with a minimum of 90% germination. Total weed seed shall not exceed 0.5%. Maximum percent inert and other crop shall be 1.50% of total seed mix
2. Seed Law. All seeds shall conform to the requirements of the Washington State Seed Laws, and where applicable, the Federal Seed Act. Reference Specification; Chapter 15.49, Washington State Seed Act.
3. Noxious Weed Seed. All seed shall be free of seeds of weeds listed as primary noxious by the Washington State Seed Law. Seeds shall not contain seeds of weeds listed as secondary noxious by the Washington State Seed Law, singly or collectively in excess of the labeling tolerance specified by the Washington State Seed Law.
4. Rejection. When seeds furnished under this specification fail to meet the requirements within tolerance, as provided by the Washington State Seed Law, the lot shall be rejected or subjected to fiscal adjustment.
5. Re-cleaning. Seeds shall be thoroughly re-cleaned and of uniformly good quality throughout each lot.

F. General:

1. Seeds shall be packed in clean, sound containers of uniform weight. Seeds shall be labeled as required by law.

2.2 HYDROSEEDING EQUIPMENT AND MATERIALS

- A. Seed shall be spread by approved mechanical (hopper or culti-packer) or hydro-seed/mulch method only.
- B. Mulch shall be SILVA MULCH at forty-five (45) pounds per 1,000 square feet.
- C. Binder shall be J-TAC at two (2) pounds per 1,000 square feet.
- D. Fertilizer: (16-16-16) or approved equal. Apply at rate of 6.25 pounds per 1,000 sq. ft.

2.3 LIME

- A. Lime shall be dolomitic limestone containing not less than eighty-five (85) percent of total carbonates. Limestone shall be ground to such fineness that one hundred (100) percent will pass a No. 20 sieve.

PART 3 EXECUTION

3.1 GENERAL

- A. All square foot quantities noted on drawings are estimates. Contractor shall calculate all areas and determine amount of plant material required at specified rate.
- B. Inspect all planting areas for the conditions specified below, and other conditions which would adversely affect the landscaping installation. Notify the Architect if adverse conditions are discovered. Commencement of landscaping installation indicates acceptance of the surrounding conditions. Protect surrounding construction from damage caused by the work of this section. Inspect for drainage & soil conditions, which would adversely affect seed growth.

3.2 HYDROSEEDING INSTALLATION

- A. Hydroseed areas indicated on drawings at any time when conditions are favorable for germination of seed and proper working of soil and establishment of turf. Calendar dates for favorable conditions area generally between April 15th and October 15th. No hydroseeding shall take place after October 15.
- B. Hydroseed shall be installed with a hydroseeder, which maintains continuous agitation of water slurry keeping additives mixed and suspended homogeneously until pumped from tank.
- C. After hydroseeding has been completed irrigate all areas systematically to promote seed germination and protect new growth.

3.3 PATCH AND REPAIR

- A. Contractor shall patch and repair damaged portions of newly hydroseeded areas. Submit proposed method for slope patch and repair to the Engineer for approval prior to commencement of work.

3.4 30 DAY MAINTENANCE AND ESTABLISHMENT PERIOD

- A. It is expressly understood that the Contractor will be responsible during the 30 maintenance and establishment period for normal landscape maintenance of the project. Maintenance of the seed areas shall include, but not be limited to, watering, mowing, weeding, monitoring, and treating any disease and/or pest-problems, cultivating and any other maintenance requirements (per standard trade practices) to keep the planting areas in a normal healthy growing condition.
- B. Replace all seed areas when plants are no longer in a satisfactory growing condition as determined by the Engineer for the duration of the guarantee period. Make replacements within seven (7) days of notification from the Engineer. Remove dead seed areas within two (2) days of notification and mark planting plan showing the exact location of replaced areas.
- C. The fertilization, watering, and maintenance requirements specified for seeding are the minimum requirements, and do not relieve the Contractor of the responsibility to provide acceptable installed seed. Contractor shall provide all additional fertilizer applications, waterings, mowings, and maintenance methods necessary beyond the minimum requirements specified in this Section to provide an acceptable stand of seed at Contractor's cost as part of the unit price.
- D. Seed Establishment
 - 1. Grow and maintain, including, but not limited to, watering, fertilization, mowing, and clean-up the seed for a period of thirty (30) working days until it has filled into an acceptable condition.
 - 2. Acceptable condition shall mean a full stand of grass, uniform in appearance, and free of weeds and/or other undesirable plant species as approved by the Engineer.

3. A full stand of seed is defined as a uniform grass cover with no bare spots over foursquare inches in area.
 4. Apply a second full-rate application of fertilizer the three days prior to the first mowing
 5. Request the Engineer inspect the seed areas, determine acceptance, and if acceptable transfer responsibility of maintenance to the Contracting Agency.
 6. Only after written acceptance of the seed areas by the Engineer, shall Contractor be eligible to be paid 100% of the seeding payment item.
 7. If the Engineer finds any seed area unacceptable, the Contractor shall immediately repair the areas at Contractor's expense until the Engineer determines acceptance.
- E. Required Tasks During the 30-Day Maintenance Period
1. Tasks shall include, but not be limited to mowing (three mowings minimum, and as many additional mowings as it takes to maintain seed areas at 1-1/2-inch height without removing more than 1/3 blade height at anyone mowing), edging, weed control, and watering as specified in Section 328400.
 2. Application of a second full-rate application of fertilizer prior to first mowing.
- F. Watering and Moisture Management
1. To encourage deep rooting, each watering shall be thorough enough to provide soil moisture a minimum of four (4) inches below soil surface. Permit soil to dry sufficiently between watering, but not so dry as to damage the seed.
 2. During the germination period for seeded areas, the plant bed shall be always kept evenly moist to a depth of 4 inches. To achieve this goal, it may be required to water areas more than once daily, depending upon weather conditions, during the germination period. Care shall be given to apply water at such a rate to not erode or wash away seed.
 3. Application rates and timing to achieve adequate moisture for active growth for seed be solely the responsibility of the Contractor.
 4. Daily inspections of seeded areas will be conducted by the Engineer during the 30-day Seed Maintenance Period. Should inspection reveal that an adequate amount of moisture is not being supplied or evenly distributed to all the seeded areas, the Engineer will place the Contractor on notice that immediate applications of water be applied and failure to do so will result in immediate suspension of the calendar day maintenance period. No additional compensation will be allowed the Contractor for these applications of water.
 5. If the Contractor continues to fail to apply adequate moisture during the germination period for five (5) consecutive calendar days, the Engineer may declare the seeding unacceptable. Within three (3) working days of notification, the Contractor will be required to reseed areas that have not been kept properly moist to provide healthy, vigorous growth.
- G. Contracting Agency's Recourse to Lack of, or Inadequate/Improper Maintenance
1. It is agreed that the City will suffer damage and be put to additional expense if the Contractor does not perform maintenance duties as specified above, and as it may be difficult to accurately compute the amount of such damage, the Contractor hereby expressly covenants and agrees to the following maintenance performance measures:
 - (a) Weeding: The Engineer will issue the Contractor up to two written notices during the maintenance period to weed contract planting areas. Whereupon the Contractor shall have seven calendar days, per notice, to complete the weeding. If weeding is not performed after the second notice, the Engineer shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.
 - (b) Replacing Dead or Dying Seed: The Engineer will issue the Contractor up to two written notices during the maintenance period to replace dead or dying seed. Whereupon the Contractor shall have seven calendar days, per notice, to replace the

dead or dying grass. If grass replacement is not performed after the second notice, the Engineer shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

- (c) Regular watering: The Engineer will issue the Contractor up to two written notices during the maintenance period to water the contract plants. Whereupon the Contractor shall have three calendar days, per notice, to water contract plants. If plant irrigation is not performed after the second notice, the Engineer shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

3.5 INSPECTION AND SUBSTANTIAL COMPLETION

- A. After completion of all seed installation and the 30-day maintenance period, the Engineer will review all areas for compliance.
- B. Grassed areas without an acceptable, uniform stand of seed, or areas damaged through any other cause prior to this inspection shall be re-grassed using the material specified for that area as herein specified at the Contractor's expense, and regrown, including specified maintenance, until an acceptable stand is achieved.

3.6 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Work includes providing Root Barrier where shown on the Drawings.

1.2 SUBMITTALS

- A. Provide manufacturer's literature of Root Barrier.

PART 2 PRODUCTS

2.1 ROOT BARRIER

- A. Root Barrier shall be 24" depth as manufactured by Deep Root; Tree Root Barriers; UB24-2 or approved equal. Material: 0.085" wall thickness, nominal, injection molded 50%post-consumer recycled polypropylene panels with UV inhibitors.
1. 7/16" wide integral molded 0.085" thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
 2. Integral molded 0.085" thickness by 2" deep vertical root directing ribs spaced at 6" O.C.
 3. Integral molded 0.085" thickness by 2" long by 3/8" wide horizontal anti-lift ground lock tabs; minimum nine per panel.
 4. Size: 24" wide by 24" deep.
 5. Integrated zipper joining system for panel connection to adjacent panel.
 6. Color: Black.

PART 3 EXECUTION

3.1 ROOT BARRIER

1. Install in accord with manufacturer's reviewed installation instructions where indicated on Drawings with vertical root directing ribs facing inwards towards trees or plants; connect panels together as required. Top of Root Barrier shall be two inches (2") below adjacent pavement edge.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Special Provision includes providing landscape edging in all areas described on the Drawings.

1.2 SUBMITTALS

- A. Product description and testing information confirming source material.

PART 2 PRODUCTS

2.1 STEEL EDGING

- A. Steel Landscape Edging Size: Comply with ASTM A569, hot-rolled, standard flexible carbon steel landscape edging, fabricated in sections with stake pockets stamped, punched, or welded to face of sections approximately thirty inches (30") apart to receive stakes. Steel landscape edging (header) shall be double staked at overlap joints, and designed to receive tapered steel stakes
 - 1. 1/8" thick, 4" wide, by 16' length, with 6 stakes (actual coverage 15'-4")
- B. Steel Landscape Edging Finish:
 - 1. Painted finish shall be Sherwin Williams H68GT85 powder coat paint electrostatically applied, and oven baked. Minimum thickness to be 15 mils. Color shall be BROWN.
- C. Steel Landscape Edging Stakes:
 - 1. Steel, tapered, 12" length and finished to match specified steel landscape edging (header). Stakes designed specifically to anchor steel landscape edging (header) in place, and made by the manufacturer of the steel landscape edging (header) for which they will be used.
 - 2. Accessories: Standard start/end sections. 90 degree corners, splice as required.
 - 3. Acceptable Manufacturers: "DURAEDGE", by The JD Russell Company, Tucson, AZ (800-888-7425) or approved equal.

PART 3 EXECUTION

- A. Steel Landscape Edging: Install steel landscape edging where indicated on Contract Drawings, according to manufacturer's recommendations. Anchor with steel stakes spaced approximately 30 inches on-center, driven below top elevation of edging. or at every stake pocket location in landscape edging (header) sections designed and manufactured to receive stakes. Stakes shall be located in solid undisturbed soil, min 85% relative compaction.
 - 1. Horizontal Alignment: Install straight section true to the alignments as indicated. free of waves or bends, using strings as guides. Install curved sections true to the alignments as indicated, free of waves or bends, following marked alignments approved in the field by the Owner's Representative.
 - 2. Vertical Alignment: Install parallel with the finished grade.
- B. Damaged Edging. Replace edging sections damaged by construction operations.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silva Cell system for planting and paving, including Silva Cell assemblies and related accessories.
2. Other materials including, but not limited to, geotextile, geogrid, aggregate, subbase material, backfill, root barrier, Water + Air System, and planting soil.

B. Related Requirements:

1. Section 32 12 16 - Asphalt Paving
2. Section 32 84 00 - Planting Irrigation
3. Section 32 93 00 - Plants

1.2 REFERENCES

A. Definitions:

1. AGGREGATE BASE COURSE: Aggregate material between the paving and the top of the Silva Cell deck below, designed to distribute loads across the top of the deck.
2. AGGREGATE SUBBASE: Aggregate material between the bottom of the Silva Cell base and the compacted subgrade below, designed to distribute loads from the Silva Cell bases to the subgrade.
3. BACKFILL: The earth used to replace or the act of replacing earth in an excavation beside the Silva Cell system to the excavation extents.
4. FINISH GRADE: Elevation of finished surface of planting soil or paving.
5. PLANTING SOIL: Soil as defined in Division 32, Section 32 94 56 - Planting Soil for Silva Cells, intended to fill the Silva Cell system and other planting spaces.
6. SILVA CELL SYSTEM:
 - (a) Silva Cell: One assembled unit made up of 1 base, 6 post assemblies, and 1 Silva Cell deck.
 - (b) Silva Cell System: Two or more Silva Cells used in combination with each other and with required accessories.
7. SUBGRADE: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.
8. WALK-THROUGH COMPACTION: A process for light compaction of soils by walking through the soil following placement.
 - (a) Walk through compaction shall result in 75-85 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method. Do not exceed root limiting compaction for the given soil type.

B. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO): AASHTO H-20
9. ASTM International (ASTM):
 - (a) ASTM D448-12, Standard Classification for Sizes of Aggregate for Road, and Bridge Construction
 - (b) ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ [600 kN-m/m³])
 - (c) ASTM D1241-07, Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses

- (d) ASTM D3786/D3786M-13, Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
- (e) ASTM D4491-99a(2014)e1, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- (f) ASTM D4533-D4533M-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- (g) ASTM D4632-D4632M-15, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- (h) ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile
- (i) ASTM D4833/D4833M-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- (j) ASTM D5262-07(2012), Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics
- (k) ASTM D6241-14, Standard Test Method for Static Puncture Strength of Geotextile and Geotextile-Related Products Using a 50mm Probe.
- (l) ASTM D6637-11, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Conference: Prior to installation of the Silva Cell system and associated Work, meet with the Contractor, Silva Cell system installer and their field supervisor, manufacturer's technical representative, the Engineer, the Owner at the Owner's discretion, and other entities concerned with the Silva Cell system performance.
 - 1. Provide at least 72 hours advance notice to participants prior to convening preinstallation conference.
 - 2. Introduce and provide a roster of individuals in attendance with contact information.
 - 3. The preinstallation conference agenda will include, but is not limited to the review of:
 - (a) Required submittals both completed and yet to be completed.
 - (b) The sequence of installation and the construction schedule.
 - (c) Coordination with other trades.
 - (d) Details, materials, and methods of installation.
 - (e) Review requirements for substrate conditions, special details, and if any, installation procedures.
 - (f) Installation layout, procedures, means and methods.
 - (g) Mock-up requirements.
- B. Sequencing and Scheduling:
 - 1. General: Prior to beginning Work of this Section, prepare a detailed schedule of the Work involved for coordination with other trades.
 - 2. Schedule utility installations prior to beginning Work of this Section.
 - 3. Where possible, schedule the installation of the Silva Cell system after the area is no longer required for use by other trades and Work. Where necessary to prevent damage, protect installed system if Work must occur over or adjacent to the installed Silva Cell system.

1.4 SUBMITTALS

- A. Action Submittals: Submit these to the Architect for review and acceptance not less than 45 days prior to start of installation of materials and products specified in this Section.
 - 1. Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets these specifications.
 - 2. Test and Evaluation Reports:
 - (a) Submit results of compaction testing required by the Specifications for approval.

- (b) Include analysis of bulk materials including soils and aggregates, by a recognized laboratory that demonstrates that the materials meet the Specification requirements.
- 3. Samples:
 - (a) One full size sample of an assembled Silva Cell (copy of manufacturers brochure with images of product may be accepted in lieu of product sample).
 - (a) Manufacturer's product data/specification sheet for geogrid.
 - (b) Manufacturer's product data/specification sheet for geotextile.
- 4. Manufacturer's Report: Submit Silva Cell system manufacturer's letter of review and approval of the Project, including Drawings and Specifications, Addenda, Clarifications and Modifications, and for compliance with product installation requirements.
- 5. Qualification Statements:
 - (a) Manufacturer:
 - (i) Submit list of completed projects demonstrating durability and longevity of in-place systems.
 - (ii) Include project name, location, and date of completion.
 - (b) Installer:
 - (i) Submit documentation of the qualifications of the Silva Cell system installer and their field supervisor, sufficient to demonstrate that both meet the requirements specified in Article 1.05 QUALITY ASSURANCE.
 - (ii) Submit list of completed projects of similar scope and scale demonstrating capabilities and experience.
- B. Closeout Submittals: Submit these to the Architect at completion of installation.
 - 1. Warranty: Submit manufacturer's warranty, fully executed.

1.5 QUALITY ASSURANCE

- A. Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from these authorities.
- B. Manufacturer Qualifications:
 - 1. A manufacturer whose product is manufactured in an ISO/TS 16949 compliant and ISO 9001 - 2008 registered factory.
 - 2. A manufacturer with not less than 100 Silva Cell systems in-place, each system in use for not less than 7 years, confirming durability and longevity of the system.
 - 3. A manufacturer with documented written approval of their product for use as a stormwater treatment device by a minimum of 3 governmental jurisdictions.
 - 4. A manufacturer with an established and demonstrated utility service and repair process, including written procedure and photographs demonstrating work.
 - 5. A manufacturer with a published operating and maintenance manual
- B. Installer Qualifications: A qualified installer with not less than 5 years of successful experience installing Silva Cell systems or related products and materials, and whose work has resulted in successful installation of underground piping, chambers and vault structures, planting soils, and planter drainage systems of a similar scope and scale in dense urban areas.
- C. Installer's Field Supervisor: A full-time supervisor employed by the installer with not less than 5 years of successful experience similar to that of the installer and present at the Project site when Work is in progress. Utilize the same field supervisor throughout the Project unless a substitution is submitted to and approved in writing by the **Architect**.

- D. Mock-Up: Prior to the installation of the Silva Cell system, construct a mock-up of the complete installation at the Project site in the presence of the Landscape Architect.
 - 1. Size and Extent: Minimum of 100 sq. ft. (10 sq. m.) in area and including the complete Silva Cell system installation with subbase, aggregate subbase, drainage installation, Silva Cell decks, posts, and bases, base course aggregate, geotextile, geogrid, backfill, planting soil, and necessary accessories.
 - 2. The mock-up area may remain as part of the installed Work at the end of the Project provided that it remains undamaged and meets the requirements of the Drawings and Specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Silva Cell System: Protect Silva Cell system components from damage during delivery, storage, and handling.
 - 1. Store components on smooth surfaces, free from dirt, mud, and debris. Store under tarp to protect from sunlight when time from delivery to installation exceeds one week.
 - 2. Perform handling with equipment appropriate to the size (height) of Silva Cells and site conditions; equipment may include, hand, handcart, forklifts, extension lifts, or small cranes, with care given to minimize damage to Silva Cell bases, posts, decks, and adjacent assembled Silva Cells.
- B. Packaged Materials: Deliver packaged materials in original, unopened containers indicating weight, certified analysis, name and address of manufacturer, and indication of conformance with State and Federal laws, if applicable. Protect materials from deterioration during delivery and while on the Project site.
 - 1. Do not deliver or place backfill, soils, or soil amendments in frozen, wet, or muddy conditions.
 - 2. Provide protection including tarps, plastic and/or matting between bulk materials and finished surfaces sufficient to protect the finish material.
 - 3. Bring planting soil to the site using equipment and methods that do not overly mix and further damage soil peds within the soil mix.
- C. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the Project limits as needed.

1.7 FIELD CONDITIONS

- A. Existing Conditions: Do not proceed with Work when subgrades, soils and planting soils are in a wet, muddy, or frozen condition.

1.8 WARRANTY

- A. The Contractor shall warrant the Silva Cell system to be free of faults and defects in accordance with the General Conditions, except that the warranty shall be extended by manufacturer's written warranty against defects in materials and workmanship as follows:
 - 1. DeepRoot® warrants to the original purchaser of its Silva Cell™ product that such product will be free from defects in materials and workmanship, and perform to DeepRoot's written specifications for the warranted product, when installed and used as specifically provided in the product's installation guidelines for a period of 20 years from the date of purchase. This warranty does not cover wear from normal use, or damage caused by abuse, mishandling, alterations, improper installation and/or assembly, accident, misuse, or lack of reasonable care of the product. This warranty does not apply to events and conditions beyond DeepRoot's control, such as ground subsidence or settlement, earthquakes, and other natural events, acts of third parties, and/or Acts of God. If this warranty is breached, DeepRoot® will provide a replacement product. Incurred costs, such as labor for removal of

the original product, installation of replacement product, and the cost of incidental or other materials or expenses are not covered under this warranty.

2. Deeproot® makes no other warranties, express or implied, and specifically disclaims the warranty of merchantability or fitness for a particular purpose. Deeproot® shall not be liable either in tort or in contract for any direct, incidental, or consequential damages, lost profits, lost revenues, loss of use, or any breach of any express or implied warranty.

PART 2 PRODUCTS

1.1 MANUFACTURER

A. Acceptable Manufacturers:

DeepRoot Green Infrastructure, LLC
101 Montgomery Street, Suite 2850
San Francisco, CA, 94104
Phone: 415.781.9700
Toll Free: 800.458.7668
Fax: 415.781.0191
www.deeproot.com

- B. Substitutions: Manufacturers seeking approval of their products are required to comply with the Owner's Instructions to Bidders, generally contained in the Project Manual. If such instructions are not included in Division 00 or Division 01, submit requests as specified herein.

1. Submit proposed substitutions to the Architect not less than 7 days prior to the date for receipt of Bids.

2.2 DESCRIPTION

- A. The term Silva Cell shall be used to refer to a single Silva Cell.
- B. Silva Cells shall be designed for the purpose of growing healthy trees and providing stormwater management.
- C. Silva Cells shall be modular, structural systems.
- D. Each Silva Cell shall be structurally-independent from all adjacent Silva Cells for incorporating utilities and other site features as well as for future repairs.
- E. Silva Cells shall be capable of supporting loads up to and including AASHTO H-20 (United States) or CSA-S6 87.5 kN (Canada) when used in conjunction with approved pavement profiles.
- F. Silva Cells shall be open on all vertical faces and horizontal planes and shall have no interior walls or diaphragms.
- G. Silva Cells shall be capable of providing a large, contiguous, continuous volume of planting soil that does not inhibit or prevent the following:
1. Placement of planting soil
 2. Walk through compaction.
 3. Compaction testing of planting soil, once in place.
 4. Movement and growth of roots
 5. Movement of water within the provided soil volume, including lateral capillary movement
 6. Installation and maintenance of utilities placed within, adjacent to, or below the Silva Cell.

- H. Silva Cells shall be able capable of being filled with a variety of soil types and soils that include peds 2 inches or larger in diameter as is appropriate for the application, location of the installation, and tree species.

2.3 SILVA CELL MATERIALS AND ACCESSORIES

- A. Silva Cell System Components: Each "Silva Cell" soil cell module (hereafter Silva Cell or "cell") is composed of one base, 6 post assemblies, and one deck.
- B. 2x Silva Cell System:
 - 1. Components: One base, six 2x posts, and one deck.
 - 2. Assembled Dimensions (Each Cell): 47.2 inches long by 23.6 inches wide by 30.9 inches high
- C. Silva Cell Materials and Fabrication:
 - 1. Bases and Posts: Homopolymer polypropylene.
 - 2. Decks: Fiberglass reinforced, chemically-coupled, impact modified polypropylene.
- D. Manufacturer's Related Silva Cell Installation Accessories:
 - 1. Strongbacks: An accessory designed to stabilize the Silva Cell posts temporarily, during soil placement, and removed for reuse prior to placing decks.
 - 2. Anchoring Spikes: 10" landscape spike for securing assembled Silva Cells to subbase.

2.4 RELATED PRODUCTS

- A. Root Barrier: Recyclable, black, injection molded panels manufactured with a minimum 50 percent post-consumer recycled polypropylene plastic with UV inhibitors, and integrated zipper joining system which allows instant assembly by sliding one panel into another; for redirecting tree roots down and away from hardscapes.
 - 1. Panel Sizes:
 - (a) No. UB18-2: 24 inches long by 18 inches deep by 0.080 inches for use with 2x and 3x systems, and for pavement profiles 12 inches or more in depth.
- B. Products meeting this specification:
 - 1. DeepRoot Tree Root Barrier (DeepRoot Green Infrastructure, LLC)
- C. Geogrid: Net-shaped woven polyester fabric with PVC coating, uniaxial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, and acids; used to provide a stabilizing force within soil structure as the fill interlocks with the grid.
 - 1. Tensile strength at ultimate (ASTM D6637): 1850 lbs/ft minimum
 - 2. Creep reduced strength (ASTM D5262): 1000 lbs/ft minimum
 - 3. Long term allowable design load (GRI GG-4): 950 lbs/ft minimum
 - 4. Grid aperture size (MD): 0.8 inch minimum
 - 5. Grid aperture size (CD): 1.28 inch maximum
 - 6. Roll size: 6-foot (1.8-m) width is preferred, up to 18-foot
 - 7. Products meeting this specification:
 - (a) Stratagrid SG 150; <http://www.geogrid.com>
 - (b) Miragrid 2XT; <http://www.tencate.com>
 - (c) Fortrac 35 Geogrid; (<http://www.hueskerinc.com>)
 - (d) SF 20 Biaxial Geogrid; <http://www.synteen.com>
- D. Geotextile: composed of high tenacity polypropylene yarns which are woven into a network such that the yarns retain their relative position and is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.
 - 1. Tensile strength at ultimate (ASTM D4595):

- (a) 4800 lbs/ft MD minimum
 - (b) 4800 lbs/ft CD minimum
- 2. Tensile strength at 5% strain (ASTM D4595)
 - (a) 2400 lbs/ft MD minimum
 - (b) 3000 lbs/ft CD minimum
- 3. Flow rate (ASTM D4491):
 - (a) 30 gal/min/ft² minimum
- 4. Apparent opening size (ASTM D4751):
 - (a) 30 sieve
- 5. UV Resistance (at 500 hours):
 - (a) 80 percent strength retained
- 6. Products meeting this specification:
 - (a) Mirafi HP570; <http://www.tencate.com>
 - (b) Geolon PP40; <http://www.tencate.com>
 - (c) Nilex Woven 2044 (Nilex); <http://www.nilex.com>
- E. Plastic Cable Ties: A tensioning device or tool used to tie similar or different materials together with a specific degree of tension.

2.5 OTHER RELATED MATERIALS

- A. Wood Blocking: Nominal dimensioned untreated lumber used for spacing assembled Silva Cells.
- B. Aggregate Subbase (Below Silva Cell Base):
 - 1. Complying ASTM D1241, Type I, Gradation B; Type I mixtures shall consist of stone, gravel, or slag with natural or crushed sand and fine mineral particles passing a No. 200 sieve.

<u>Sieve</u>	<u>Percent Passing</u>
1-1/2 inches	100
1 inch	75 to 95
3/8 inch	40 to 75
No 4	30 to 60
No 10	20 to 45
No 40	15 to 30
No 200	5 to 15
 - 2. Local Department of Transportation (DOT) virgin aggregate that most closely meets the gradation of ASTM D1241.
- C. Aggregate Base Course (Above Silva Cell Deck):
 - 1. Same as aggregate subbase specified above.
- D. Planting Soil: Refer to Section 32 94 56 - Planting Soil for Silva Cells.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine the conditions under which the Silva Cells are to be installed.
 - 1. Carefully check and verify dimensions, quantities, and grade elevations.

2. Carefully examine the Drawings to become familiar with the existing underground conditions before digging. Verify the location of aboveground and underground utility lines, infrastructure, other improvements, and existing trees, shrubs, and plants to remain including their root system.
3. Notify the Contractor and the Architect in writing in the event of conflict between existing and new improvements, of discrepancies, and other conditions detrimental to proper and timely completion of the installation.
4. Obtain written approval of changes to the Work prior to proceeding. Proceed with installation only after changes have been made and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take proper precautions as necessary to avoid damage to existing improvements and plantings.
- B. Prior to the start of Work, layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the complete Silva Cell system.
- C. Coordinate installation with other trades that may impact the completion of the Work.

3.3 TEMPORARY PROTECTION

- A. Protect open excavations and Silva Cell system from access and damage both when Work is in progress and following completion, with highly visible construction tape, fencing, or other means until related construction is complete.
- B. Do not drive vehicles or operate equipment over the Silva Cell system until the final surface material has been installed.

3.4 EXCAVATION

- A. General: Excavate to the depths and shapes indicated on the Drawings. Provide smooth and level excavation base free of lumps and debris.
- B. Confirm that the depth of the excavation is accurate and includes the full section of materials required to place the subbase aggregate, Silva Cell, and pavement profile as indicated on the Drawings.
- C. Over-excavate beyond the perimeter of the Silva Cell to allow for:
 1. The extension of aggregate subbase beyond the Silva Cell layout as shown on the Drawings.
 2. Adequate space for proper compaction of backfill around the Silva Cell system.
- D. If unsuitable subgrade soils are encountered, consult the Owner's geotechnical consultants for directions on how to proceed.
- E. If conflicts arise during excavation, notify the Architect in writing, and make recommendations for action. Proceed with Work only when action is approved in writing.

3.5 SUBGRADE COMPACTION

- A. Compact subgrade to a minimum of 95 percent of maximum dry density at optimum moisture content in accordance with ASTM D698, Standard Proctor Method, or as approved by the Owner's geotechnical representative.
- B. Do not exceed 10 percent slope for subgrade profile in any one direction. If the 10 percent slope is exceeded, contact manufacturer's representative for directions on how to proceed.

3.6 INSTALLATION OF GEOTEXTILE OVER SUBGRADE

- A. Install geotextile over compacted subgrade.

1. Lay geotextile flat with no folds or creases.
2. Install the geotextile with a minimum joint overlap of 18 inches.

3.7 INSTALLATION OF AGGREGATE SUBBASE BELOW SILVA CELL BASES

- A. Install aggregate subbase to the depths indicated on the Drawings.
- B. Extend subbase aggregate a minimum of 6 inches beyond the base of the Silva Cell layout.
- C. Compact aggregate subbase to a minimum of 95 percent of maximum dry density at optimum moisture content in accordance with ASTM D698, Standard Proctor Method.
- D. Do not exceed 10 percent slope on the surface of the subbase. Where proposed grades are greater than 10 percent, step the Silva Cells to maintain proper relation to the finished grade.

3.8 INSTALLATION OF SILVA CELL BASE

- A. Install the Silva Cell system in strict accordance with manufacturer's instructions and as specified herein; where requirements conflict or are contradictory, follow the more stringent requirements.
- B. Layout and Elevation Control:
 1. Provide layout and elevation control during installation of the Silva Cell system to ensure that layout and elevations are in accordance with the Drawings.
- C. Locate and mark other Project features located within the Silva Cell layout (e.g. light pole bases, utility pipes). Apply marking to identify the extent of the Silva Cell layout around these features. Follow the layout as shown on the Drawings to ensure proper spacing of the Silva Cell bases. Refer to the Drawings for offsets between these features and the Silva Cells.
- D. Check each Silva Cell component for damage prior to placement. Reject cracked or chipped units.
- E. Place the Silva Cell bases on the compacted aggregate subbase, as shown on the Drawings.
 1. Maintain spacing no less than 1 inch and no more than 6 inches apart, assuming geotextile covering the decks meets the specifications in section 2.04 paragraph C.
- F. Follow the Silva Cell layout plan as shown on the Drawings.
- G. Install Silva Cell bases around, over, or under existing or proposed utility lines, as indicated on the Drawings.
- H. Level each Silva Cell base as needed to provide full contact with subbase. Adjust subbase material, including larger pieces of aggregate, so each base sits solidly on the surface of the subbase. Silva Cell bases that rock or bend over any stone or other obstruction protruding above the surface of the subbase material are not allowed. Silva Cell bases which bend into dips in the subbase material are not allowed. The maximum tolerance for deviations in the plane of the subbase material under the bottom of the horizontal beams of each Silva Cell base is 1/4 inch in 4 feet (6 mm in 1200 mm).
- I. Anchor Silva Cell base with 2 anchoring spikes per base.

3.9 INSTALLATION OF SILVA CELL POSTS

- A. 2x Silva Cell System:
 1. Attach 2x posts to the installed Silva Cell base. Each base will receive six 2x posts. Place the end of the post with tabs into the base. Rotate post clockwise to snap in place.

3.10 INSTALLATION OF STRONGBACKS, GEOGRID, BACKFILL AND PLANTING SOIL

- A. Install strongbacks on top of the Silva Cell posts by snapping into place over installed posts prior to installing planting soil and backfill.
 - 1. Strongbacks are required only during the placement and compaction of the planting soil and backfill.
 - 2. Move strongbacks as the Work progresses across the installation.
 - 3. Remove strongbacks prior to the installation of the Silva Cell decks.
- B. Install geogrid around the perimeter of the Silva Cell system where the compacted backfill and planting soil interface.
 - 1. Do not place geogrid between the edge of the Silva Cells and adjacent planting areas.
 - 2. Cut the geogrid to allow for a 6-inch overlap at the Silva Cell base and a 12-inch overlap at the Silva Cell deck.
 - 3. Provide a minimum 12-inch overlap between adjacent sheets of geogrid.
 - 4. Secure geogrid with cable ties below the top of the posts, along the post ridges.
- C. Place the first lift of backfill material loosely around the perimeter of the Silva Cell system, between the geogrid and the sides of the excavation. Place backfill to approximately the midpoint of the Silva Cell post. Do not compact.
- D. Place the first lift of planting soil in the Silva Cell system to approximately the midpoint of the Silva Cell post.
 - 1. Level the planting soil throughout the system.
 - 2. Walk-through the placed planting soil to remove air pockets and settle the soil.
 - (a) Lightly compact soils by walking through the soil following placement.
 - (b) Walk through compaction shall result in 75-85 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method. Do not exceed root limiting compaction for the given soil type.
- E. Compact the first lift of backfill material, previously spread, to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method or in accordance with Project Specifications for hardscape areas, whichever is greater.
- F. Add and compact additional backfill material so that the final finished elevation is at approximately the same level of the placed planting soil within the Silva Cells.
 - 1. Maintain the geogrid between the Silva Cell system and the backfill material at all times.
- G. Place the second lift of backfill material loosely around the perimeter of the Silva Cell system, between the geogrid and the sides of the excavation so that the material is 2 to 3 inches below the top of the posts. Do not compact.
- H. Place the second lift of planting soil inside of the Silva Cell to the bottom of the strongbacks. Walk through compact.

3.11 INSTALLATION OF SILVA CELL DECK

- A. Obtain final approval by the **Architect** of planting soil installation prior to installation of the Silva Cell decks.
- B. Remove strongbacks, level out the planting soil, and immediately install decks over the posts below. Place deck over the top of the posts. Push decks down until the deck clips lock into the posts, snapping the deck into place.
- C. Fold the 12 inches (300 mm) of geogrid onto the top of the decks.

3.12 FINAL BACKFILL PLACEMENT AND COMPACTION

- A. Place and compact final lift of backfill material to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method, such that the backfill is flush with the top of the installed deck. Do not allow compacting equipment to come in contact with the decks.

3.13 INSTALLATION OF GEOTEXTILE AND AGGREGATE BASE COURSE OVER THE DECK

- A. Ensure geotextile meets the specifications in section 2.04 paragraph C.
- B. Place geotextile over the top of the deck and extend to the edge of the excavation. Overlap joints a minimum of 18 inches (450 mm). Leave enough slack in the geotextile for the aggregate base course to push the geotextile down in the gaps in between the decks.
- C. Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics. Work the aggregate from one side of the layout to the other so that the fabric and aggregate conform to the Silva Cell deck contours.
- D. Maintain equipment used to place aggregate base course completely outside the limits of the Silva Cell excavation area to prevent damage to the installed system.
- E. For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the Silva Cell manufacturer.
- F. Compact aggregate base course(s) to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method. Utilize a vibration or plate compactor with a maximum weight of 800 lbs (362.87 kg).
- G. Do not drive vehicles or operate equipment over the completed aggregate base course.

3.14 INSTALLATION OF CONCRETE CURBS AT TREE OPENINGS, AGGREGATE SUBBASE AND PAVEMENT ABOVE THE SILVA CELL SYSTEM

- A. Place concrete curbs along planting areas and tree openings as shown on the Drawings to retain the aggregate base course from migrating into the planting soil.
- B. When staking concrete forms (e.g. curbs around the tree openings), prevent stakes from penetrating the Silva Cell decks.
- C. Turn down edge of concrete paving to the Silva Cell deck along the edges of tree openings or planting areas to retain the aggregate base course material.
- D. When paving type is a unit paver or other flexible material, provide a concrete curb under the paving at the edge of the Silva Cell deck to retain the aggregate base course material at the tree opening.
- E. Place paving material over Silva Cell system in accordance with the Drawings.
 - 1. The Silva Cell system does not fully meet loading strength until the final paving is installed. Do not operate construction equipment on top of the Silva Cell system until paving installation has been completed.
- F. Use care when placing paving or other backfill on top of Silva Cell system to prevent damage to the Silva Cell system or its components.

3.15 INSTALLATION OF ROOT BARRIERS

- A. Install root barrier in accordance with manufacturer's installation instructions.

3.16 INSTALLATION OF PLANTING SOIL WITHIN THE TREE PLANTING AREA

- A. Remove rubble, debris, dust, and silt from the top of the planting soil within the tree opening that may have accumulated after the initial installation of the planting soil within the Silva Cells.
- B. Install additional planting soil within the tree openings, to the depths indicated on the Drawings.
 - 1. Use the same soil used within the Silva Cells for planting soil within the tree openings.
- C. Compact planting soil under the tree root ball as needed to prevent settlement of the root ball.

3.17 PROTECTION

- A. Keep construction traffic away from the limits of the Silva Cells until the final pavement profile is in place. The Silva Cell system does not fully meet loading strength until the final paving is installed.
 - 1. Do not operate equipment directly on top of the Silva Cell system until paving installation has been completed.
 - 2. Provide fencing and other barriers to prevent vehicles from entering into the Silva Cell area.
- B. When the Silva Cell installation is completed and the permanent pavement is in place, limit traffic and construction related activities to only loads less than the design loads.

3.18 CLEAN UP

- A. Perform clean up during installation and upon completion of the Work. Maintain the site free of soil, sediment, trash, and debris. Remove excess soil materials, debris, and equipment from the site following completion of the Work of this Section.
- B. Repair damage to adjacent materials and surfaces resulting from installation of this Work using mechanics skilled in remedial work of the construction type and trades affected.

END OF SECTION

PART 1 GENERAL

1.1 EXTENT OF WORK IN THIS SECTION

- A. The work included under this section includes the performance of all work required to furnish, install, test, and disinfect Ductile Iron Pipe (all public water mains), hydrants, service connection to within 5 feet of the building line, valves, meters, and other appurtenances as shown in the Contract Drawings or as directed by the Engineer.
- B. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Project Plans & Specifications, WSDOT Standard Specifications, Public Works Engineering & Construction Standards in City of Puyallup, and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER AREAS

- A. Earthwork – 31 01 00
- B. Flexible Paving – 32 12 00
- C. Mechanical Division
- D. Electrical Division

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. All water mains and appurtenances shall be hydrostatic tested and disinfected in accordance with Standard Specifications, Section 7-09.3(23) and 7-09.3(24). Hydrostatic testing of water systems shall be observed by the Engineer. The Contractor shall contact the City of Puyallup Engineering Division at least 48 hours in advance of testing and disinfection.

1.4 SUBMITTALS

- A. Product data, including pressure rating, rated capacity, and settings of selected models for the following:
 - 1. Pipe and fittings.
 - 2. Joints and couplings, including gaskets for joints
 - 3. Backflow preventers.
 - 4. Valves.
 - 5. Fire hydrants.
 - 6. Fire department connections.
 - 7. Identification materials and devices.

PART 2 PRODUCTS

2.1 WATER MAINS AND APPURTENANCES

- A. Pipe:
 - 1. All pipe shall be AWWA Standards H3-71, C151-71, and cement lining C104-71, and shall be ductile cast-iron, standard thickness Class 50 push-on joints or M.J. joints. The pipe shall be of 150 psi working pressure, plus 100 psi surge pressure. Pipe shall meet City of

Puyallup requirements.

2. All pipe shall be marked with a 2 inch detectable metalized tape. Detector tape shall be brightly colored and bear the repeating imprint "WATER". Detector tape shall be buried 12 to 18 inches above the crown of each water main.
- B. Fittings: Material for fittings such as crosses, tees, bends, reducers, and sleeves shall be ductile iron. Public system fittings shall be M.J., flanged or push-on joints and shall conform to AWWA specifications C-110-71 and C-104-71. Mechanical joints shall be AWWA C153 ductile iron. Flanged fittings shall be short body Class 125 flanges.
- C. Concrete Thrust Blocking: Concrete blocking shall be as specified in the Standard Detail Plans or as directed by the Project Engineer. Blocks shall be installed as specified in Section 7-09.3(21) of the Standard Specifications. No precast blocks are allowed.
- D. Gate Valves:
 1. Gate valves shall be installed with cast-iron valve boxes. Gate valves shall be shortbody, suitable for a non-shock shut-off pressure of 130 psi valves and suitable for direct burial.
 2. Gate Valves shall be resilient seated iron-body, full-bronze mounted valves conforming to AWWA C509 and suitable for service with the type and class of pipe used.
 3. All valves shall have non rising stems and shall open counterclockwise and shall be equipped with a 2 inch square operating nut. Valves will be flange or M.J. joints.
 4. All valves shall be AWWA approved.
- E. Butterfly Valves: Butterfly valves shall be rubber seated and shall be approved by AWWA C504, Class 150B. Butterfly valves shall be suitable for direct burial. Shaft seals shall be standard O-ring seals. The size of the butterfly valves shall be the same as that of the line on which they are located.

The valve operator shall be of the traveling-nut or worm-gear type, sealed, gasketed, and permanently lubricated for underground service. The valve operator shall be constructed to the standard of the valve manufacturer to withstand all anticipated operating torques and designed to resist submergence in groundwater.
- F. Post indicator valves shall conform to NFPA standards and shall be as approved by the Fire Marshall. Post Indicator Valve shall be UL approved. Valves shall be iron-body, full-bronze mounted, resilient-seat valves and suitable for service with the type and class of pipe used. The valve operator shall be of the traveling-nut or worm-gear type, sealed, gasketed, and permanently lubricated for underground service. The valve operator shall be constructed to the standard of the valve manufacturer to withstand all anticipated operating torques and designed to resist submergence in groundwater.
- G. Fire Main and Hydrants: Comply with requirements of NFPA 24 for installation of fire protection loop. All fire hydrants and fire mains must conform to the City of Puyallup Standard Details.
- H. Fire Department Connection: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate. The FDC shall conform to UL 405.
- I. Blow-off Assembly: Blow-off assemblies shall be in accordance with the City of Puyallup Standard Specifications.
- J. Air-Vacuum Release Valve Assembly: Air-Vacuum Release Valve Assembly shall be in accordance with the Standard Specifications.
- K. Water Meters: Water meters shall be in accordance with details in the drawings. Domestic

meter shall be City approved 2" meter reading in cubic feet with transmitter or City approved equal. Private fire hydrant meter shall be City approved 2" meter. Irrigation sub-meter shall be per landscape specifications reading in cubic feet with transmitter or City approved equal. Meters shall measure flow in cubic feet. All meters shall be supplied and installed by the Contractor in accordance with manufacturer's recommendations.

- L. Backflow preventers shall be per City specifications. Reduced pressure backflow assembly shall be Watts series LF009 or equal in hot box enclosure on concrete pad.

PART 3 EXECUTION

3.1 GENERAL

All Public System work and private work shall be subject to the inspection and approval of City of Puyallup and Engineer. All fire protection system work shall also be subject to the inspection and approval of the City Fire Marshall.

3.2 PIPE INSTALLATION

- A. Pipe laying shall meet the requirements of Section 7-08 of the Standard Specifications. All water mains shall have minimum covering of 5 feet.
- B. Whenever a trench is excavated the entire trench above the pipe zone shall be backfilled with Bank-Run Gravel, Class "B", and compacted to a 95% density as defined by ASTM 0-1556.
- C. The Contractor must notify the Engineer of a proposed connection time at least four working days in advance.
- D. Comply with requirements of NFPA 24 for installation of fire protection loop.

3.3 FIRE HYDRANT INSTALLATION

- A. Fire hydrant installation must comply with Standard Details.
- B. Fire hydrants must be maintained in an operable condition at all times and must be repaired or replaced when defective. Hydrants shall be fully operable before construction commences above grade level.
- C. Underground supplies to fire hydrants must be inspected. Such inspection shall include visual inspection of piping and hydrostatic pressure test of a minimum of 200 psi or 50 psi in excess of street main pressure, whichever is greater. A flow test will be required when installation is complete.

END OF SECTION

PART 1 GENERAL

1.1 EXTENT OF WORK IN THIS SECTION

- A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal, including oil/water separators.
- B. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Project Plans & Specifications, WSDOT Standard Specifications, Public Works Engineering & Construction Standards in City of Puyallup, and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

- A. Earthwork – 31 01 00
- B. Mechanical Division
- C. Electrical Division

1.3 SUBMITTALS

- A. Product data for pipe, fittings, and structures.
- B. Shop drawings for precast concrete sanitary manholes, including frames and covers.
- C. Shop drawings for precast concrete grease trap, including frames and covers.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- A. General: All pipe and pipe fitting materials shall conform to Standard Specifications Division 7. Pipe shall be PVC Sewer Pipe and Fittings in accordance with Standard Specifications Section 9-05.12(1) using ASTM D-3034, SDR 35, bell-and-spigot ends. Joints shall conform to ASTM D 3212 using elastomeric gaskets conforming to ASTM F 477. Ductile iron pipe shall be class 51 or greater, lined with protecto 401TM epoxy lining or equivalent.
- B. Cleanouts shall be according to the Standard Specifications and Project Documents.
- C. Manholes shall conform to the Standard Specifications and Project Documents.

2.2 OIL WATER SEPARATOR

- A. Oldcastle Precast or equal oil/water separators in accordance with Project Documents. Ensure traffic rated lids for heavy vehicles, 50 ton minimum.

PART 3 EXECUTION

3.1 GENERAL

- A. Trench width shall conform to Standard Specifications 2-09.4. Pipe, cleanouts, and manholes installation shall conform to Standard Specifications 7-08 and 7-17 unless noted otherwise.
- B. No bedding material shall be used unless accepted by the Project Engineer. Samples shall be submitted by the Contractor at least 72 hours in advance of its intended use to enable it to be inspected and tested.

Bedding shall be placed in more than one lift as shown on City of Puyallup Standard Plans. The first lift to provide at least 4-inch thickness under any portion of the pipe (6 inches in the case of solid rock excavation) to be placed before the pipe is installed. This bedding layer shall extend the full width of the trench bottom to the specified thickness after being consolidated by the use of a "flat tamper." This lift shall be spread smoothly and bell holes dug where necessary to

ensure uniform support along the full length of the pipe barrel.

Subsequent lifts of not more than 6 inches shall be placed up to the spring line of the pipe. These lifts shall be consolidated first by the use of tamping bars, taking care to work the material under the pipe haunches so that no voids are left, then a flat tamping bar shall be used to compact the bedding material along the side of the pipe to the trench walls to provide lateral support for the pipe. These lifts shall be individually compacted to 90% density, as determined by ASTM D698, Method "D."

Further lifts of moderately-compacted bedding material shall be placed, not more than 6 inches thickness to a minimum of 8 inches, above the crown of the pipe (a minimum of 12 inches above the crown of pipe where rock is encountered in trench excavation).

- C. Bank-Run Gravel for Trench Backfill: Wherever a trench is excavated in the existing or newly-paved roadway, sidewalk or other areas where minor settlement would be detrimental, the entire trench shall be backfilled with Bank-Run Gravel, Class "B," and compacted to a 95% density as defined by ASTM 0-1556. Selected native materials may be used for trench backfill in other areas if approved by the Engineer.
- D. All sanitary sewer line shall be cleaned per Standard Specification 7-17.3(2).
- E. Joints and Infiltration: The method of making joints and materials used shall be included in the specifications. Leakage tests shall be according to Standard Specification 7-17.3(2)F for non-air-permeable materials and 7-17.3(2)E for air permeable materials.
The use of television camera or other visual methods for inspection prior to placing the sewer in service is required.
- F. Oil water separators to be installed per manufacturer recommendations.

END OF SECTION

PART 1 GENERAL

1.1 EXTENT OF WORK IN THIS SECTION

- A. This Section includes storm sewerage system piping and appurtenances, from a point 5 feet outside the building to the point of disposal.
- B. All labor materials, and equipment required to complete the work included in this section as part of the functioning systems shown on the drawings and in the specifications in accordance with the Project Plans & Specifications, WSDOT Standard Specifications, Public Works Engineering & Construction Standards in City of Puyallup, and specifically including restoration of all existing services, utilities and site improvements that may have been disturbed by the work, is considered incidental to the work.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

- A. Earthwork – 31 01 00
- B. Rigid Paving 32 12 00

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Specification Sections.
- B. Product data for pipe, fittings, structures and check valves.
- C. Shop drawings for precast concrete storm drainage catch basins, including frames, covers, and grates, trench drains, and water quality vault lids.

PART 2 PRODUCTS

- 2.1 General:** All pipe and pipe fitting materials shall conform to Standard Specifications unless otherwise indicated on the plans.

2.2 STEEL PIPE AND FITTINGS

- A. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
 - 1. Special-Joint Bands: Corrugated steel with O-ring seals.
 - 2. Standard-Joint Bands: Corrugated steel.
 - 3. Coating: Zinc.

2.3 PE PIPE AND FITTINGS

- A. Substitution of Hancor HI-Q Sure-Lok 10.8 watertight joint pipe or equal conforming to ASTM D3212 is allowed.

2.4 PVC PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping:
 - 1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.5 CONCRETE PIPE AND FITTINGS

- A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class 1, Class 2 or Class 3, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
 - 1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets

2.6 DUCTILE IRON PIPE

- A. Pipe shall be AWWA Standards C151, and shall be ductile cast-iron, standard thickness Class 50 push-on joints or M.J. joints. Pipe shall meet City of Puyallup requirements.

2.7 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.8 CLEANOUTS

- A. Cleanouts shall conform to the Standard Specifications and Project Documents.

2.9 CATCH BASINS

- A. Catch basins and appurtenances shall conform to WSDOT Standard Plans B-5.20, B-5.40 and B-10.20.
- B. Unless otherwise specified, cast iron products shall conform to ASTM A48 Class 30 and ductile iron products shall conform to ASTM A536 Grade 80-55-06.

2.10 BEDDING AND BACKFILL

- A. Bedding and trench backfill shall be as shown on City of Puyallup Standard Plans and as specified in the Standard Specifications. Bedding shall be placed in more than one lift.

2.11 DETENTION POND

- A. Detention system shall be as shown on the contract documents.

2.12 TRENCH DRAIN

- A. Trench drain shall be Zurn Z886-HD or equal with in-line catch basins per plan.

2.13 BIORETENTION

- A. Bioretention systems shall be as shown on the contract documents.

2.14 OIL WATER SEPARATOR

- A. Oldcastle Precast or equal oil/water separators in accordance with Project Documents. Ensure traffic rated lids for heavy vehicles, 50 ton minimum.
- B. Substation oil containment infrastructure including oil stop valve, gate valve, containment curb, perforated drain, and yard rock per Project Documents.

PART 3 EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."
- B. Pipe, cleanout, and catch basin installation shall conform to Standard Specifications 7-04.
- C. Whenever a trench is excavated in the existing or proposed roadway, sidewalk, or other areas where minor settlement would be detrimental, the entire trench above the pipe zone shall be backfilled with Bank-Run Gravel, Class "B", and compacted to a 95% density as defined by ASTM D-1556.
- D. Unless otherwise specified on the drawings, the channel at all outlet pipes shall receive a minimum 7 foot long by 4 foot wide by 1.0 foot deep layer of rock channel Lining. Rock shall enclose the entire outlet end of the pipe and extend a minimum of 5 feet downstream from the invert of the pipe. Rock shall be placed to form a firm, dense protective mat and shall conform to the design surface of the ditch. Individual rocks shall not protrude more than 3 inches from

the design surface.

3.2 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Make branch connections from side into existing piping. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.3 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Section "Earthwork."

3.4 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.

3.6 CLEANING AND TESTING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.
- B. Cleaning and testing of piping shall conform to Standard Specification 7-04.3(1). Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
- C. Storm drainage conveyance system within extent of impermeable liner (in village area) must be professionally installed and leak tested. Test with water at surface head pressure after backfill and compaction. The intent is to ensure that gas from leak testing does not migrate into catch basins or pipe then out the leak village extents.

END OF SECTION

PART 1 GENERAL

1.1 WORK UNDER THIS SECTION INCLUDES FURNISHING, DELIVERY AND INSTALLATION OF:

- A. Building Perimeter Drainage System.
- B. Filter aggregate and fabric and bedding.

1.2 RELATED REQUIREMENTS

- A. Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.
- B. Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.3 SUBMITTALS

- A. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the work of this section.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Perforated PVC Underdrain Pipe 9-05.2(6)
- B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2 AGGREGATE AND BEDDING

- A. Gravel Backfill for Drains 9-03.12(4)

2.3 ACCESSORIES

- A. Geotextiles properties shall conform to WSDOT Standard Specifications 9-33.2(1) Tables 1 through 3.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with granular fill.
- B. Remove large stones or other hard matter which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- B. Place drainage pipe on clean cut subsoil.
- C. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches.
- F. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 4 inch lifts, consolidating each lift.
- H. Do not displace or damage pipe when compacting.
- I. Place impervious fill over drainage pipe aggregate cover and compact.

J. Connect to storm sewer system with unperforated pipe, through installed sleeves.

3.4 FIELD QUALITY CONTROL

A. Quality Requirements: Field inspection and testing.

3.5 PROTECTION

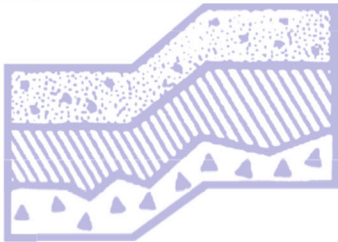
A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

GEOTECHNICAL REPORT

**PSE Operational Training Center
325 Todd Road Northwest
Puyallup, Washington**

Project No. T-8829



Terra Associates, Inc.

Prepared for:

**Trammell Crow Company
Seattle, Washington**

**April 6, 2023
Revised August 28, 2023**



TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

April 6, 2023
Revised August 28, 2023
Project No. T-8829

Mr. Alex Garcia Mendoza
Trammell Crow Company
600 University Street, Suite 2912
Seattle, Washington 98101

Subject: Geotechnical Report
PSE Operational Training Center
325 Todd Road Northwest
Puyallup, Washington

Dear Mr. Mendoza:

As requested, we have conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design.

Our field exploration indicates the site is generally underlain by native alluvial sediments composed of alternating and interbedded layers of soft to stiff silt to clayey silt, and very loose to medium dense sand to silty sand. Below a depth of approximately 15 feet beneath existing surface grades, the relative density of the sand deposits becomes medium dense to very dense as indicated by some of the test borings and the deeper CPT data. Groundwater is shallow residing between five and ten feet below the current site grades at the time our field work was completed.

In our opinion, the native soils on the site will be suitable for support of the proposed development provided the recommendations presented in this report are incorporated into project design and construction.

We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

Michael J. Xenos, E.I.T.
Staff Engineer



Theodore J. Schepper, P.E.
Senior Principal Engineer

8-28-23

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**Geotechnical Report
PSE Operational Training Center
325 Todd Road Northwest
Puyallup, Washington**

1.0 PROJECT DESCRIPTION

The project consists of developing the approximately six-acre one parcel property with a PSE Operational Training Center (OTC) along with associated infrastructure improvements. Review of the site plan prepared by Zervas Architects, dated July 21, 2023, shows the OTC building centrally located on the property with a floor area of approximately 33,800 square feet. The area west of the building is designated for outdoor training and includes two smaller buildings, covered areas, burn pit, substation yard and other training features. Design elevations in this western outdoor training area will require raising site grades by placing five to six feet of fill material. Design elevations in the central building and paved eastern site areas are near existing with cuts and fills required to achieve design grades of less than two feet.

The main central building will be a timber framed structure with the western smaller training building steel framed. Both buildings will have their floors constructed at grade. We anticipate structural loading will be relatively light with columns carrying 50 to 75 kips and continuous bearing walls carrying 2 to 4 kips per lineal foot. Loading on the floor slab is not expected to exceed 200 pounds per square foot (psf).

Stormwater will be collected and conveyed to a below grade stormwater detention facility located in the eastern portion of the site. The vault floor will be constructed at approximately elevation 29 feet. When considering the thickness of the vault foundation, this design elevation will require an excavation approaching 20 feet below existing site grades.

The recommendations in the following sections of this report are based on our understanding of the design features outlined above. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and to supplement them, if required.

2.0 SCOPE OF WORK

Our scope of work was completed in accordance with our authorized proposal, dated October 6, 2022. On November 16 and 17, 2022, we observed soil and groundwater conditions at the site by drilling 13 test borings advanced with a hollow-stem auger to depths ranging from approximately 10 to 30 feet below existing site grades. On November 18, 2022, two cone penetration tests (CPTs) were advanced at the site by In Situ Engineering, under subcontract with our office to maximum depths of approximately 60 to 70 feet below existing surface grades. In addition, seismic shear wave testing was completed at one of the CPT locations. Using this data, we performed analyses to develop geotechnical engineering recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the City of Puyallup Municipal Code (KCC).
- Site preparation and grading.
- Building preload/surcharge program.
- Excavations.
- Foundations.
- Floor slabs at grade.
- Lateral earth pressures for wall design.
- Stormwater facilities.
- Subsurface drainage.
- Utilities.
- Pavements.

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment is beyond Terra Associates' purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The site is located north and east of the intersection of Todd Road Northwest and 4th Street Northwest in Puyallup, Washington. The site is bounded by a railroad along the northeast. The site location is shown on the attached Vicinity Map, Figure 1.

The eastern parcel is currently partially developed and used as a storage yard. The western parcel is not developed and is largely an open grass-covered field. Site topography is relatively flat with no obvious signs of sloping.

3.2 Subsurface

The soil conditions observed at the exploration locations generally consisted of native alluvial sediments composed of alternating and interbedded layers of soft to stiff silt to clayey silt, and very loose to medium dense sand to silty sand. Trace, small organic fragments were observed in several samples obtained from the test borings.

Below a depth of approximately 15 feet beneath existing surface grades, the relative density of the sand deposits becomes medium dense to very dense as indicated by some of the test borings and the deeper CPT data. The CPT data also indicate that the alluvial sediments become predominately fine-grained below a depth of approximately 45 feet beneath existing surface grades, composed of soft to stiff silt to clayey silt deposits. CPT-2 indicates the presence of medium dense to very dense sand deposits underlying the predominant silt deposits at a depth of approximately 67 feet below existing surface grades.

The exceptions to this general condition were observed at Test Borings B-7, B-8, B-9, B-12, and B-13. In Test Boring B-7, we observed numerous organic peat inclusions at a depth of approximately 10 feet. The sample obtained at approximately 20 feet in Test Boring B-9 consisted of a partially decomposed tree trunk. We observed up to approximately four feet of fill material in Test Borings B-8, B-12, and B-13 composed of loose to medium dense gravel with silt and sand to silty gravel with sand.

The *Geologic Map of the Tacoma 1:100,000-Scale Quadrangle, Washington*, by J.E. Schuster, A.A. Cabibbo, J.F. Schilter, and I.J. Hubert (2015) maps the site as Alluvium (Qa). This map unit is consistent with the native soils observed in our field explorations.

The United States Department of Agriculture Natural Resources Conservation Service (NRCS) classifies the onsite soils as Pilchuck fine sand, Puyallup fine sandy loam, and Sultan silt loam materials. A soil horizon, consisting of these materials, is typically deposited by alluvial processes in the form of flood plains and is derived from alluvium deposited by the Puyallup River which is consistent with our exploratory findings and knowledge of the area's geologic setting.

The preceding discussion is intended to be a brief review of the soil conditions observed at the site. More detailed descriptions are presented on the Test Boring Logs and CPT Logs attached in Appendix A. The approximate locations of the Test Boring and CPTs are shown in attached Figure 2.

3.3 Groundwater

The site is underlain by a regional groundwater table residing in the alluvial sediments. Based on observations during drilling and measurements obtained from installed groundwater monitoring wells, groundwater was located at a depth of approximately 4.5 feet below existing grades in the western portion of the site to approximately 10 feet below existing grades in the eastern portion of the site at the time of our November exploration. Given the time of year our field work was completed, and our experience with groundwater conditions in the area, the groundwater levels observed during drilling likely represent near seasonal low levels.

To evaluate the seasonal weather influence, Test Borings B-11 and B-13 were converted to groundwater monitoring wells. The monitoring wells were instrumented with automatic level loggers. Based on data collected from December 2022 through March 29, 2023, this seasons high groundwater was recorded at a depth of 7.2 feet at Test Boring B-11 and 8 feet at Test Boring B-13. The fluctuation of the groundwater levels over the course of the study is shown in hydrographs presented in Appendix B of this report.

When referenced to existing surface elevations, the groundwater table is at approximately elevation 39 feet at Test Boring B-13 and 38.8 feet at Test Boring B-11. This indicates a slight approximately .1 percent groundwater flow gradient to the west. Projecting this gradient to western area of the site indicates the groundwater table would be around elevation 38.4 feet or about two to three feet below grade in this lower elevated portion of the site.

3.4 Geologically Hazardous Areas

Section 21.06.1210(1) of the City of Puyallup Municipal Code (PMC) defines geologic hazards as “...areas susceptible to erosion, landsliding, earthquake, volcanic activity or other potentially hazardous geological processes. Areas susceptible to these types of hazards are hereby designated as geologically hazardous areas and subject to the provisions of this chapter.” We have evaluated the site for these hazards in the following sections below.

3.4.1 Erosion Hazard Areas

Section 21.06.1210(3)(a) of the PMC defines erosion hazard areas as “...areas identified by the U.S. Department of Agriculture’s Natural Resources Conservation Service or identified by a special study as having a “moderate to severe,” “severe,” or “very severe” erosion potential.”

The soils observed on the site are classified as Pilchuck fine sand, Puyallup fine sandy loam, and Sultan silt loam by the United States Department of Agriculture Natural Resources Conservation Service (NRCS). Over the site with existing gradients, these soils will have a slight susceptibility to erosion when exposed. Therefore, the site does not present an erosion hazard per the PMC. Regardless, the site soils would be susceptible to some erosion when exposed during construction. In our opinion, proper implementation, and maintenance of Best Management Practices (BMPs) for erosion prevention and sediment control would adequately mitigate the erosion potential in the planned development area. Erosion protection measures as required by the City of Puyallup will need to be in place prior to and during grading activities at the site.

3.4.2 Landslide Hazard Areas

Section 21.06.1210(3)(b) of the PMC defines landslide hazard areas as “...areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include any areas susceptible to landslide because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors, and include, at a minimum, the following:

(i) Areas of historic failures, such as:

(A) Those areas delineated by the United States Department of Agriculture Natural Resources Conservation Service as having a significant limitation for building site development;

(B) Those coastal areas mapped as class u (unstable), uos (unstable old slides), and urs (unstable recent slides) in the Department of Ecology Washington coastal atlas; or

- (C) Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the United States Geological Survey or Washington Department of Natural Resources.
- (ii) Areas with all three of the following characteristics:
- (A) Slopes steeper than 15 percent;
 - (B) Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
 - (C) Springs or groundwater seepage.
- (iii) Areas that have shown movement during the holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of this epoch;
- (iv) Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;
- (v) Slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking;
- (vi) Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action, including stream channel migration zones;
- (vii) Areas that show evidence of, or are at risk from snow avalanches;
- (viii) Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; and
- (ix) Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet except areas composed of bedrock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.”

As stated above, the site’s topography is relatively flat with no obvious signs of sloping. There are no landslide hazard areas on or near the site.

3.4.3 Volcanic Hazard Areas

Section 21.06.1210(3)(d) of the PMC defines volcanic hazard areas as “...areas subject to pyroclastic flows, lava flows, debris avalanche, inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity. Volcanic hazard areas shall be classified as Case I or Case II lahars per the definitions in PMC 21.06.210. Pyroclastic-flow hazard zones and inundation zones for Case I and II lahars are identified in the report Sedimentology, Behavior, and Hazards of Debris Flows at Mount Rainier, Washington, U.S. Geological Survey Professional Paper 1547, 1995. All volcanic hazard areas regulated under this code are located within lahar time travel zone 3.”

The site is located within the Mount Rainier lahar hazard zone as shown on the USGS Mt. Rainier Lahar Hazard Map, dated November 9, 2016. Given the distance from Mt. Rainier and the general absence of pervasive lahar deposits observed in the CPTs and test borings, it is our opinion that the site meets the definition of a Case I volcanic hazard area per the PMC.

3.4.4 Seismic Hazard Areas

Section 21.06.1210(3)(c) of the PMC defines seismic hazard areas as "... areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, or tsunamis. Settlement and soil liquefaction conditions occur in areas underlain by cohesionless, loose, or soft-saturated soils of low density, typically in association with a shallow ground water table."

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sands underlying the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

The site is mapped as having a high susceptibility to soil liquefaction on the Washington Department of Natural Resources *Natural Hazards Single-Topic Map*.

Based on the soil and groundwater conditions observed at the site, we expected that the site soils would have the potential to liquefy. Therefore, we completed an analysis of soil liquefaction potential incorporating field soil strength values and soil types determined from the CPT's. An assumed depth to groundwater of five feet was used in the analysis based on depths to groundwater measured in the monitoring wells prior to the wet season. The analysis is based on a Magnitude 7 earthquake inducing ground motions having a peak ground acceleration (PGA) value of 0.5g. This acceleration represents an earthquake with a 2 percent probability of exceedance in 50 years.

The results of our analysis indicate soil liquefaction could occur during the design earthquake event, resulting in total settlements approaching approximately three-and-one-half to five inches, with one-half of that settlement likely being differential in nature. Results of the analysis are attached in Appendix C.

In our opinion, the potential settlement is borderline regarding structural impairment and should be reviewed by the project structural engineer. If the owner is not willing to accept the risk of building damage, requiring repair, should liquefaction-induced settlements occur, or if the structural engineer cannot design the structure to meet all governing life safety codes, including the life safety provisions of the current International Building Code, foundations should be supported on ground improved using vibrated stone columns designed to mitigate soil liquefaction settlements.

3.5 Seismic Site Class

As discussed, soil conditions at the site will be subject to the soil liquefaction phenomenon. Because of this condition, per the current International Building Code (IBC), subsurface conditions would be assigned Site Class “F”, which would require performing a site-specific seismic analysis to determine seismic forces for structural design. However, the IBC allows for using code derived seismic values for the soil conditions indicated if the buildings fundamental period is equal to or less than .5 seconds. We expect that this building will fall into this category. In this case, based on soil conditions encountered, Site Class “E” can be used to determine seismic design forces.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, development of the site as proposed is feasible from a geotechnical engineering standpoint. The primary geotechnical concern at the site is the presence of soil strata susceptible to consolidation under the planned building loads. The compressible soils consist of layers of very soft to stiff silt, in addition to collections and inclusions of organic peat, that vary in thickness across the site. These soils are compressible and, if not mitigated, will likely cause unacceptable levels of differential building settlement under expected static building loads.

Given the depth to the compressible silt layers, in our opinion, the potential post-construction building settlements can be mitigated by implementing a surcharge program. This would entail raising site grades to finish floor elevation and then placing an additional depth of surcharge fill for a period of time to induce settlements prior to application of building loads. Building construction can begin after completion of the surcharge program.

The building can be supported on conventional spread footings bearing on a minimum of two feet of structural fill. Depending upon final building grades, the existing granular fill observed at Test Borings B-8 and B-12, located in the eastern developed storage yard area, could serve as this structural fill layer provided it is re-compacted to achieve structural fill compaction requirements. The building floor and exterior pavements can be similarly supported.

If building schedules do not allow for a surcharge program to take place, or if the owner is unwilling to or cannot accept the risk of seismically induced building settlement, the building can be supported on ground improved by installing vibrated stone columns. If completed over the entire building footprint, this would preclude the need for a fill surcharge program. If stone columns are only used to improve ground conditions below building footings, surcharging to mitigate potential floor slab settlement is recommended.

The majority of the native and existing fill soils observed at the site contain a significant amount of fines and will be difficult to compact as structural fill when too wet. The ability to use native soil soils from site excavations as structural fill will depend upon its moisture content and the prevailing weather conditions at the time of construction.

If grading activities will take place during winter, the owner should be prepared to import clean granular material for use as structural fill and backfill. Alternatively, stabilizing the moisture in the native and existing fill soils with cement or lime can be considered.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, all vegetation and organic surface soils should be stripped and removed from the site. We expect surface stripping depths of about three to six inches will be required to remove the organic surficial soils. Organic soils will not be suitable for use as structural fill but may be used for limited depths in nonstructural areas or for landscaping purposes.

Demolition of existing structures should include removal of existing foundations and other buried utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

Prior to fill placement or construction of building foundations or site pavements, we recommend all exposed subgrade surfaces be observed by a representative of Terra Associates, Inc. to verify soil conditions are as expected and suitable for support. The contractor should be prepared to proofroll subgrade areas with heavy construction equipment to assist in evaluating the suitability of the bearing subgrade. If excessively yielding areas are observed and cannot be stabilized in place by compaction, the affected soils should be excavated and removed to firm bearing and grade restored with new structural fill. If the depth of excavation to remove unstable soils is excessive, use of a geotextile reinforcing/separation fabric, such as Mirafi 600X or equivalent, can be considered in conjunction with structural fill. Our experience has shown that, in general, a minimum of 18 to 24 inches of a clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

All building footings should obtain support on a minimum of two feet of granular structural fill, extending at least one foot laterally from the edge of footing. As discussed earlier, the existing granular fill observed at Test Borings B-8 and B-12 located in the eastern developed storage yard area, could serve as this structural fill layer provided it is re-compacted to achieve structural fill compaction requirements.

The majority of the native and existing fill soils observed at the site contain a sufficient percentage of fines (silt and clay size particles), which will make them difficult to re-compact as structural fill if they are too wet or too dry. Accordingly, the ability to use the soils from site excavations as structural fill will depend upon their moisture content and the prevailing weather conditions when site grading activities take place. Soils that are too wet to properly compact can be dried by aeration during dry weather conditions. Alternatively, treatment with cement or lime can be considered. If additives are used, additional Best Management Practices (BMPs) will need to be implemented to mitigate potential impacts to construction stormwater runoff.

If grading activities are planned during the wet winter months, or if they are initiated during the summer and extend into fall and winter, the contractor should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent.

4.3 Surcharge Program

We recommend surcharging the building area to limit building foundation and floor slab settlements to tolerable levels. For this procedure, we recommend placing structural fill in the building areas to the design floor elevation and then placing an additional four-foot depth of surcharge fill. The surcharge fill should extend a minimum of two feet beyond the building perimeter footing edge. This surcharge fill does not need to meet any special requirements other than having a minimum in-place unit weight of 120 pounds per cubic foot (pcf). However, it may be advisable to use a good quality fill to raise grades in other portions of the site, such as parking and driveway areas, if necessary.

In the western pavement areas where five to six feet of fill is required to establish design grades, the recommended full surcharge depth is not required. Here we recommend placing fill to the design final pavement elevation and allowing settlement under this fill loading to occur prior to pavement or utility construction.

Total settlement under the surcharge fill is estimated in the range of four to six inches. These settlements are expected to occur in about four to six weeks following full application of the building fill.

To verify the amount of settlement and the time rate of movement, the surcharge program should be monitored by installing settlement markers. The settlement markers should be installed on the existing grade prior to placing any building or preload fills. Once installed, elevations of both the fill height and marker should be taken twice weekly until the full height of the surcharge is in place. Once fully surcharged, readings should continue weekly until the anticipated settlements have occurred. A typical settlement marker detail is provided as Figure 3.

It is critical that the grading contractor recognize the importance of the settlement marker installations. All efforts must be made to protect the markers from damage during fill placement. It is difficult, if not impossible, to evaluate the progress of the surcharge program if the markers are damaged or destroyed by construction equipment. As a result, it may be necessary to install new markers and extend the surcharging time period in order to ensure that settlements have ceased and building construction can begin.

Potential long-term settlements due to secondary compression of the peat layers, which cannot be fully mitigated by surcharging, will also occur. The magnitude of this settlement will be greater in the early years diminishing with time. The approximate total settlement due to secondary compression is estimated to be 1.5 to 2 inches in 20 years. Approximately 50 percent of the total secondary settlement may be differential in nature due to the varying thickness of the peat layers. For floor slab design purposes, we estimate these differential settlements will occur over a distance of 100 feet.

4.4 Excavations

All excavations at the site associated with confined spaces, such as utility trenches, must be completed in accordance with local, state, and federal requirements. Based on regulations outlined in the Washington Industrial Safety and Health Act (WISHA), the fill soils would be classified as Type C soil.

Accordingly, temporary excavations in Type C soils should have their slopes laid back at an inclination of 1.5:1 (Horizontal:Vertical) or flatter, from the toe to the crest of the slope. All exposed temporary slope faces that will remain open for more than two days should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. If there is insufficient room to slope, the temporary excavation sides shoring will be required. Properly designed and installed shoring trench boxes can be used to support utility trench excavations where required.

Based on our study, groundwater should be anticipated within excavations extending below depths of about three to seven feet below existing site grades during the wet winter months. Excavations extending below these depths will likely encounter groundwater with volumes and flow rates sufficient to require some level of dewatering. Shallow excavations that do not extend more than two feet below the groundwater table can likely be dewatered by conventional sump-pumping procedures along with a system of collection trenches. Deeper excavation as is expected for construction of the stormwater detention facility will require dewatering by well points or isolated deep-pump wells. The dewatering system should be designed and installed by an experienced dewatering contractor.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

4.5 Foundations

In our opinion, following the successful implementation of the surcharge program, the buildings can be supported on conventional spread footing foundations bearing on structural fill as recommended in the Site Grading and Preparation section of this report. However, if the owner is not willing to accept the risk for building damage due to the potential for liquefaction induced settlements during an earthquake or it is determined that the estimated liquefaction settlements would preclude design of the structure the building shell to meet all governing life safety codes, including the life safety provisions of the current International Building Code, the building foundations should be supported on ground improved using vibrated stone columns designed to mitigate soil liquefaction settlements.

Spread Footings

In our opinion, following the completion of a successful surcharge program as outlined in Section 4.3, the building may be supported on conventional spread footing foundations. As noted, all foundations must be supported on a minimum of two feet of structural fill that extends laterally beyond the edge of the footing a minimum distance of one foot. Structural fill used for support of footings should consist of a granular import material meeting the grading recommendations for a wet weather structural fill.

Foundations exposed to the weather should bear at a minimum depth of one and one-half feet below adjacent exterior grades for frost protection. Interior foundations should be supported at a minimum depth of one foot below the finished floor elevation.

We recommend designing foundations for a net allowable bearing capacity of 2,500 psf. For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the expected building loads and this bearing stress applied, in general, total, and differential settlements should not exceed one inch and one-half inch, respectively. The differential settlement is expected to occur between perimeter wall and interior column locations.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings should be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We do not recommend including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be backfilled with structural fill, as described in Section 4.2 of this report. The values recommended include a safety factor of 1.5.

Ground Improvement

As noted earlier if the owner is unwilling to accept the risk of building damage due to liquefaction settlement, the building can be supported on ground improved using vibrated stone columns specifically designed to mitigate liquefaction settlement to tolerable levels. This method creates highly densified columns of graded aggregate that would extend through the upper loose and soft to medium stiff soils into the underlying medium dense to dense sand deposits. Due to the methods used to construct the columns, some improvement of the adjacent soils is also realized.

Moreover, these methods can provide liquefaction mitigation by providing drainage paths and reduced pore pressures during ground shaking, and by constructing stiff, non-liquefiable inclusions in the soils. Once constructed, conventional spread footing foundations can be designed to bear immediately above the stone columns.

These ground improvement techniques are typically completed on a design/build approach with both design and construction completed by a geotechnical specialty contractor. We can assist in contacting and selecting the specialty contractor, if desired.

4.6 Slab on Grade Floors

Suitable support for slab on grade floors will be provided by subgrade prepared as recommended in Section 4.2 of this report following implementation of the surcharge program. Immediately below the floor slab, we recommend placing a four-inch-thick capillary break layer composed of clean, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture transmission through the slab that affects floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained. We recommend floor designers and contractors refer to the updated American Concrete Institute (ACI) Manual of Concrete Practice for further information regarding vapor barrier installation below slab-on-grade floors.

With the floor subgrade prepared as recommended, a subgrade modulus (k_s) value of 100 pounds per square inch per inch of deflection (pci) can be used in design of the building floor slabs subject to heavy lift truck traffic.

4.7 Lateral Earth Pressures for Wall Design

The magnitude of earth pressure development on retaining walls partly depend upon the quality of wall backfill. Where fill is placed behind retaining walls, we recommend placing and compacting it as structural fill. The fill should be compacted to a minimum of 90 percent of its maximum dry unit weight as determined by ASTM Test Designation D-1557 (Modified Proctor). To guard against the build-up of hydrostatic pressure, wall drainage must also be installed. We recommend that wall drainage consist of a minimum 12-inch-thick layer of washed gravel placed adjacent to the wall. Alternatively, a composite drainage panel such as Mirafi G100N or equal can be used. A four-inch diameter perforated pipe should be placed on a bed of gravel along the base of the wall footing and directed to a suitable outlet. A typical wall drainage detail is attached as Figure 4.

With granular backfill placed and compacted as recommended and drainage properly installed, we recommend designing restrained (not free to deflect) retaining walls for an at-rest earth pressure equivalent to a fluid weighing 50 pcf. A value of 35 pcf may be used for the case where the wall is unrestrained. These values do not include other surcharge loading such as from fill backslopes or adjacent footings that may act on the wall. If such conditions exist, then the imposed loading must be included in wall design. Values of friction at the base of wall foundations and passive earth pressure that are used in design to resist lateral loads are provided in Section 4.5 of this report.

4.8 Stormwater Detention Vault

With the eastern detention vault foundation bearing at a depth of 15 to 20 feet below existing site grades, soils that will likely be exposed will consist of medium dense fine to medium sand. These sands will be suitable for support of the detention vault and no over excavation and replacement with crushed rock would be required for bearing purposes. For constructability however, it would be advisable to construct a working mat to avoid excessive disturbance of the native sand subgrade. For this purpose, we recommend over-excavating the by 6-inches and restoring grade with clean 1 ¼-inch to 2-inch crushed rock. Additionally, any organic peat or organic inclusions exposed should be removed to expose competent native soils. Vault foundations supported in this manner can be designed for an allowable bearing capacity of 2,500 psf. For short-term loads, such as seismic, a one-third increase in this allowable capacity can be used.

Vault walls should be designed as below-grade retaining walls following the parameters outline in Section 4.7 of this report. Any portion of the wall for which drainage cannot be provided should be designed for an earth pressure equivalent to a fluid weighing 85 pcf. Where applicable, a uniform horizontal traffic value of 75 psf should be included in the design of vault walls.

The detention vault will be subject to uplift pressures if drainage is not provided for the detention vault walls. For design, uplift forces should be based on a groundwater elevation equal to elevation 40 feet. The weight of the structure and the weight of the soil above its foundation will provide resistance to uplift. A soil unit weight of 125 pcf can be used in designing the structure to resist uplift forces.

4.9 Drainage

Infiltration Feasibility

In general, based on the shallow seasonal water table and the fine-grained nature of the soils observed across the site, it is our opinion that infiltration should not be relied on to manage development stormwater runoff on a whole scale basis. Conventional stormwater detention with controlled release should be used to manage a majority of the stormwater runoff.

It may be feasible to use low impact development (LID) features such as shallow bioretention cells or permeable pavements for managing a minor component of the runoff. Bioretention cells could be considered along the northern margin of the site where shallow soil conditions generally consist of silty sand and sand with silt with a few silt seams. Designing these elements with an infiltration component equivalent to .2 inches per hour would be feasible in our opinion. Permeable concrete pavement could also be considered across the site with design based on an infiltration rate of .05 inches per hour.

Surface

Final exterior grades should promote free and positive drainage away from the building areas. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the building perimeter, except in paved locations. In paved locations, a minimum gradient of two percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the structures.

Subsurface

Foundation drains should be installed where floor slab wetness or interior moisture due to water vapor is not desired. Where foundation drainage is installed, we recommend it consist of four-inch diameter perforated PVC pipe that is enveloped in washed ½- to ¾-inch gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. The foundation drains and roof downspouts should be tightlined separately to an approved point of controlled discharge.

4.10 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA), or City of Puyallup specifications. As a minimum, trench backfill should be placed and compacted as structural fill, as described in Section 4.2 of this report. As noted, the existing fill and native soils are moisture sensitive and close moisture control will be required to facilitate proper compaction. If utility construction takes place during the wet winter months, it will likely be necessary to import suitable wet weather fill for utility trench backfilling.

The utility contractor should also be prepared for encountering unstable loose native soils below the pipe invert elevations. If not removed from below the pipe and replaced with crushed rock or additional bedding material, pipe deflections may occur as a result of the soil yielding and compressing in response to loading imposed during trench backfilling. The need to over-excavate and stabilize the pipe foundation before backfilling should be evaluated by observation and testing during construction.

4.11 Pavements

Pavement subgrades should be prepared as described in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proof rolled with heavy rubber-tired construction equipment such as a loaded 10-yard dump truck to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. New pavements for the project will consist of drive aisles accessing parking spaces and storage areas. Accordingly, we expect traffic will consist of cars and light trucks, along with heavy traffic in the form of tractor-trailer rigs. For design considerations, we have assumed traffic in parking and in car/light truck access pavement areas can be represented by an 18-kip Equivalent Single Axle Loading (ESAL) of 50,000 over a 20-year design life. For heavy traffic pavement areas, we have assumed an ESAL of 300,000 would be representative of the expected loading. These ESALs represent loading approximately equivalent to 3 and 18, loaded (80,000-pound GVW) tractor-trailer rigs traversing the pavement daily in each area, respectively. If higher truck traffic volumes are expected, we should be notified and asked to review and revise the following pavement recommendations, as needed.

With a stable subgrade prepared as recommended, we recommend the following options for pavement sections:

Light traffic and parking:

- Two inches of hot mix asphalt (HMA) over four inches of crushed rock base (CRB).
- Full depth HMA – four inches.

Heavy traffic:

- Three inches of HMA over eight inches of CRB.
- Full depth HMA – six inches.

For exterior Portland cement concrete (PCC) pavement, we recommend the following:

- Six inches of PCC over two inches of CRB.
 - 28-day compressive strength – 4,000 psi.
 - Control joints spaced at a maximum of 15 feet.

Soil cement stabilization or constructing a soil cement base for support of the pavement section can also be considered as an alternative to the above conventional pavement sections. Assuming a properly constructed soil cement base having a minimum thickness of 12 inches and a minimum seven-day compressive strength of 100 pounds per square inch (psi), a minimum HMA pavement thickness of three inches would be required for the heavy traffic areas. The design of the soil cement base should be completed using samples of the subgrade exposed at the time of construction.

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for half-inch class HMA, PCC, and CRB.

Long-term pavement performance will depend upon surface drainage. A poorly drained pavement section will be subject to premature failure resulting from surface water infiltrating the subgrade soils and reducing their supporting capability. For optimum performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks as they occur. In addition, because of long-term secondary compression of the peat material, some subsidence of the pavement surface resulting in depressed bird bath areas should be expected. Above normal maintenance of the pavement requiring repair of failed pavement in these areas should be planned for.

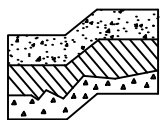
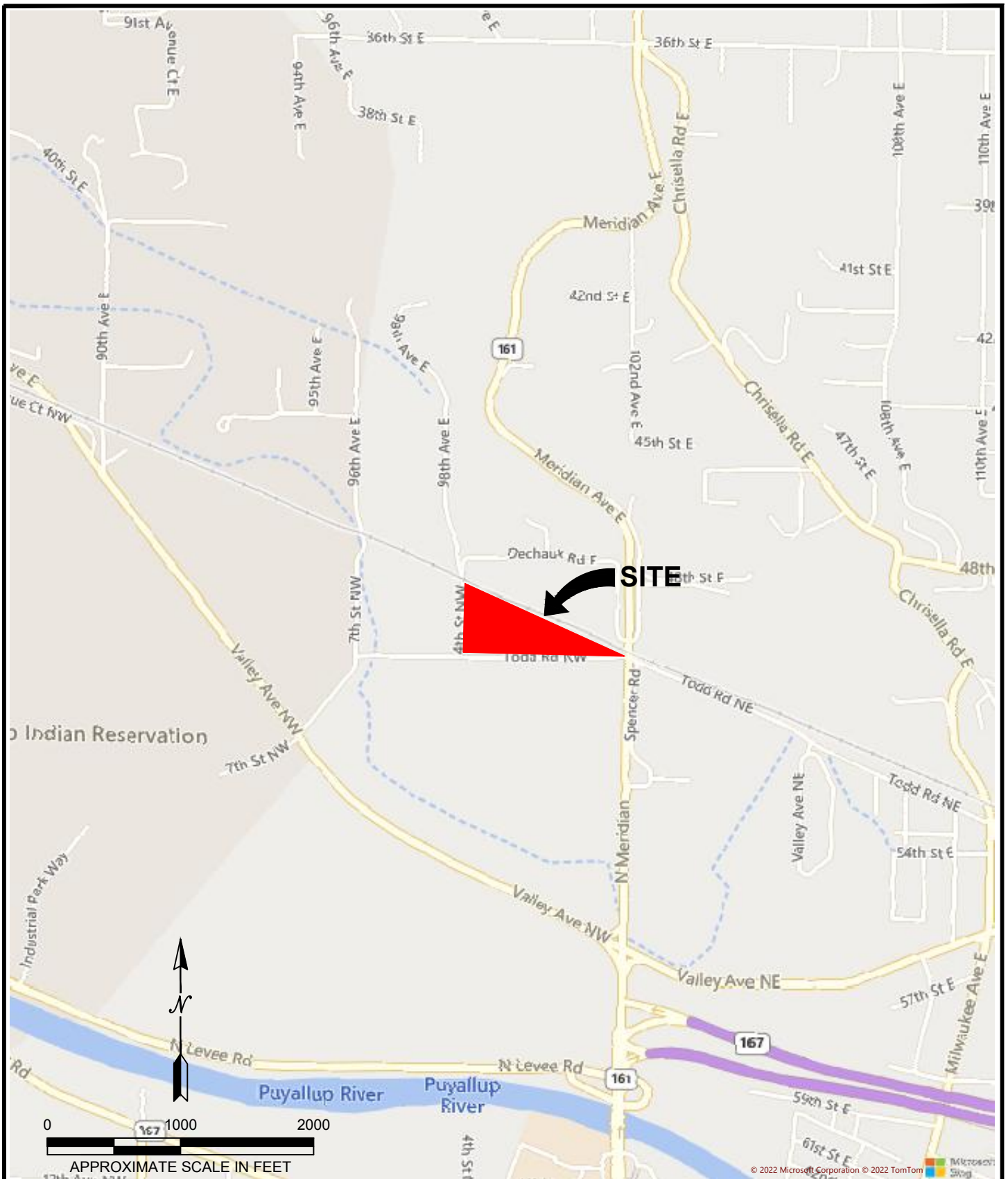
5.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final design drawings and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the PSE Operational Training Center project in Puyallup, Washington. This report is for the exclusive use of Trammell Crow Company and their authorized representatives.

The analyses and recommendations presented in this report are preliminary in nature and are based on data obtained from the test borings and CPTs completed on the site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



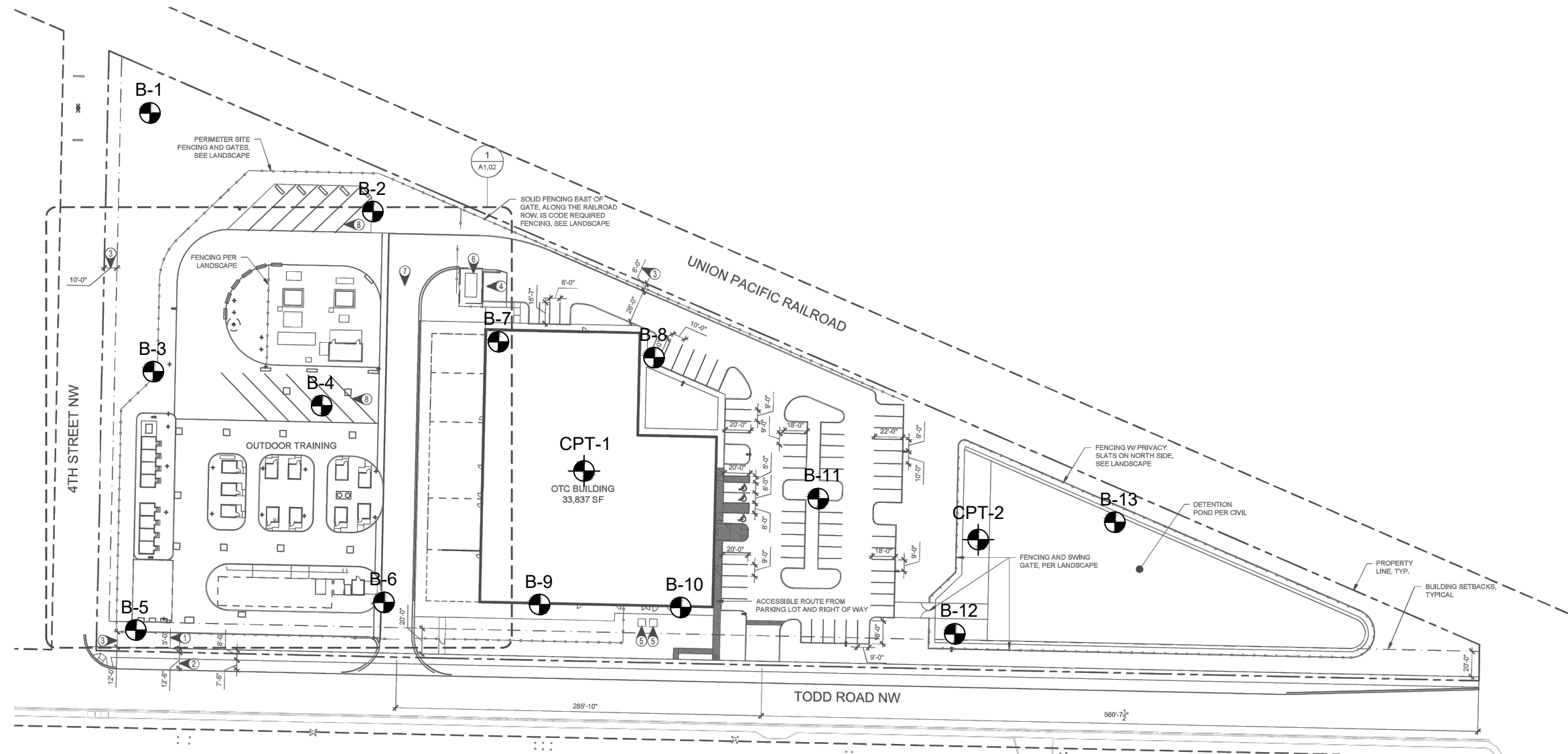
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VICINITY MAP
PSE OPERATION TRAINING CENTER
PUYALLUP, WASHINGTON

Proj.No. T-8829

Date: AUG 2023

Figure 1



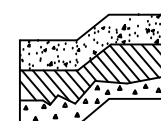
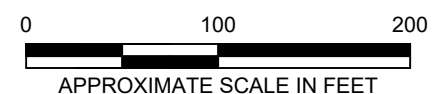
NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY CLIENT.

LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE CONE PENETRATION TEST



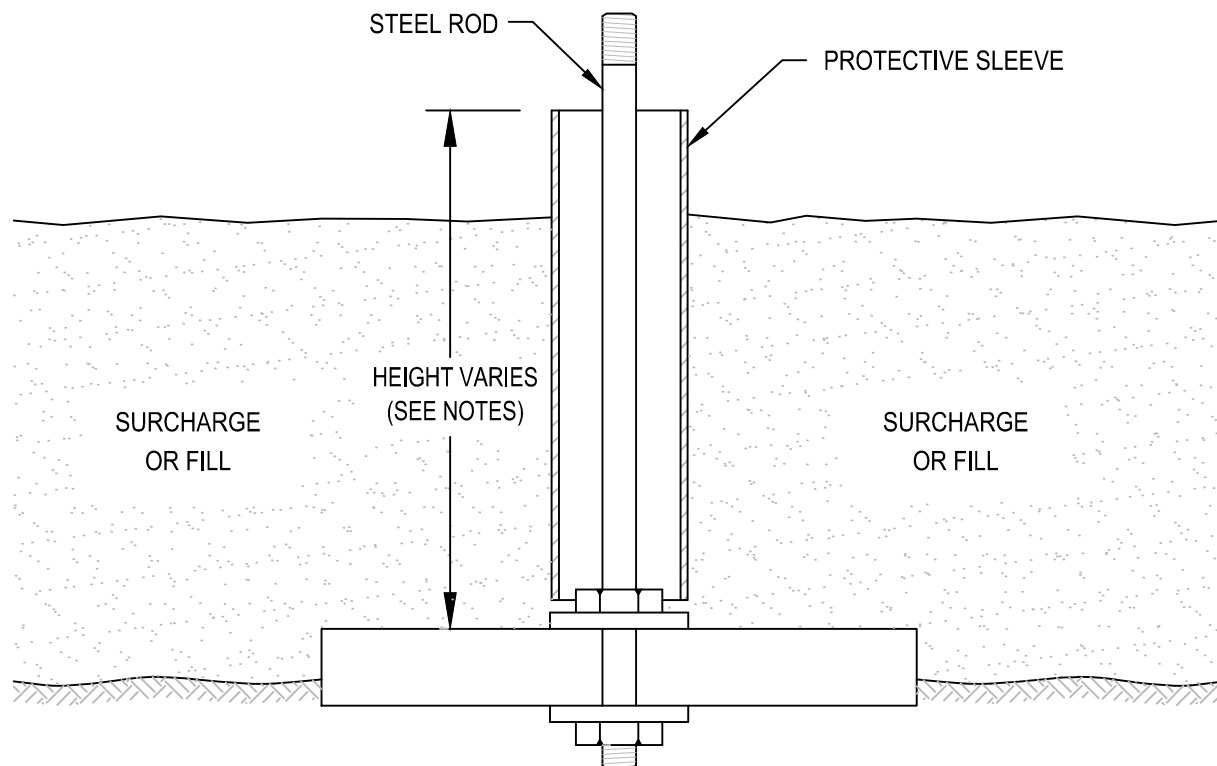
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EXPLORATION LOCATION PLAN
PSE OPERATION TRAINING CENTER
PUYALLUP, WASHINGTON

Proj.No. T-8829

Date: AUG 2023

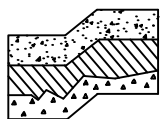
Figure 2



NOT TO SCALE

NOTES:

1. BASE CONSISTS OF 3/4" THICK, 2'x2' PLYWOOD WITH CENTER DRILLED 5/8" DIAMETER HOLE.
2. BEDDING MATERIAL, IF REQUIRED, SHOULD CONSIST OF CLEAN COARSE SAND.
3. MARKER ROD IS 1/2" DIAMETER STEEL ROD THREADED AT BOTH ENDS.
4. MARKER ROD IS ATTACHED TO BASE BY NUT AND WASHER ON EACH SIDE OF BASE.
5. PROTECTIVE SLEEVE SURROUNDING MARKER ROD SHOULD CONSIST OF 2" DIAMETER PLASTIC TUBING. SLEEVE IS NOT ATTACHED TO ROD OR BASE.
6. ADDITIONAL SECTIONS OF STEEL ROD CAN BE CONNECTED WITH THREADED COUPLINGS.
7. ADDITIONAL SECTIONS OF PLASTIC PROTECTIVE SLEEVE CAN BE CONNECTED WITH PRESS-FIT PLASTIC COUPLINGS.
8. STEEL MARKER ROD SHOULD EXTEND AT LEAST 6" ABOVE TOP OF PLASTIC PROTECTIVE SLEEVE.
9. PLASTIC PROTECTIVE SLEEVE SHOULD EXTEND AT LEAST 1" ABOVE TOP OF FILL SURFACE.



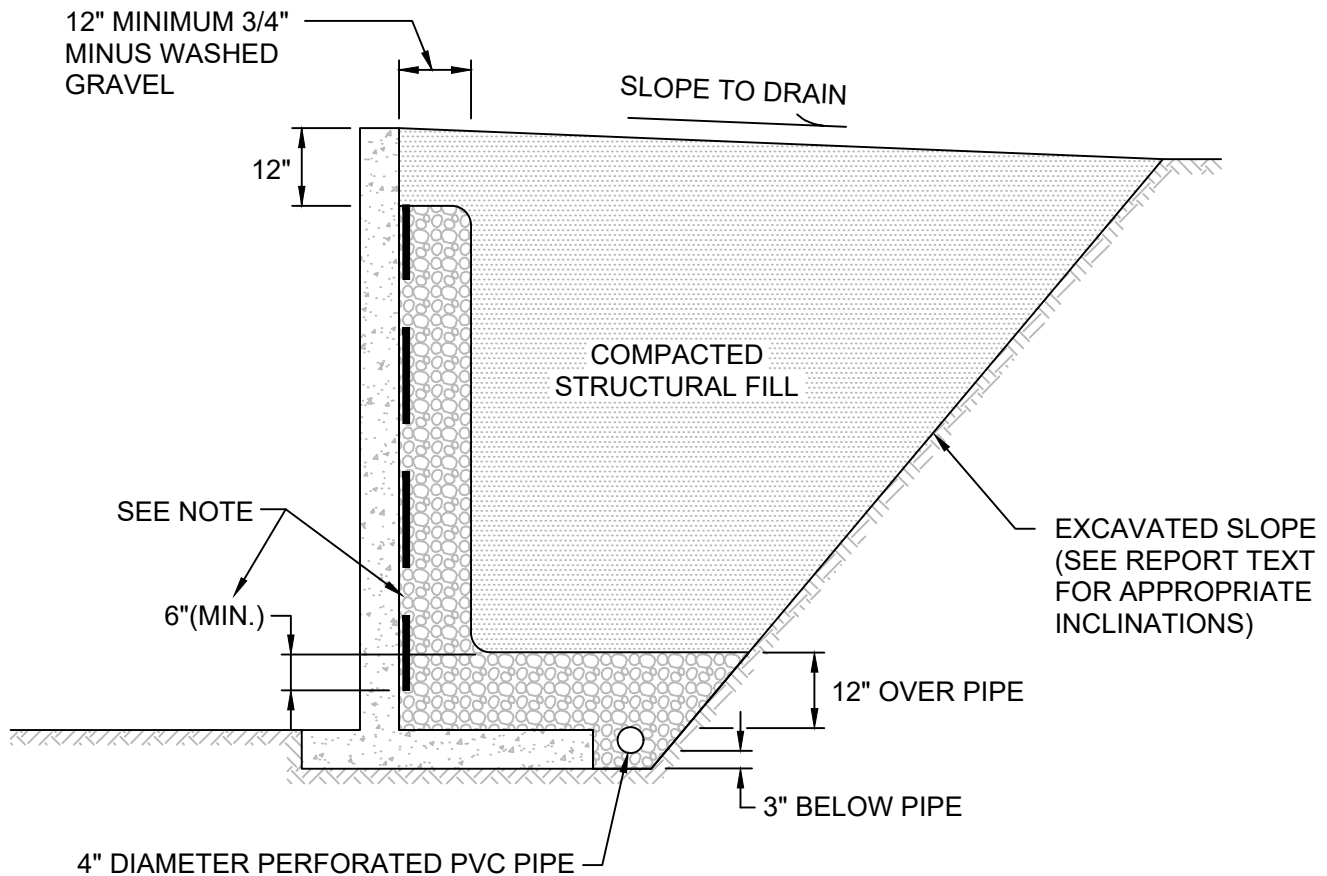
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SETTLEMENT MARKER DETAIL
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Proj.No. T-8829

Date: AUG 2023

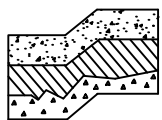
Figure 3



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.



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TYPICAL WALL DRAINAGE DETAIL
PSE OPERATION TRAINING CENTER
PUYALLUP, WASHINGTON

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Date: AUG 2023

Figure 4

APPENDIX A FIELD EXPLORATION AND LABORATORY TESTING

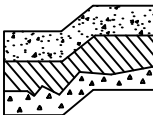
PSE Operational Training Center Puyallup, Washington

On November 16, 2022, and November 17, 2022, we observed soil conditions at 13 test borings drilled to depths of approximately 10 to 30 feet below existing surface grades. On November 18, 2022, In-Situ Engineering, under subcontract with Terra Associates, Inc., performed 2 cone penetration tests (CPTs). Test boring and CPT locations were determined in the field by measuring from existing site features. The approximate locations of the test borings and CPTs are shown on the attached Exploration Location Plan, Figure 2. Test Boring Logs are attached as Figures A-2 through A-14.

A geotechnical engineer from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each test boring, obtained representative soil samples, and recorded water levels observed during drilling. During drilling, soil samples were obtained in general accordance with ASTM Test Designation D-1586. Using this procedure, a 2-inch (outside diameter) split barrel sampler is driven into the ground 18 inches using a 140-pound hammer free falling from a height of 30 inches. The number of blows required to drive the sampler 12 inches after an initial 6-inch set is referred to as the Standard Penetration Resistance value or N value. This is an index related to the consistency of cohesive soils and relative density of cohesionless materials. N values obtained for each sampling interval are recorded on the Test Boring Logs, Figures A-2 through A-14. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test borings were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Boring Logs. Grain size analyses were performed on select soil samples. The results are shown on Figures A-15 and A-16.

InSitu Engineering, under subcontract with Terra Associates, Inc., conducted two electric CPTs at locations selected by Terra Associates, Inc. which are shown in Figure 2. The CPTs were advanced to depths of 60 to 70 feet below the surface. The CPT was instrumented, and an approximately 1.5-inch diameter cone was pushed into the ground at a constant rate. During advancement, continuous measurements are made of the resistance to penetration of the cone and the friction of the outer surface of the sleeve. The cone is also equipped with a porous filter and a pressure transducer for measuring groundwater or pore water pressure generated. Measurements of tip and sleeve frictional resistance, pore pressure, and interpreted soil conditions are summarized in graphical form on the attached CPT Logs.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS More than 50% material larger than No. 200 sieve size	GRAVELS More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
			SP	Poorly-graded sands, sands with gravel, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS More than 50% material smaller than No. 200 sieve size	SILTS AND CLAYS Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity. (Lean clay)
			OL	Organic silts and organic clays of low plasticity.
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity. (Fat clay)
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.
DEFINITION OF TERMS AND SYMBOLS				
COHESIONLESS	Standard Penetration Resistance in Blows/Foot		I2" OUTSIDE DIAMETER SPILT SPOON SAMPLER II2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER ▼WATER LEVEL (Date) TrTORVANE READINGS, tsf PpPENETROMETER READING, tsf DDDRY DENSITY, pounds per cubic foot LLLIQUID LIMIT, percent PIPLASTIC INDEX NSTANDARD PENETRATION, blows per foot	
	Density			
Very Loose	0-4			
Loose	4-10			
Medium Dense	10-30			
Dense	30-50			
Very Dense	>50			
COHESIVE	Standard Penetration Resistance in Blows/Foot			
	Consistency			
Very Soft	0-2			
Soft	2-4			
Medium Stiff	4-8			
Stiff	8-16			
Very Stiff	16-32			
Hard	>32			
 Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences			UNIFIED SOIL CLASSIFICATION SYSTEM PSE OPERATION TRAINING CENTER PUYALLUP, WASHINGTON	
			Proj.No. T-8829	Date: AUG 2023

LOG OF BORING NO. B-1

Figure No. A-2

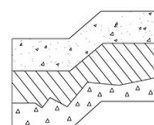
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 4.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot			Moisture Content (%)
				10	30	50	
0		Blackish-gray silty SAND, fine to coarse sand, moist to wet, trace rootlets, occasional silt seam. (SM)	Loose				
5							
10		Blackish-gray SAND with silt, fine to coarse sand, wet, trace small organic fragments. (SP-SM)					
15							

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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LOG OF BORING NO. B-2

Figure No. A-3

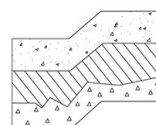
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 4.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		Blackish-gray SAND, fine to medium sand, moist, trace rootlets, occasional sandy silt seam. (SP)	Loose						9	10.1
5		Gray sandy SILT, fine sand, wet, occasional clayey silt layer, occasional rootlet. (ML)							6	31.6
		Gray clayey SILT, wet, trace rootlets, interbedded sand seams. (ML)	Soft						2	52.3
10			Stiff						9	31.1
		Blackish-gray SAND, fine to coarse sand, wet, interbedded silt seams. (SP)	Loose							27.5
		Test Boring terminated at approximately 10 feet. Groundwater seepage observed at approximately 4.5 feet.								
15										

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LOG OF BORING NO. B-3

Figure No. A-4

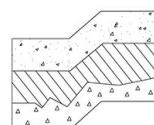
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 4.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		Gray SILT, moist, mottled, occasional rootlet, occasional sand seam. (ML)	Medium Stiff						5	35.4
5		Gray clayey SILT, wet, occasional rootlet. (ML)	Soft						2	36.7
		Blackish-gray SAND with silt, fine to coarse sand, wet, occasional small organic fragment, occasional clayey silt seam. (SP-SM)	Loose						5	27.3
10									6	29.0
		Test Boring terminated at approximately 10 feet. Groundwater seepage observed at approximately 4.5 feet.								
15										

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LOG OF BORING NO. B-4

Figure No. A-5

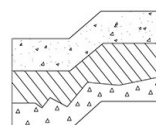
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 4.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot						Moisture Content (%)	
				10	30	50					
0		Gray SILT, moist, generally mottled, localized oxidized laminations, occasional rootlet, occasional charcoal inclusion. (ML)	Soft	•						3	38.7
5		Blackish-gray to gray clayey SILT, wet, mottled, occasional rootlet, occasional sand with silt layer. (ML)			•						2
		Interbedded sand seams observed	Medium Stiff	•						8	31.9 23.7
10		Blackish-gray SAND, fine to coarse sand, wet, trace gravel, occasional silt seam. (SP)	Loose	•						7	24.8
15		Test Boring terminated at approximately 10 feet. Groundwater seepage observed at approximately 4.5 feet.									

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LOG OF BORING NO. B-5

Figure No. A-6

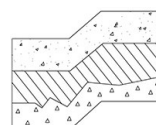
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 4.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		Alternating layers of brownish-gray silty SAND and sandy SILT, fine to medium sand, moist, mottled, trace rootlets. (SM/ML)	Very Loose	●					3	27.7
5		Gray clayey SILT, wet, mottled, trace sand, occasional rootlet. (ML)	Soft	●					2	40.6
			Medium Stiff	●					6	36.8
		Blackish-gray SAND with silt, fine to medium sand, wet, occasional silt seam. (SP-SM)	Loose	●						25.2
10		Blackish-gray SAND, fine to coarse sand, wet, occasional silt layer. (SP)	Very Loose	●					3	26.1
		Test Boring terminated at approximately 10 feet. Groundwater seepage observed at approximately 4.5 feet.								
15										

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LOG OF BORING NO. B-6

Figure No. A-7

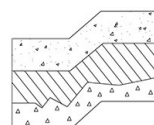
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 17, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 6 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot			Moisture Content (%)
				10	30	50	
0		Brownish-gray silty SAND, fine sand, moist, occasional rootlet, occasional clayey silt layer. (SM)	Loose				
5		Alternating layers of silty SAND and sandy SILT, fine sand, moist to wet, mottled, occasional sand seam. (SM/ML)	Very Loose				3
		Gray SILT, moist to wet, mottled, interbedded sandy silt layers, occasional sand seam. (ML)	Soft				4
10		Gray clayey SILT, moist to wet, oxidized laminations. (ML)					3
15		Test Boring terminated at approximately 10 feet. Groundwater seepage observed at approximately 6 feet.					

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LOG OF BORING NO. B-7

Figure No. A-8

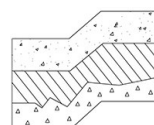
Project: PSE Operational Training Facility Project No: T-8829 Date Drilled: November 16, 2022

Client: Trammel Crow Company Driller: BoreTec Logged By: MJX

Location: Puyallup, Washington Depth to Groundwater: 6 ft Approx. Elev: NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		Brownish-gray silty SAND, fine sand, moist to wet, slightly mottled, trace sandy silt seams, occasional rootlet. (SM)	Very Loose	●					3	18.9
5			Loose	●					5	38.0
		Brownish-gray SAND with silt, fine to medium sand, wet, trace silt layers. (SP-SM)		●					8	29.0
		Gray clayey SILT, moist, trace small organic fragments, interbedded sand layers. (ML)	Soft	●					3	42.2
10		*Numerous organic PEAT inclusions observed in upper 6 inches of sample*								
		Blackish-gray SAND with silt, fine to medium sand, wet, occasional silt layer. (SP-SM)	Loose	●					9	29.3
			Medium Dense		●				17	29.1
15										
		Gray SILT, moist, occasional small organic fragment, interbedded and inundated sand layers. (ML)	Very Stiff		●				19	27.9
20		Test Boring terminated at approximately 20 feet, Groundwater seepage observed at approximately 6 feet.								
25										

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LOG OF BORING NO. B-8

Figure No. A-9

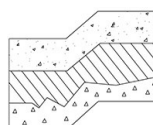
Project: PSE Operational Training Facility Project No: T-8829 Date Drilled: November 16, 2022

Client: Trammel Crow Company Driller: BoreTec Logged By: MJX

Location: Puyallup, Washington Depth to Groundwater: 10 ft Approx. Elev: NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		FILL: Gray silty GRAVEL with sand, fine to coarse sand, fine to coarse gravel, wet, trace rootlets. (GM)	Loose	•					5	5.6
5		Brownish-gray clayey SILT, moist, mottled, trace sand seams, occasional rootlet. (ML)	Medium Stiff	•					5	30.4 16.8
		Brownish-gray SAND with silt, fine to medium sand, moist, occasional silt layer. (SP-SM)		•					5	36.0
10		Gray sandy SILT, fine to medium sand, moist, mottled, trace sand seams. (ML)	Loose							
		Blackish-gray SAND with silt, fine to coarse sand, wet, occasional silt layer. (SP-SM)	Medium Dense	•					11	26.4
		Gray SILT, moist to wet, trace sand seams, trace fine gravel. (ML)	Medium Stiff	•					5	44.4
15		Blackish-gray SAND with silt, fine to medium sand, wet, occasional fine gravel. (SP-SM)		•					13	28.6
20		Dark gray SAND with silt, fine to medium sand, wet, occasional fine gravel, interbedded silt layers. (SP-SM)	Medium Dense		•				20	27.8
25		Blackish-gray SAND with silt, fine to medium sand, wet, interbedded silt layers. (SP-SM)			•				24	27.6
30			Dense			•			31	24.2
35		Test Boring terminated at approximately 30 feet. Groundwater seepage observed at approximately 10 feet.								

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LOG OF BORING NO. B-9

Figure No. A-10

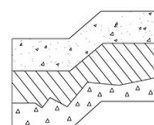
Project: PSE Operational Training Facility Project No: T-8829 Date Drilled: November 16, 2022

Client: Trammel Crow Company Driller: BoreTec Logged By: MJX

Location: Puyallup, Washington Depth to Groundwater: 7.5 ft Approx. Elev: NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		Brownish-gray silty SAND, fine sand, moist, occasional gravel, occasional rootlet, interbedded sand seams, interbedded silt seams. (SM)	Loose	•					6	16.3
5				•					5	17.8
7.5		Gray sandy SILT, fine sand, moist to wet, mottled, interbedded and inundated sand seams. (ML)		•					7	33.5
10		Gray clayey SILT, moist to wet, occasional localized mottling, occasional localized oxidized lamination. (ML)	Medium Stiff	•					6	42.8
12.5		Gray SILT, wet, occasional small organic fragment. (ML)		•					4	40.4
15		Blackish-gray SAND with silt, fine to medium sand, wet, interbedded silt layers. (SP-SM)	Loose	•					9	30.7
20		Light brown organic PEAT, wet, fibrous, trace sand. (PT) (Partially decomposed tree trunk)	Very Loose	•					3	211.4
25		Gray sandy SILT, fine to medium sand, wet, interbedded silty sand layers. (ML)	Medium Dense			•			26	33.2
30		Gray SILT with sand, fine to medium sand, wet, interbedded silty sand layers. (ML)	Stiff		•				13	32.2
		Test Boring terminated at approximately 30 feet.								
		Groundwater seepage observed at approximately 7.5 feet.								
35										

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LOG OF BORING NO. B-10

Figure No. A-11

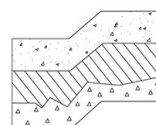
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 16, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 10 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot			Moisture Content (%)		
				10	30	50			
0		Grayish-brown sandy SILT, fine sand, moist, localized mottling, localized oxidized laminations, trace small organic fragments, interbedded fine sand layers. (ML)	Loose	•				7	12.9
5				•				5	23.3
		Brownish-gray SAND, fine to medium sand, moist, occasional silt seam. (SP)		•				6	11.3
10		Gray SILT, moist to wet, oxidized laminations, trace small organic fragments, interbedded and inundated sand layers. (ML)	Medium Stiff	•				4	36.8
			Stiff	•				10	35.2
15		Gray SAND with silt, fine to medium sand, wet, interbedded silt layers. (SP-SM)	Medium Dense	•				14	28.4
20		Gray sandy SILT, fine sand, moist to wet, occasional silt seam, occasional wood waste inclusion. (ML)		•				13	32.6
		Test Boring terminated at approximately 20 feet. Groundwater seepage observed at approximately 10 feet.							
25									

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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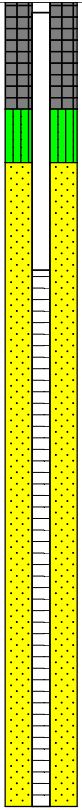
LOG OF BORING NO. B-11

Figure No. A-12

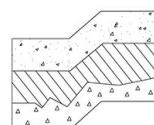
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 16, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 10 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot			Moisture Content (%)	Observ. Well	
				10	30	50			
0		Brownish-gray SILT with sand, fine sand, moist, mottled, trace rootlets. (ML)	Medium Stiff	•			4	36.6	
5		Brownish-gray silty SAND, fine sand, moist to wet, interbedded silt with sand layers. (SM)	Loose	•			4	24.3	
		Gray SAND with silt, fine to medium sand, moist to wet, interbedded and mottled silty sand and silt layers. (SP-SM)		•			5	28.2	
10		Gray SILT, moist to wet, interbedded and inundated sand with silt layers. (ML)		•			4	30.7	
		Gray SAND with silt, fine to medium sand, wet, occasional silt layer. (SP-SM)	Medium Dense	•			11	31.2	
20		Test Boring terminated at approximately 15 feet. Groundwater seepage observed at approximately 10 feet. Boring converted to groundwater monitoring well with monument no. BNV 571.							

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LOG OF BORING NO. B-12

Figure No. A-13

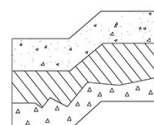
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 16, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 9 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot					Moisture Content (%)	
				10	30	50				
0		FILL: Gray GRAVEL with silt and sand, fine to coarse sand, fine to coarse gravel, moist, scattered rootlets. (GP-GM)	Loose						8	9.1
5		Gray SILT, moist, mottled, trace sand seams. (ML)	Stiff						11	32.5
		Brown SAND, fine to coarse sand, moist, (SP)	Medium Dense						10	9.6
		Gray SAND with silt, fine to coarse sand, moist to wet, trace gravel, occasional silt seam. (SP-SM)							11	16.3
10		Blackish-gray SAND, fine to coarse sand, wet, trace fine gravel, trace silt. (SP)							12	24.7
15			Loose						9	18.7
		Test Boring terminated at approximately 15 feet. Groundwater seepage observed at approximately 9 feet.								19.8
20										

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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Geology and
Environmental Earth Sciences

LOG OF BORING NO. B-13

Figure No. A-14

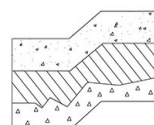
Project: PSE Operational Training Facility **Project No:** T-8829 **Date Drilled:** November 16, 2022

Client: Trammel Crow Company **Driller:** BoreTec **Logged By:** MJX

Location: Puyallup, Washington **Depth to Groundwater:** 10 ft **Approx. Elev:** NA

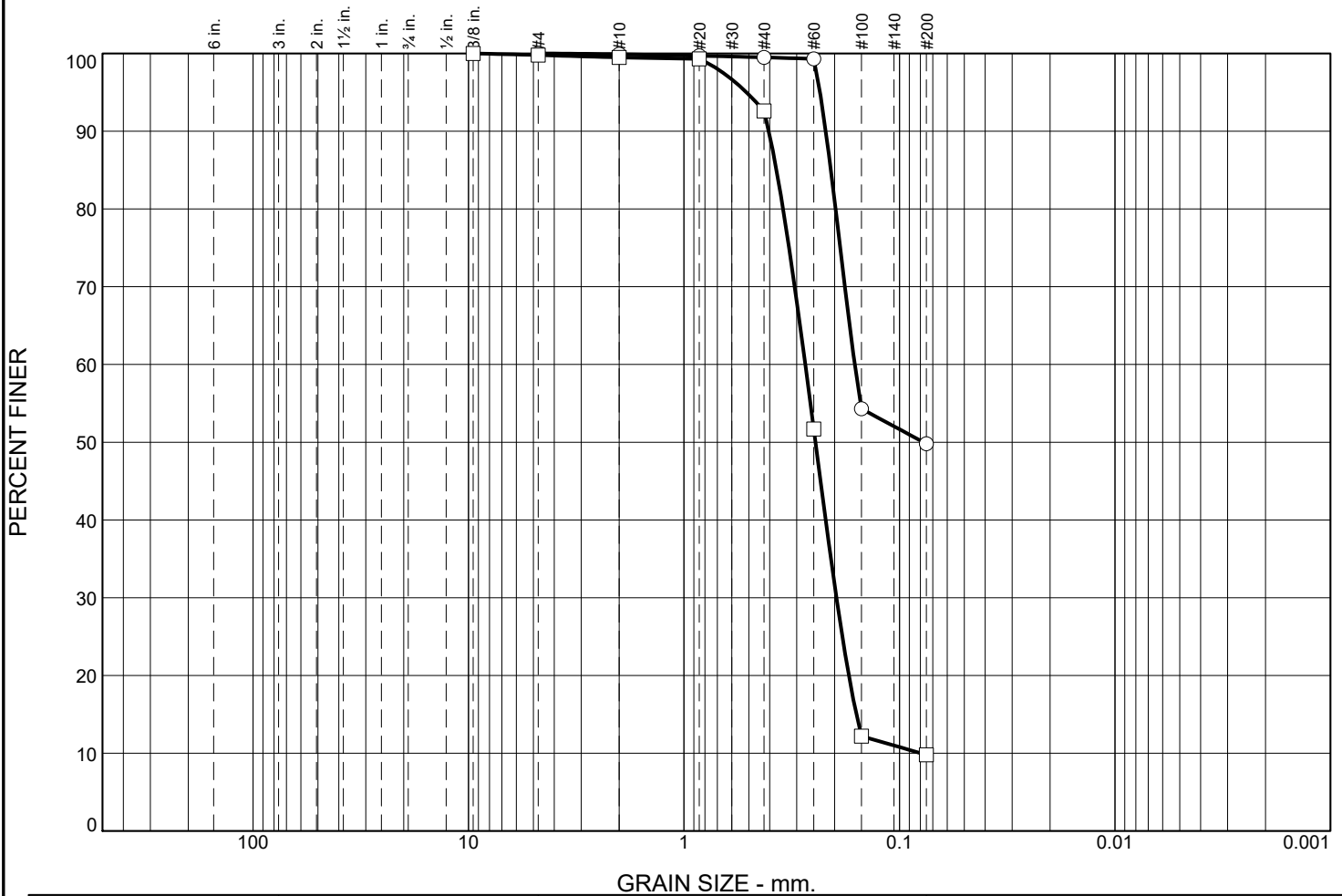
Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot			Moisture Content (%)	Observ. Well
				10	30	50		
0		FILL: Gray GRAVEL with silt and sand, fine to coarse sand, fine to coarse gravel, moist. (GP-GM)	Medium Dense				14	9.9
5		Brownish-gray sandy SILT, fine sand, moist, mottled, occasional gravel, occasional rootlet. (ML)	Loose				4	22.3
10		Gray SILT, moist to wet, oxidized laminations, trace sand, occasional small organic fragment, interbedded sand with silt and silty sand layers. (ML)	Medium Stiff				8	20.1
15							5	36.5
20							8	26.5
25		Blackish-gray SAND with silt, fine to medium sand, wet, occasional fine gravel, interbedded silty sand and silt layers. (SP-SM)	Medium Dense				10	31.2
30							29	25.0
35							16	26.6
40							24	24.9
45		Test Boring terminated at approximately 30 feet.						
50		Groundwater seepage observed at approximately 10 feet.						
55		Boring converted to groundwater monitoring well with monument no. BNV 572.						

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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Particle Size Distribution Report



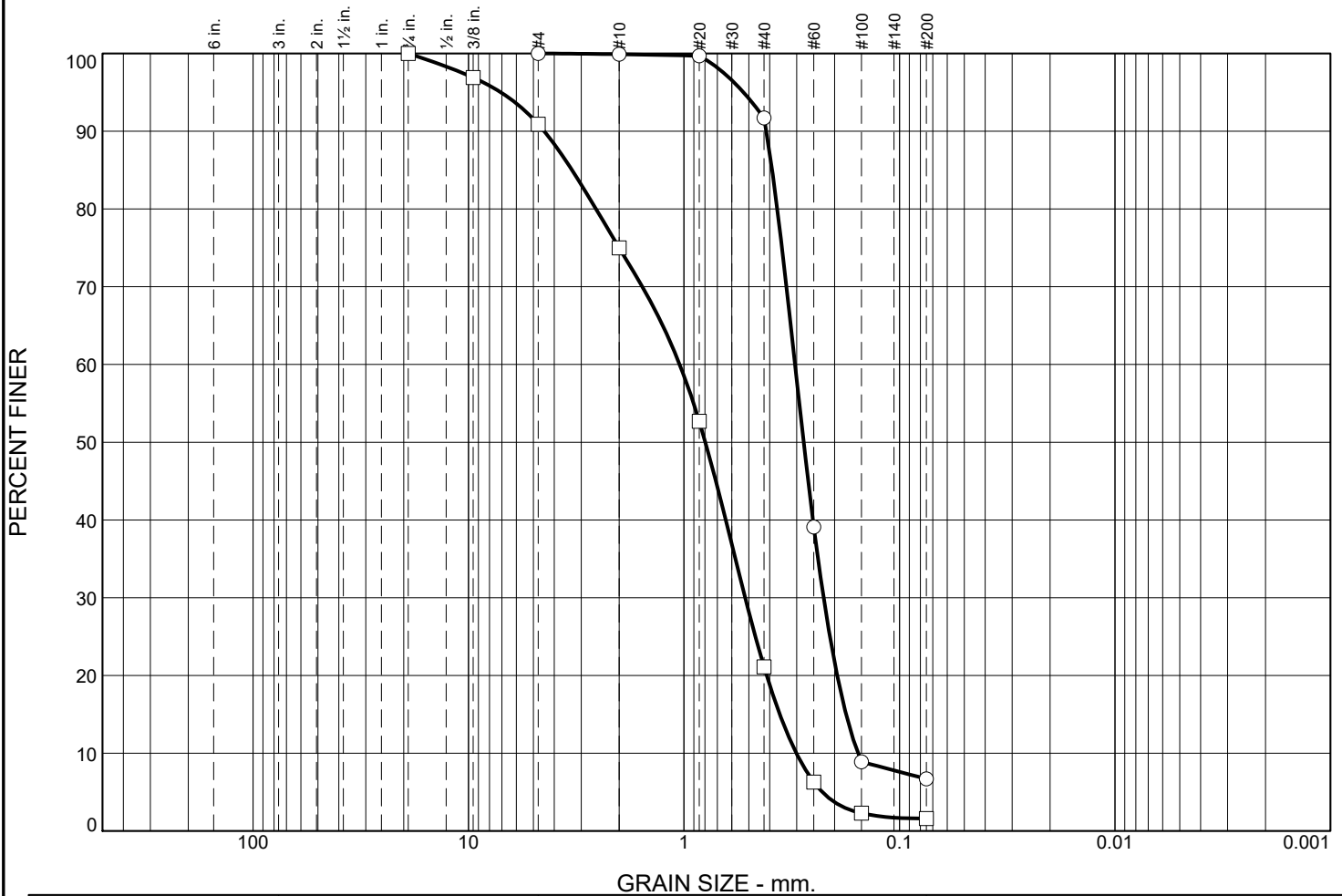
GRAIN SIZE - mm.									
	% +3"	% Gravel		% Sand			% Fines		
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	0.0	0.1	0.4	49.7	49.8		
□	0.0	0.0	0.2	0.3	6.9	82.8	9.8		
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c
○			0.2081	0.1612	0.0773				
□			0.3720	0.2736	0.2455	0.1961	0.1585	0.0795	1.77
									3.44

Material Description							USCS	AASHTO
○ Silty SAND							SM	
□ SAND with silt							SP-SM	

Project No. T-8829			Client: Trammel Crow Company			Remarks: ☐ Tested on November 29, 2022 ☐ Tested on November 29, 2022
Project: PSE Operational Training Facility						
☐ Location: Test Boring B-7	Depth: 2.5 ft	Sample Number: 1				
☐ Location: Test Boring B-8	Depth: 15 ft	Sample Number: 7				
Terra Associates, Inc.						Figure A-15
Kirkland, WA						

Tested By: KJ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	8.2	85.0	6.7	
□	0.0	0.0	9.1	15.9	53.9	19.5	1.6	

	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			0.3897	0.3051	0.2784	0.2251	0.1769	0.1556	1.07	1.96
□			3.3088	1.0474	0.7961	0.5200	0.3592	0.3008	0.86	3.48

Material Description								USCS	AASHTO
○ SAND with silt								SP-SM	
□ SAND								SP	

Project No. T-8829			Client: Trammel Crow Company			Remarks: ☐ Tested on November 29, 2022 ☐ Tested on November 29, 2022
Project: PSE Operational Training Facility						
☐ Location: Test Boring B-8	Depth: 25 ft	Sample Number: 9				
☐ Location: Test Boring B-12	Depth: 15 ft	Sample Number: 7				
Terra Associates, Inc.						Figure A-16
Kirkland, WA						

Figure A-16

Tested By: KJ

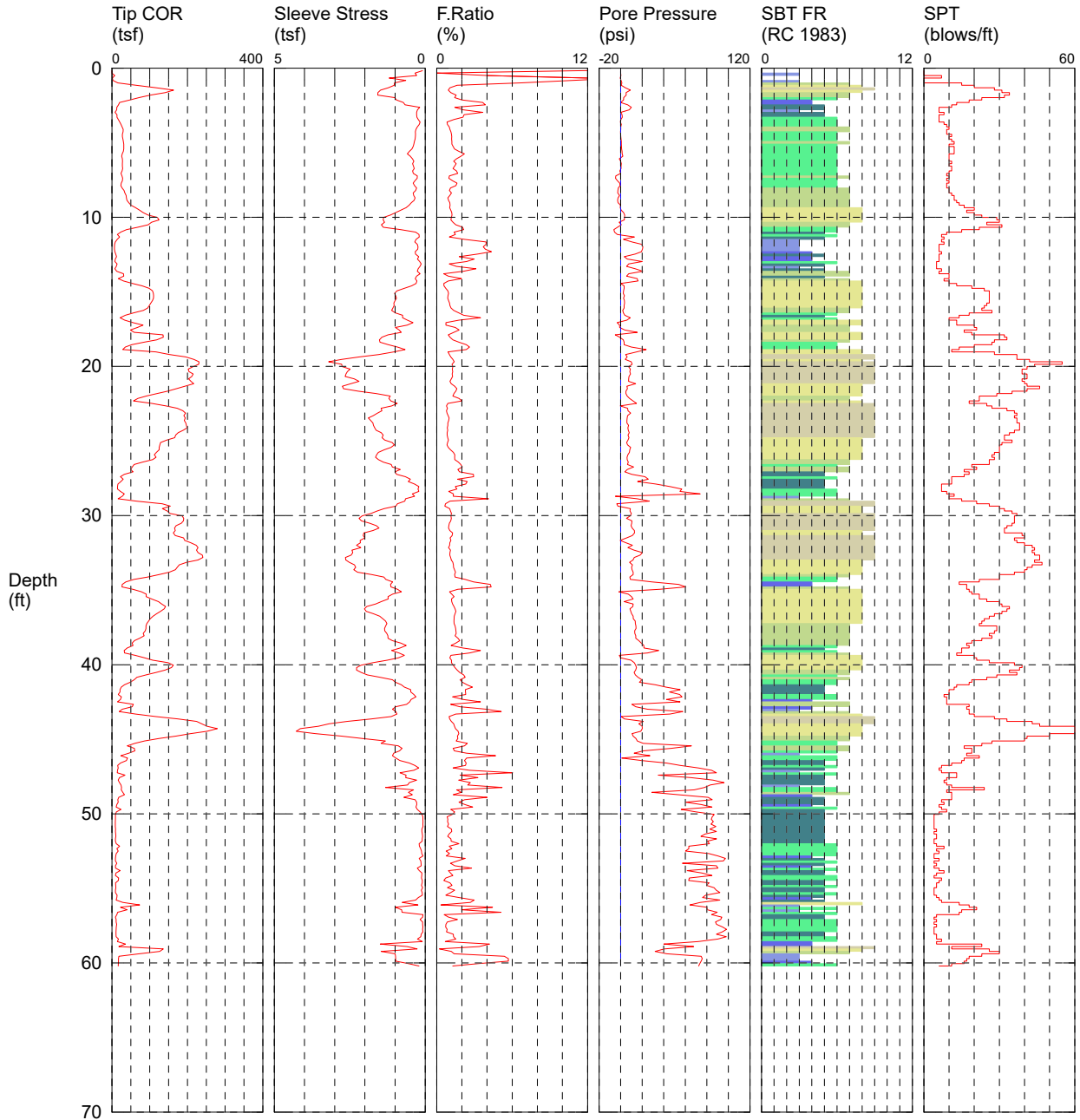
CPT LOGS



CPT-01

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Terra Associates
LOCATION: Puyallup
JOB NUMBER: T-8829
COMMENT: PSE Operational Training Center

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE: 11/18/2022 11:40:03 AM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None

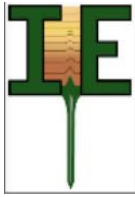


TOTAL DEPTH: 60.203 ft

DEPTH INTERVAL: 0.050 m

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

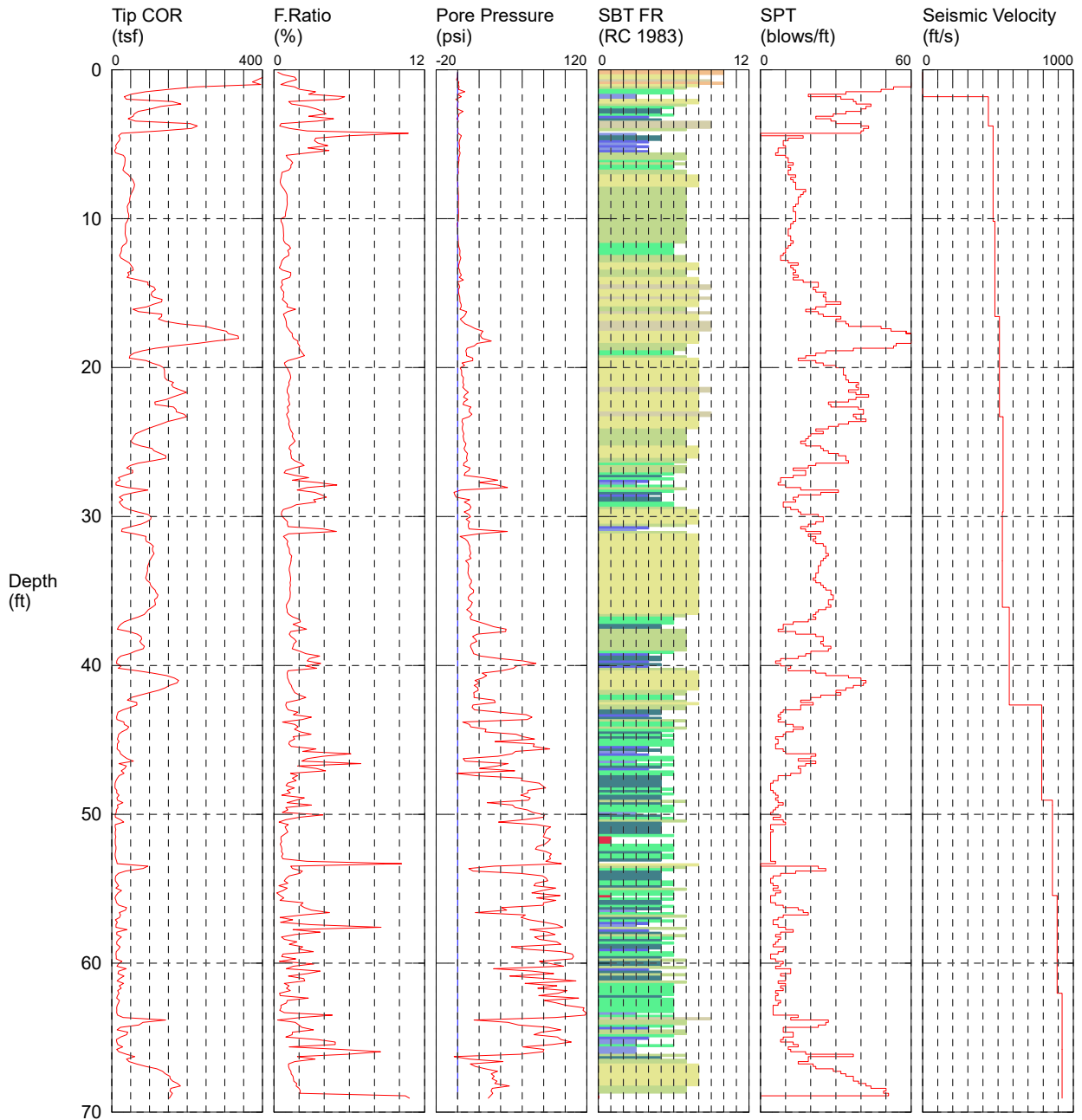
*SBT/SPT CORRELATION: UBC-1983



CPT-02

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Terra Associates
LOCATION: Puyallup
JOB NUMBER: T-8829
COMMENT: PSE Operational Training Center

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE: 11/18/2022 1:29:19 PM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None



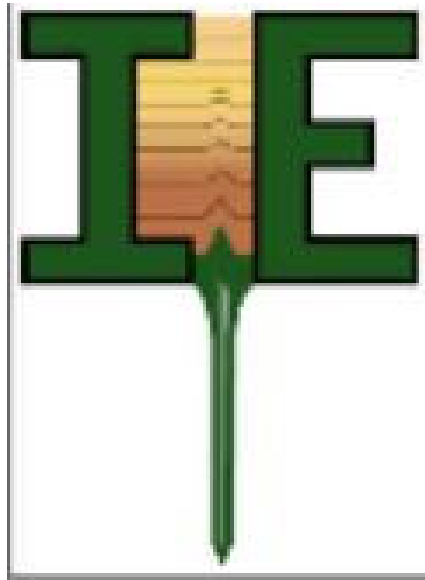
TOTAL DEPTH: 69.062 ft

DEPTH INTERVAL: 0.050 m

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT-02



OPERATOR: Okbay

CPT CONTRACTOR: In Situ Engineering

CUSTOMER:

CONE ID: DDG1351

LOCATION: Puyallup

TEST DATE: 11/18/2022 1:29:19 PM

JOB NUMBER: T-8829

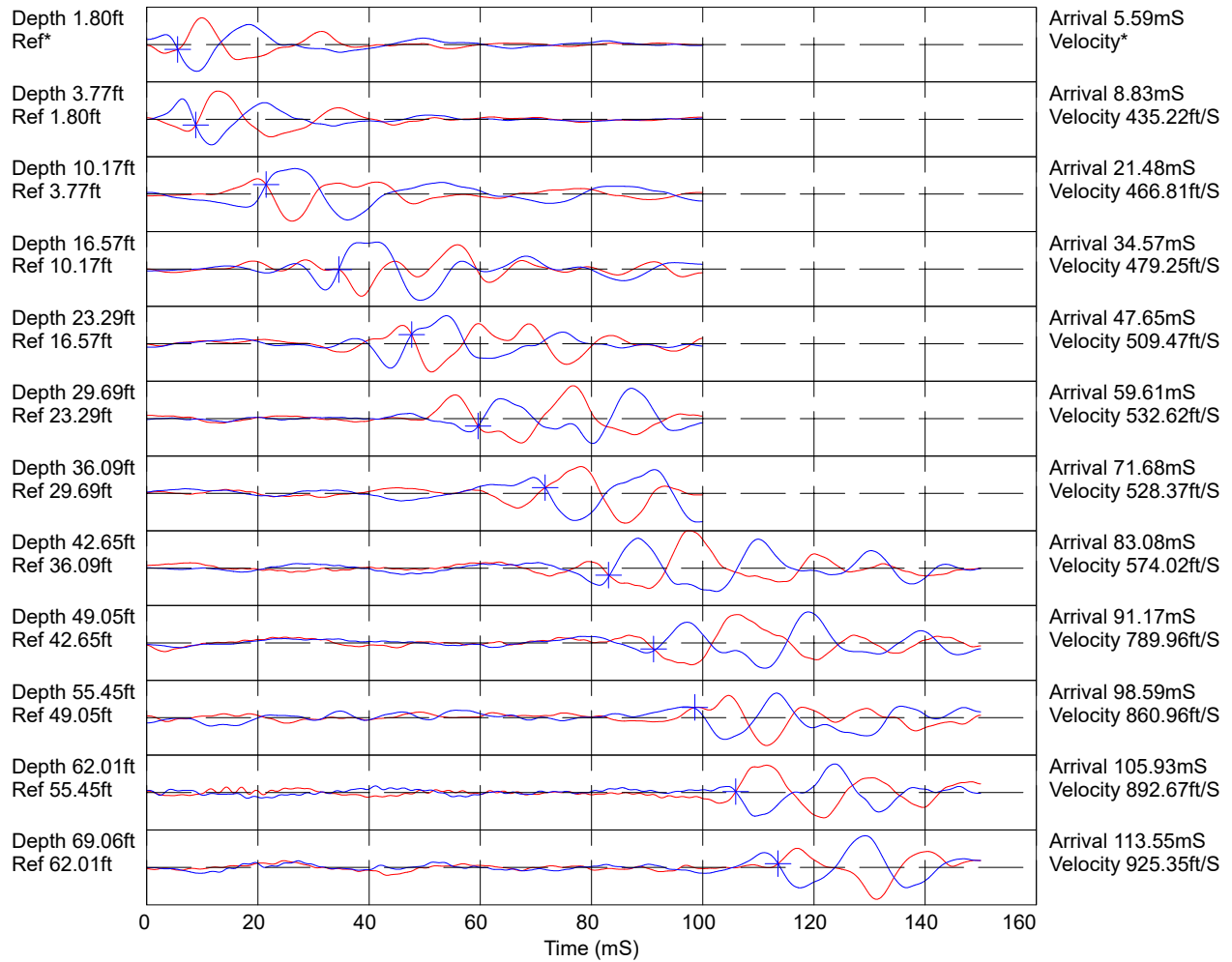
COMMENT: PSE Operational Training Center

PREDRILL 0 ft

BACK FILL: 20% Grout + Bentonite Chips

SURFACE PATCH: None

HOLE NUMBER: CPT-02



Hammer to Rod String Distance (ft): 2.62
 * = Not Determined

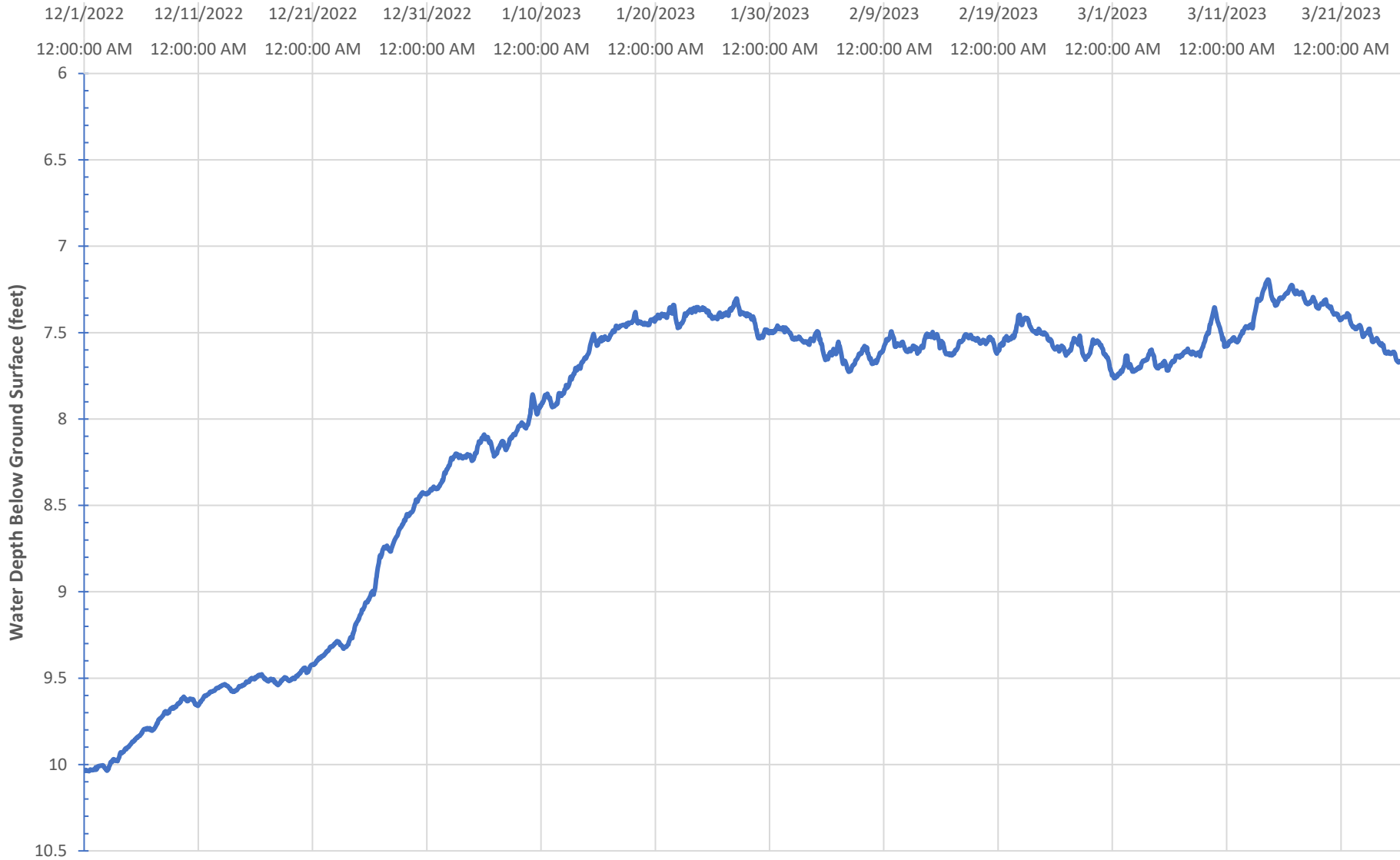
COMMENT: PSE Operational Training Center

APPENDIX B

GROUNDWATER MONITORING HYDROGRAPHS

T-8829 PSE Operational Training Facility Test Boring B-11 Depth to Groundwater

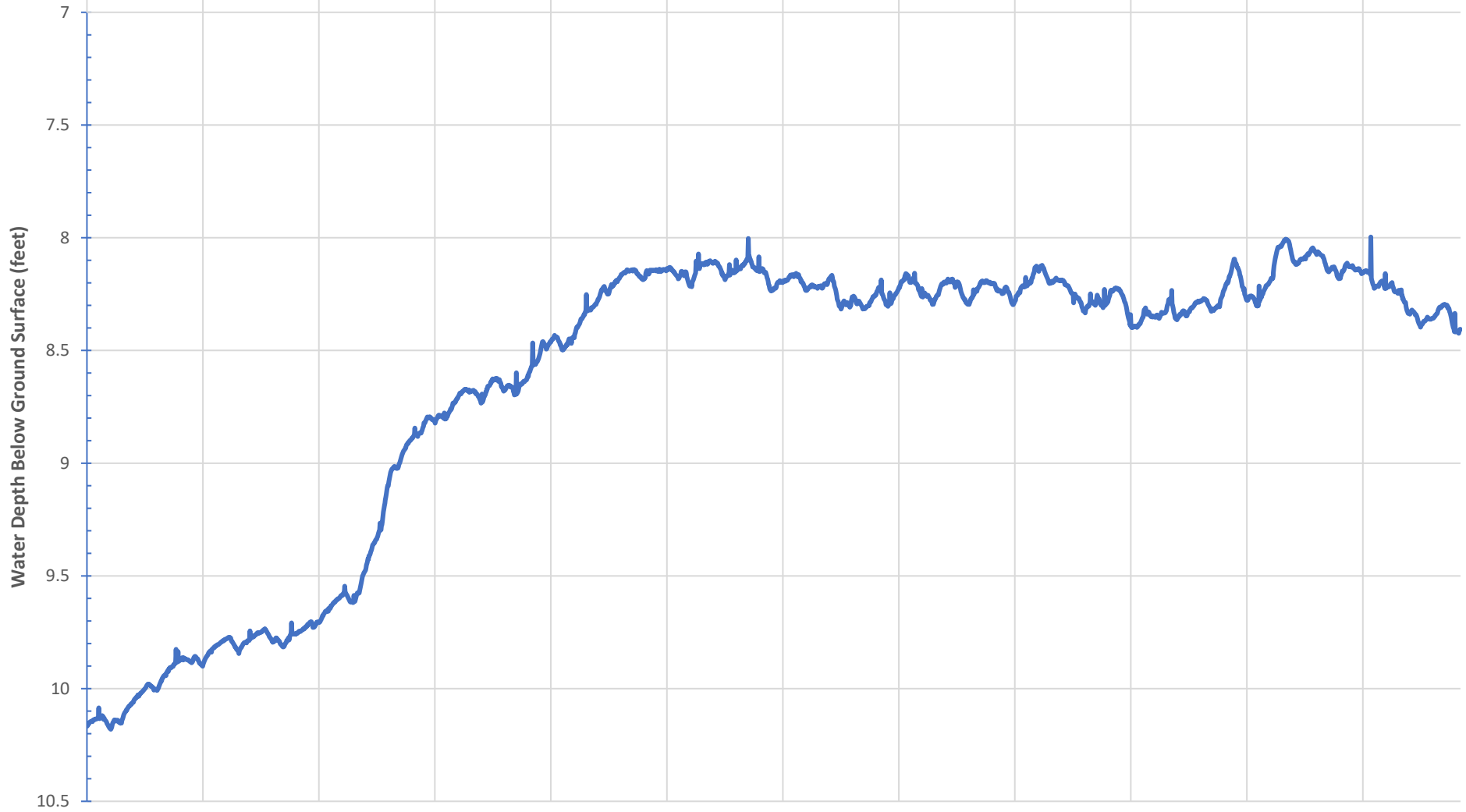
Date & Time



T-8829 PSE Operational Training Facility Test Boring B-13 Depth to Groundwater

Date & Time

12/1/2022	12/11/2022	12/21/2022	12/31/2022	1/10/2023	1/20/2023	1/30/2023	2/9/2023	2/19/2023	3/1/2023	3/11/2023	3/21/2023
12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM	12:00:00 AM



APPENDIX C

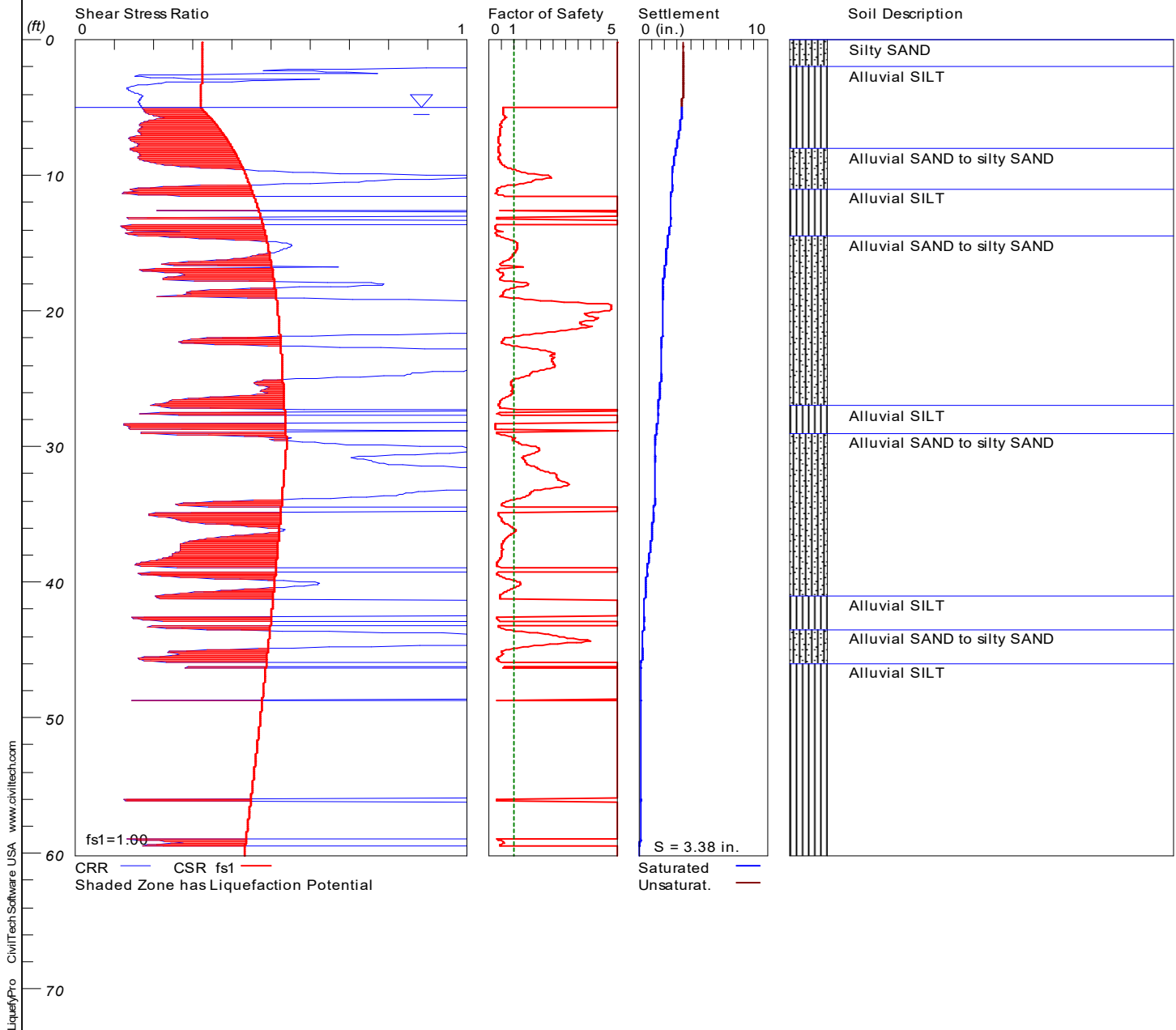
LIQUEFACTION ANALYSIS RESULTS

LIQUEFACTION ANALYSIS

T-8829 PSE Operational Training Facility

Hole No.=CPT-01 Water Depth=5 ft

Magnitude=7
Acceleration=0.5g



LIQUEFACTION ANALYSIS

T-8829 PSE Operational Training Facility

Hole No.=CPT-02 Water Depth=5 ft

Magnitude=7
Acceleration=0.5g

